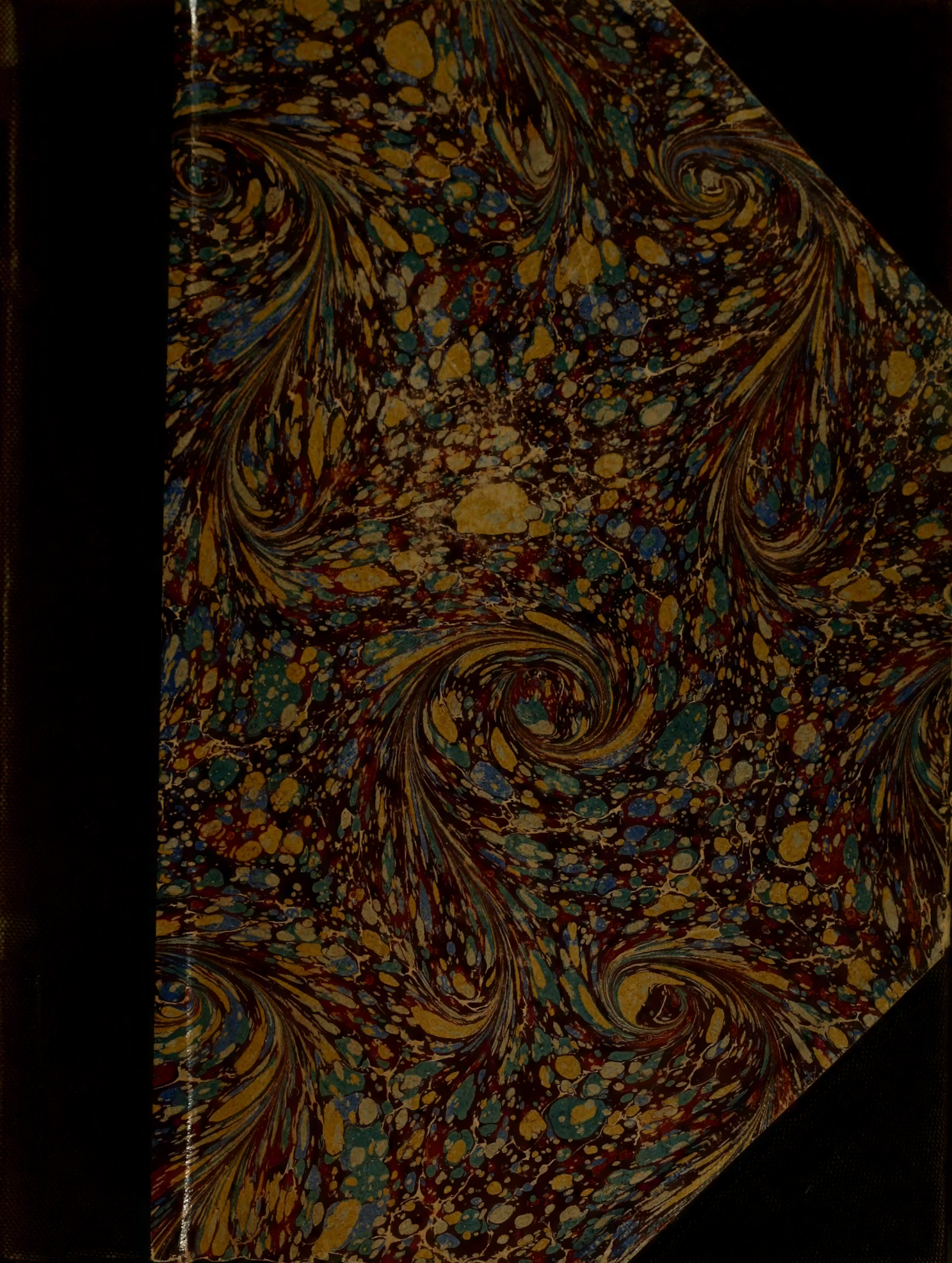

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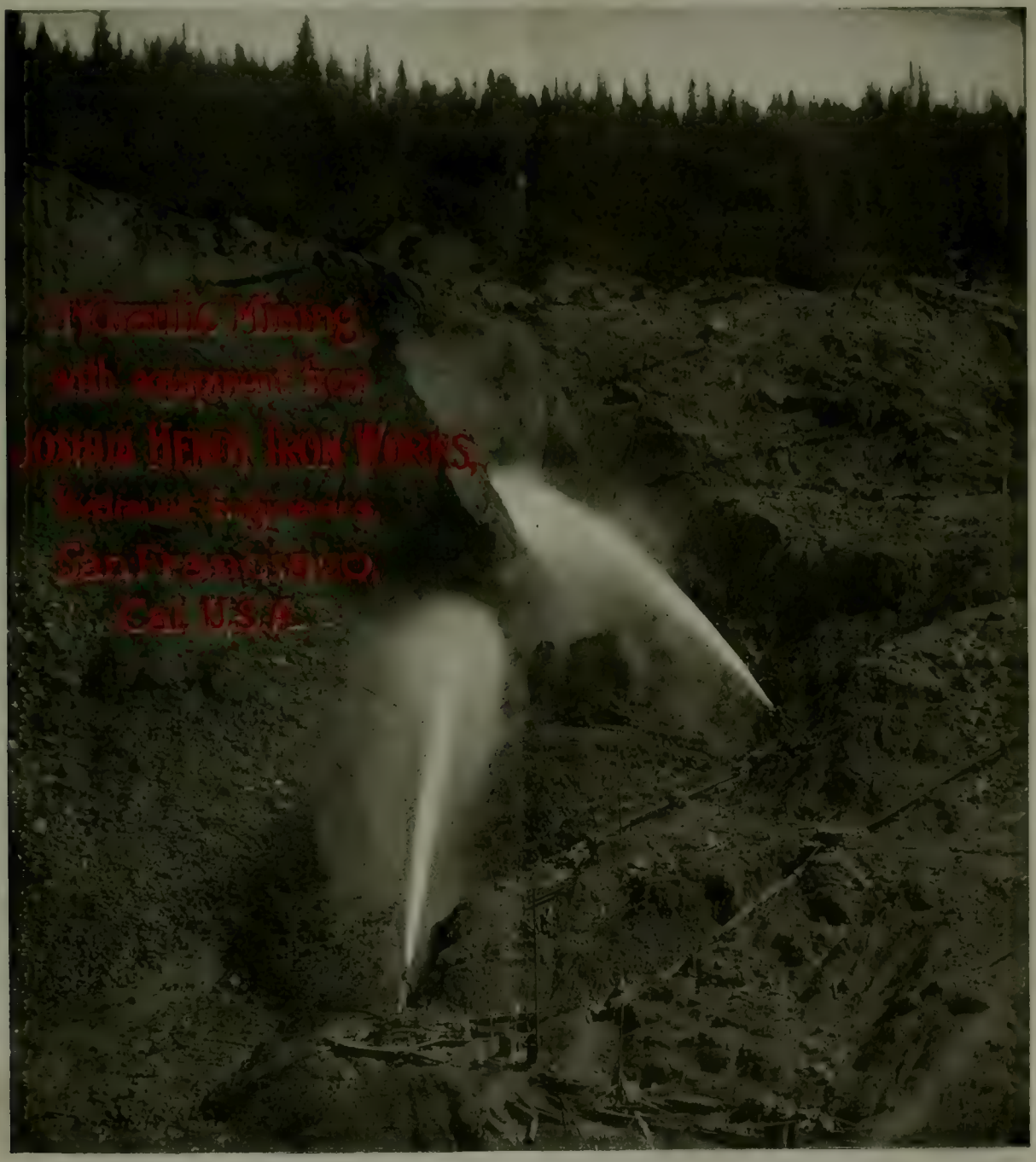

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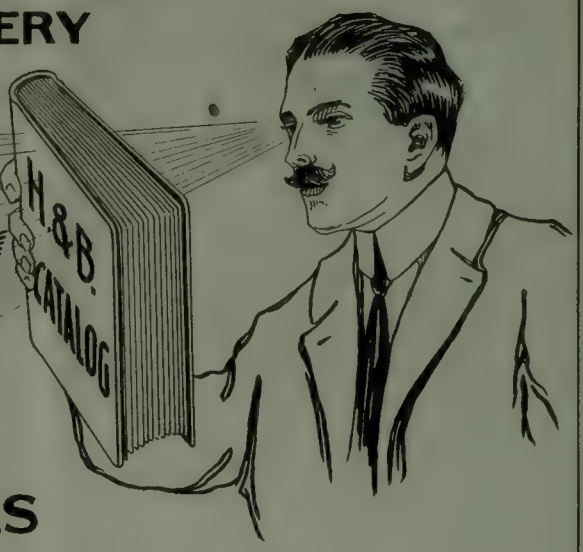

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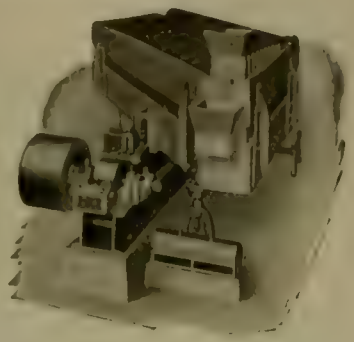

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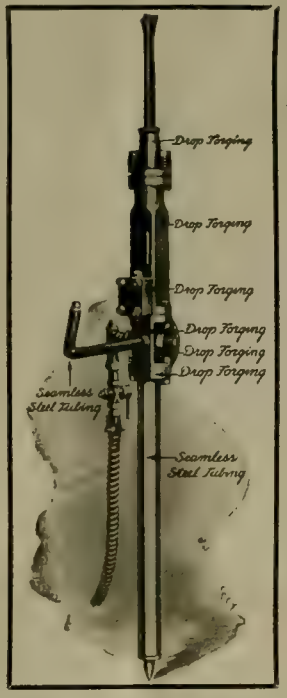

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An index to Volume 108 has been prepared and will be sent on request.

—THE BUTTE MINER— —MAY 10, 1

Water Liner Machines Now in Use in Butte's Mines Solve the Dust Problem

Within the last eight or ten months most of the large mining companies operating in Butte have installed special machines that do away with the dust from drilling, which has been one of the chief, if not the pricipal cause of miners' consumption, according to State Mining Inspector William H. Orem. He predicts there will be more activity in mining in Montana this season that ever before, says the Helena Record.

Until the installation of water liner machines in the last few months, all holes were bored dry, and the fine powdery dust filled the workings and was inhaled by the miners. Now 40 or 50 water liner machines are in use and with them the holes are drilled wet and there is no dust engendered. So successful have the machines been, and such a great improvement in working conditions has followed their introduction that in a very little while practically every mine in Butte will be so equipped, Mr. Orem believes.

"I was down in Arizona several months ago inspecting the mines there with particular reference to safety appliances. While I obtained many valuable ideas, the general standard of safety there is no higher than here in Montana, and I am convinced that Montana standards will compare most favorably with those to be found anywhere in the mining world. In Arizona last year 13,500 men were employed and 66 men were killed; in Montana 15,500 men were employed and 50 were killed.

Butte is Normal.

"Butte is normal and is employing it usual quota of men, but with the increased attention being given to zinc there, I believe many more men will be permanently employed within the next two years. It is asserted, and there is no reason for doubting the statement, that within two years Butte's output of zinc will be as great as its output of copper. There are large deposits of zinc now unworked that soon will be adding to the camp's wealth. The Butte-Superior has a zinc mill in successful operation, and the Clark plant will start operations in about a month.

"The Helena district gives promises of being one of the liveliest in the state this year outside of Butte. Radersburg, I am informed, never looked better. In the lowest levels of the Keating there are six or seven feet of ore. Other districts where there will be more activity than has been manifested for a number of years are in Deer Lodge, Powell and Granite counties, in the Little Rockies of Blaine county, in Libby, and around Saltese in Missoula county, and in the southern part of the state in Beaverhead county."

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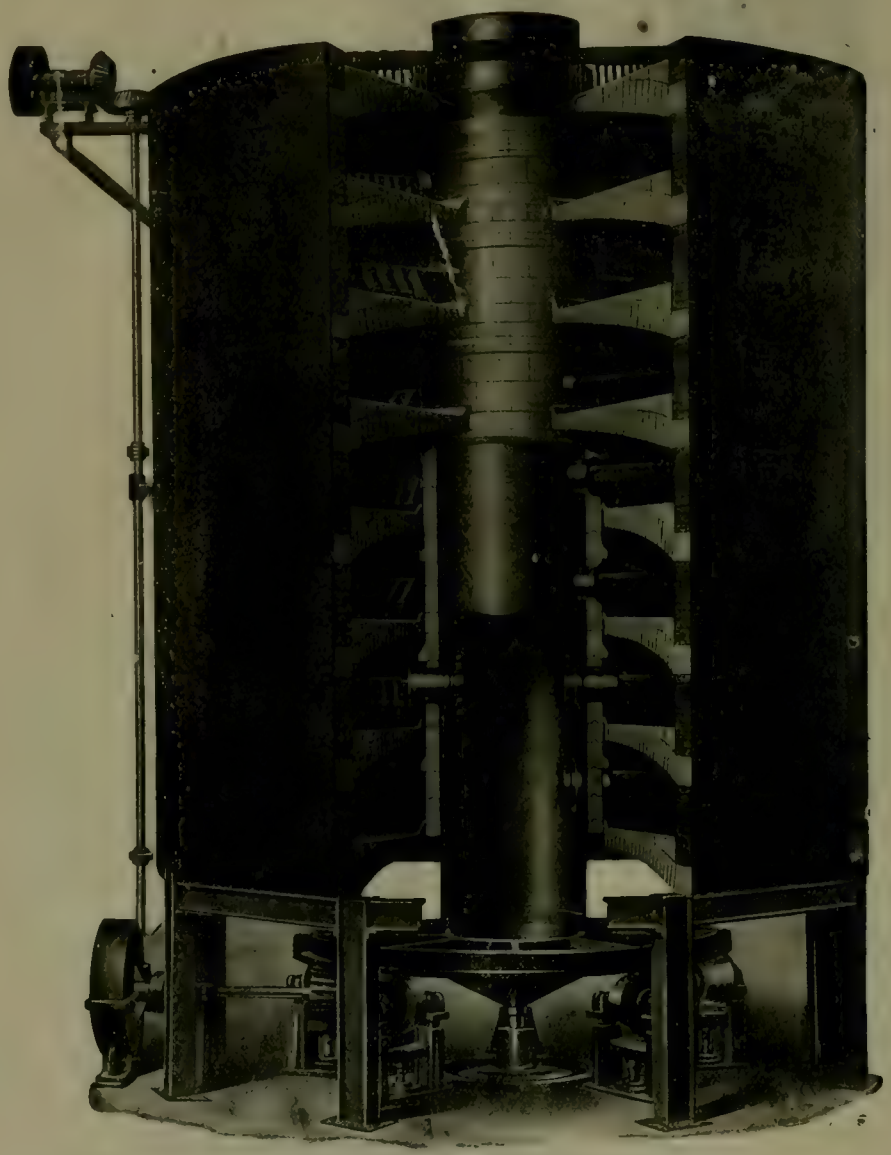

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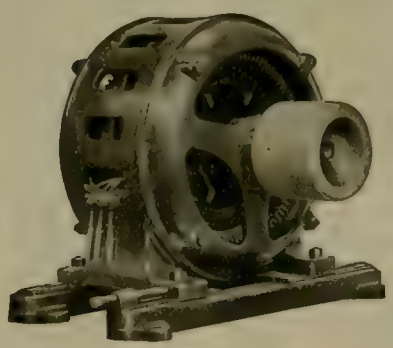

simplify mill construction and allow greater flexibility in the arrangement of equipment.

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Bulletin No. 4922-A, "Electricity in Metal Mines," and Bulletin No. 4886-A, "Electricity in Coal Mines," or Bulletin No. 4939, "Electric Hoists," will be sent on request.

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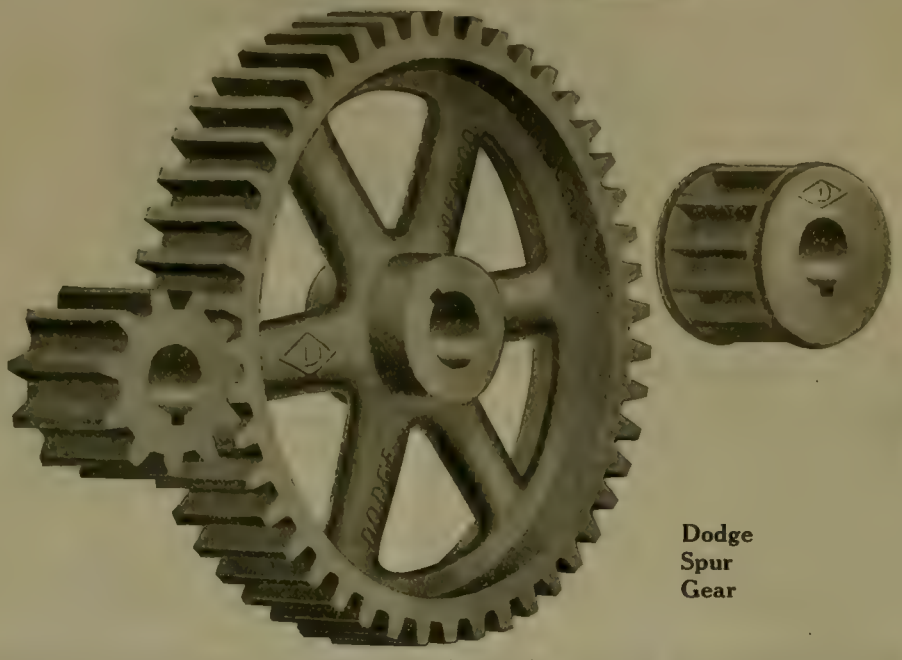

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NATIONAL

Facts About "NATIONAL" Pipe That

No. 1

A Short History of Pipe and Early Methods of Manufacturing

IN the early history of man's endeavor to solve the difficulties of mere existence, some sort of tube for the conveyance of fluids must have been employed.

Probably the "bamboo," which in tropical countries grows to five or six inches in diameter at the base, was used. It is today frequently used by "coolie" gardeners for conveying water along the surface of the ground for short distances.

EARLY ADVANCEMENT.

The next step was a "pottery" tube, and these are found in Egyptian, Aztec and other prehistoric remains, which are brought to light by the excavations of archaeologists.

There is ample evidence that lead tubes were largely used in Grecian and Roman civilization. In many museums lead pipe and bronze water faucets (closely resembling the modern faucet) are shown which were recovered from the ruins of Pompeii, Herculaneum, and other buried cities.

Pliny, whose writings cover the last three-quarters of the first century A. D., states that "in order to raise water up to an eminence lead pipes must be employed."

FIRST IRON TUBES.

Probably the first imperative need for iron tubes was for the manufacture of gun barrels.

After the invention of gun powder, the first cannons were made of bronze, and early Spanish cannons are wonderful examples of metal-working skill in ornamentation.

But this was too expensive a material for gun barrels, and the need for cheaper material brought out the earliest application of wrought iron for tubes.

FIRST METHODS OF WELDING.

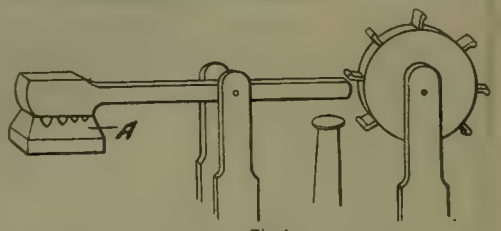

Fig. 1

In the early history of wrought iron tubes, the only known method consisted in bending an iron plate or strip to form a "skelp," and the edges were welded together piecemeal by a smith hammering the red hot metal over a rod or mandrel. A rather expensive and tedious process.

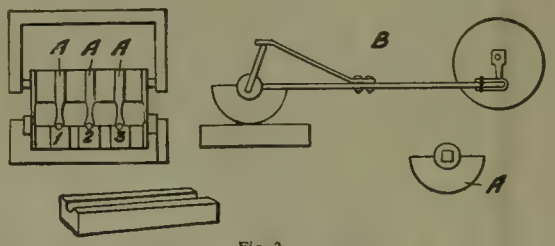

Fig. 2

NATIONAL TUBE COMPANY

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NATIONAL

NATIONAL

Every Mining Engineer Should Know

In 1812 an Englishman named Osborn patented machinery for "welding and making barrels of firearms and other cylindrical articles."

EARLY PROCESSES EXPLAINED.

Figure 1. The skelp is raised to a welding heat in an open or close fire and, after the mandrel has been inserted is then placed in the swage or anvil A, and welded by the action of the tilt hammer.

In figure 2 the inventor states: "I take a skelp and place it in either of the beds, 1, 2, 3, according to the part required to be welded, and which welding is effected by the swage segments A performing half a revolution, the manner of which is explained by the profile B."

This is believed to have been the earliest form of machinery for welding iron tubes. But as may readily be seen the process was not very rapid, and in the next two or three years a new necessity arose for iron tubes in quantities.

About the time of Osborn's invention for tube-welding machinery, another Englishman was perfecting his process of making coal gas for lighting purposes.

GAS TUBES.

Iron tubes (gas tight) for this purpose were essential, and the inventor of gas lighting (Murdock) first collected and used old gun barrels (of which there was an abundant supply at the close of the various European wars), screwing the barrels together into a continuous tube to convey the gas.

(Parenthetically, it may be said, some pessimists have stated that modern economists have reversed Murdock's methods, and made gun barrels for remote markets from gas pipe!)

The extension of gas lighting was very rapid, and the necessity for production of iron tubes with greater facility and less cost became apparent.

FIRST BUTT-WELDING.

The inventors were equal to the occasion, as they generally seem to be. In 1824 James Russell filed a specification for "an improvement in the manufacture of tubes for gas and other purposes." This apparatus will be shown in the next announcement, which will be published in the August 1st issue of Mining and Scientific Press.

¶ To readily identify "NATIONAL" material and as protection to manufacturer and consumer alike, the practice of National Tube Company is to roll in raised letters of good size on each few feet of every length of welded pipe the name "NATIONAL" (except on the smaller butt-weld sizes, on which this is not mechanically feasible, on these smaller butt-weld sizes the name "NATIONAL" appears on the metal tag attached to each bundle of pipe).

LOOK FOR THE MARK

Name Rolled in Raised Letters on National Tube Company Pipe

¶ When writing specifications or ordering tubular goods, always specify "NATIONAL" pipe, and identify as indicated.

¶ In addition, all sizes of "NATIONAL" welded pipe below four or five inches are subjected to a roll-knobbling process known as Spellerizing to lessen the tendency to corrosion, especially in the form of pitting. This Spellerizing process is peculiar to "NATIONAL" pipe, to which process National Tube Company has exclusive rights.

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ANOTHER STEP FORWARD

ANNOUNCEMENT

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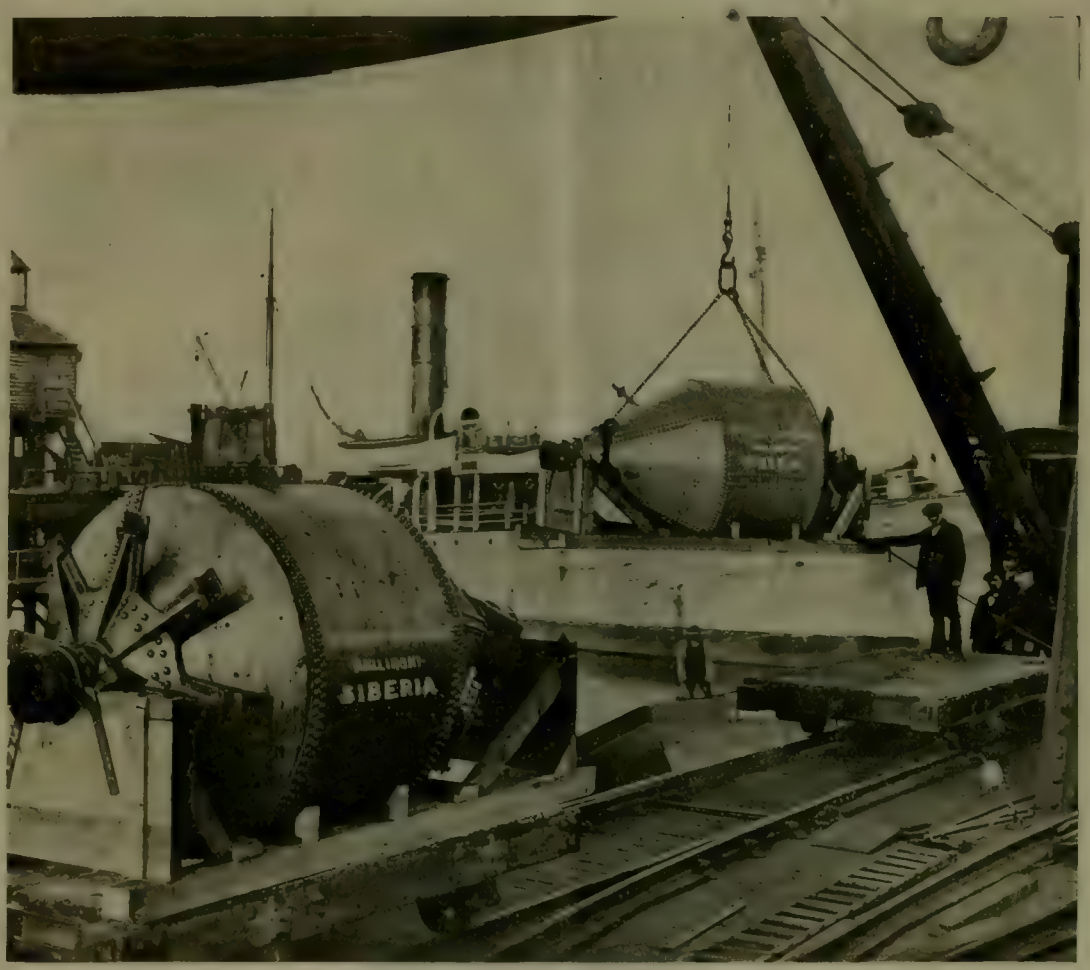

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READERS will find the table of contents formerly on this page, upon the second white page in the paper. The new arrangement will allow more space both for the table itself and for editorial matter.

DECISION of the suit of the Kennedy Extension Mining Company against the Argonaut Mining Company has been rendered and is favorable to the Argonaut. The points at issue were briefly discussed in our issue of January 17, and a full summary of this important case will follow.

GENERAL FELIPE ANGELES and Lic. Luis Cabrera are prominent among those named at the Niagara Falls conference as possible successors of Huerta. As both are Constitutionalists, it is hardly likely that Huerta will accept them and as Carranza has ambitions of becoming president, neither can count upon his support.

CALIFORNIA mine operators will welcome the announcement that the Mine Owners Casualty Indemnity Exchange has been organized in order to reduce the cost of workmen's compensation insurance through coöperation of the mine operators. This is a matter in which we take much interest and that we propose to discuss fully next week. In the meantime inquirers can get full information at the offices of the new company in the First National Bank building, San Francisco.

ALASKANS were especially interested in the decision of the case of Likaits *v.* Johnson construing the Alaska placer act and reported in our issue of June 6. The case arose over use of a power of attorney to locate placer ground. Another case was that of Sutherland *v.* Purdy, reported in May. Briefly, the new law requires that power of attorney, to be effective in placer location, must be recorded within the judicial district in which it is used and limits its use to two locations in any one month. In the one case the recording was not done until after the location was made, though before the second locator filed on the claim, a fact perhaps not made sufficiently clear in our abstract. The court held that the order of the acts was immaterial in view of the good faith shown and the climatic and geographical conditions faced. In the second case the record was improperly made but has held to be good none the less. The judge held that, having in view the actual conditions in the field, when a locator deposits his documents in the proper recording office and pays the recording fee, later receiving the documents back bearing the endorsement of record, he is not liable for any errors or neglect of the recorder. These are sensible business-like decisions in line with the general rule that the mining law is to be interpreted in accordance with the conditions as they are rather than as they might be.

THE NATOMAS fiasco points again to the moral we have often preached; namely, the sound economic basis of the work of independent engineers. The men of the regular staff of the Natomas are highly qualified, but human nature is not to be denied, and as vendors we all see most keenly the strong points of what we have to sell. We have previously referred to mistakes made by the consulting engineer who in this case acted for the London bondholders. He has replied in the *Press* and also in a special report to the stockholders by urging that he merely accepted figures given him by the men on the ground. The very fact that his having done so has involved him in the necessity of making elaborate explanations and excuses, is the best of arguments against an engineer in any such situation accepting critical data at second hand.

CREATION of a petroleum division in the U. S. Bureau of Mines and appointment of Mr. W. A. Williams to be its chief, is in some ways the most important move made by the United States government in its relation to petroleum production in many months. The new division is to have charge of all technologic work connected with oil on the public and Indian lands. As owner of large areas in the midst of productive fields, and of even larger tracts of potential oil land, the Government has a direct interest in securing the most economical development and the maximum yield. Waste of gas and flooding of oil sands is as serious when on public as on private land. In Oklahoma, too, the Secretary of Interior, as guardian for the Indians, has heavy responsibilities in connection with actual production of gas and oil, and if oil is to be produced from public lands by lease or otherwise for the navy, to say nothing of proposals that the Government should build pipelines, there is every reason why the Department should

have on its staff men who really know the oil business. Petroleum producers have complained, not without justification, that in the past, government action has been too often uninformed, or based upon half knowledge. Mr. Williams is a thoroughly competent oil man, a graduate of Stanford University and experienced through service with the Associate and General Petroleum companies. He has the confidence of California operators and may be expected to win that of Eastern petroleum producers as they come to know him. It is understood that $60,000 is available for beginning his work and an amendment to the sundry civil bill has been introduced increasing this sum to $200,000.

REFINANCING NATOMAS

Plans for relieving Natomas Consolidated of California from financial difficulties have been worked out in London and were announced in San Francisco, June 18. In the interest of the new plan, an appeal is being made to bondholders by a committee consisting of Messrs. Frank B. Anderson, Herbert Fleishacker, Percy T. Morgan, George E. Webber, and Curtis H. Lindley; certainly a list of weighty names. Among those active in formulating the plan in London were Mr. Herbert C. Hoover and others of equal standing. Nonetheless opposition has appeared, being voiced by McCutchen, Olney, and Willard, and a formidable revolt on the part of bondholders is not improbable. When a company having a liberal number of conflicting securities gets into financial difficulties, it is hardly to be expected that any plan for reorganization will be accepted without protest. The very condition that makes reorganization necessary, implying as it does some failure or miscarriage of plans, requires that there shall be some sacrifice in order to offset it. With security-holders having unequal interests, it is natural that each should try to save for himself what he can, and equally inevitable that the other parties in interest, if informed and vigilant, should protest. There is abundant room for difference of opinion, and it is possible to discuss these differences, we hope, without imputing to anyone more than the normal desire to save what he may for himself.

It is proposed to organize a new company and to issue $3,000,000 in five-year notes; $16,500,000 in 20-year, 6 per cent, first mortgage bonds, using $4,500,000 of these to secure the five-year notes; $7,250,000 in non-cumulative stock; and $9,250,000 in common stock. The right is reserved to pay the first five years interest on the bonds in bonds of the same series, and $2,500,000 of the issue is held for that purpose. A new English company capitalized at £600,000 is to be formed to hold the common stock. The securities are to be distributed as follows: The Natomas Syndicate will buy the $3,000,000 issue of notes for $2,700,000, and the common stock. Each holder of $1000 of the first mortgage bonds of the present Natomas company will receive $600 in the new bonds and $400 in preferred stock. Each holder of $1000 of second mortgage bonds will receive $500 in preferred stock and £5 in the stock of the English company. Each holder of $100 of stock in Natomas Consolidated will receive £1 in stock of the English company. The floating debt creditors will surrender their securities and take 90-day notes or the new five-year notes at 90 cents. Since the floating debt amounts to $1,088,000 and the debt to the Natomas Syndicate is $1,213,000, it is evident that but little additional cash will become available under this arrangement. The plan proposed is peculiar in that floating debt creditors and holders of junior securities, in return for the advancement of a relatively small amount of additional capital, are to be given preference over first-mortgage bond holders. The latter are asked to consent to receive further bonds in lieu of interest for the next five years. This payment of interest on bonds by issuing more bonds is strongly reminiscent of the nursery rhyme:

> Big bugs have little bugs to bite 'em;
> Little bugs have littler bugs,
> And so on *ad infinitum.*

If, indeed, a plan has been found by which interest on debts can be met by merely creating more debts, a delightful field for financing is opened. Seriously, however, this but postpones the day of reckoning and adds to the interest charge. In the meanwhile, the handling of the property will be in the control of those who have a minor interest, and in five years the best part of the most nearly liquid asset, the gold reserves, will be gone. Whether the market for land will have improved enough to offset this is a question.

The serious matter, the one of general interest, is the light regard paid to the first mortgage bonds. Natomas bonds have been endorsed as suitable for investment of trust funds by bankers standing high in the business world. Now they are swept aside to give piled-up security to those who advance money on short-time notes. Incidentally, it develops that by reason of the issue of reclamation bonds, the first mortgage bonds are in fact now junior securities. No wonder that it was found difficult to make this clear to British bondholders. It is far from lucid to many nearer the home of the Company.

The men and the banks that advanced money this spring to save Natomas from a receivership have a strong claim for preference in the reorganization. By certain of the directors at least, personal securities were advanced to save the Company credit. No adjustment can be satisfactory that does not take into account such claims. But the bondholders also have equities, and back of that is the public interest. There can be no question but that public confidence in Western securities will be seriously injured if Natomas bonds are set aside in this fashion. A bond should stand for something. If as a matter of fact it has come to represent nothing definite, it will be hard hereafter to sell bonds, as it is now hard to sell stocks, and industry will suffer.

It is difficult to determine the real present value of

the various Natomas securities. The concern is an unusual enterprise. In part it is founded on gold dredging and in part it is a land reclamation scheme. However speaking in a large way it is not the land dredged for gold that is being reclaimed by drainage and irrigation. The scheme is much more ingenious than that. Briefly, 9501 acres of gold-dredging land, valued December 31 1913, at $14,433,532, and estimated by the Company engineers to contain $10,250,634 net, forms the basis of a profitable industry which, with subordinate sums from sale of crushed rock and subsidiary enterprises has been paying interest on bonds issued to obtain funds for reclaiming valley lands immediately north of Sacramento. In the end it has been planned that the reclaimed lands should be sold at such prices as to afford a profit on the whole enterprise.

The plan has many excellent features. Gold-dredging is a profitable but short-lived enterprise. A gold-dredging field may be quickly equipped and brought into production, and, while the dredging ground lasts, the income will be sufficient to carry a large bond issue, such as is necessary to finance a reclamation project through the long lean years while the land is being brought under cultivation and sold. It has the inherent difficulty that it combines two dissimilar enterprises, both of which are speculative. A speculative enterprise, to assure success, requires special knowledge and close attention, and it is a rare thing for a manager, or even a group of managers, to handle dissimilar businesses equally well. As noted by *The Mining Magazine*, there is even a movement now toward having boards of consulting engineers instead of one for companies engaged exclusively in mining and closely related industries, and it is a well known fact that mining companies only in the rarest instances make money from such agricultural lands as they chance to own. On the other hand, farmers as mine managers have become a byword. To combine gold-dredging and farming is simply to invite disaster.

And disaster came. We have repeatedly directed attention to the fact that estimates made by the Natomas management and the Company's consulting engineer have proved sadly out. The gold-dredging ground owned by the Company has long been known to be valuable, but much of it is cemented and hard to dig. Building a dredge to handle it necessarily involved an experimental element. It is true, probably, that the final outcome is even yet not wholly certain, since the dredges, large and strong as they are, are subjected to unusually heavy strains, and it is too soon to say what their life will be and what is a proper amortization charge. They are magnificent dredges and are performing well, but operating costs for short periods are often deceptive. Delay in equipping the ground with a full fleet is the obvious cause of the disaster that has overtaken the Company; the gold has come from the ground too slowly and in too small amounts, while all the time interest charges were mounting and engineering expenses in connection with the land reclamation were to be met. Re-designing and re-building the dredges was inevitable, although the main lines have not been changed; this, together with a most unusual sequence of fire loss and wrecks, has been responsible for the delay. The fact that it was not anticipated, throws a shadow over the judgment of the engineers concerned and causes bondholders to question everything. This attitude is reinforced by such circumstances as that Mr. E. J. de Sabla, in speaking before the bond and stock holders in London in 1911, estimated the profit for 1913 at $2,000,000; in fact the total was $1,151,887. The net yield from gold-dredging for last year was estimated at $1,350,000, and proved to be $992,366. It is a brave tale of optimistic venture, but a sorry one of estimates and performance.

It is even more difficult to form an estimate of the value of the lands being reclaimed. In round numbers there are 28,000 acres of irrigated lands and 60,000 of reclamation lands. Mr. de Sabla said, in the address quoted, that the land had cost about $25 per acre. This, however, makes but a small fraction of the amount realized from sale of bonds alone, about $8,500,000, and there are still heavy payments on land to be met. That reclamation of land is itself profitable as well as good for the state in which the land lies, has been abundantly proved; provided always that the land be well chosen, the engineering and the estimates sound, and the market reasonably certain and near in point of time. The best lands go begging at times and in places, and interest on money spent in throwing up embankments and putting in drains and irrigating ditches may well eat up the profit on the work if the sale of the land be slow.

Another factor that is not always sufficiently considered is that mere reclamation of land is not all. The expense of preparing it for crops, the building of houses, barns, and fences is considerable, and must all be figured into the cost. It must either be done by the vendor or its cost deducted from the price that would otherwise be paid by purchaser. It is not possible to sell land, in any large way, except upon terms that permit the purchaser to earn good interest on his investment, and it is not always possible to sell even good land promptly. A recent investigation showed that in California the mere cost of selling lands absorbs 40 per cent of the price realized, and the notable failure of California to attract settlers rapidly can undoubtedly be laid to the absurd overvaluation of the lands on the market. An individual may make satisfactory returns from a few acres devoted to some special crop, but a state as large as France with only two-fifths of its population on the farms, must be content to attract settlers on an "alfalfa basis." Improved lands of equal value can be bought in Europe today for less than is being asked in California, while in Canada, Australia, and other new countries settlers are offered the choice of excellent lands at prices still lower. These are facts that must be taken into account when it is proposed to reclaim and market any such area as 80,000 acres. We

would not pose as an expert on agricultural lands. We understand that some Natomas land is of high value; some doubtless is not worth the money spent reclaiming it. Such inequalities are inevitable when great areas are included in a single project. How much is good and how much bad, we do not know, nor are we aware of any certain information available to the public or the bondholders answering this question. According to the Natomas report of December 31, last, a few acres have been leased for a cash rental of $10 per acre, though the larger amount leased is at $2.64 per acre. If all the irrigated and reclamation land be leased at $10 per acre cash rental, the return would still be less than enough to pay 6 per cent interest on the valuation placed on the reclamation lands alone. This would leave it necessary for the gold-dredging properties, valued by the directors at $14,000,000, but now estimated to contain about $10,000,000 net, of which the present value is perhaps half that amount, to care for amortization.

It is difficult to see how the bonds are ever to be paid in full except by the fortuitous influx of an unheard of number of land buyers willing to pay top prices and do it quickly. This may be too pessimistic a view. If so, it is because adequate engineering studies either have not been made or their results are not available to bondholders. Indeed, what is most wanted is more light upon the whole matter. The reorganization committee may indeed be proposing the only possible plan, but the Company is paying dear for a relatively small amount of money, and it is probable that if the whole property were examined and full information given, competition would be invoked and better terms could be made. At any rate, bondholders are now very much in the dark and are asked to act upon information that is entirely inadequate. They should look before they leap.

GOLD EXPORTS

The movement of over $60,000,000 in gold bars and coin from the United States to European countries in the past six months has given rise to general interest and discussion. So far as this country is concerned, this unusual movement does not seem fraught with any profound or sinister significance. The gold reserves of the world are a fluid medium, flowing from the points where the pressure is higher to where it is less, and the movement in one direction at a given time may be speedily followed by a reverse flow a short time later. We buy large quantities of merchandise from foreign countries; we sell even larger quantities to them in return. Large sums must be annually paid to European investors for interest on their holdings in this country, and if the investors wish to leave the money here for investment in new securities, or if they wish to 'take out in trade' our indebtedness to them, international dealings will be marked by large exports of goods from the United States and small exports of specie. On the other hand, if European investors reduce their purchases from us and show a desire to receive their interest return in specie for employment at home, merchandise exports will fall off and specie exports will increase. Such a situation exists at the present time. The uncertain effect of the basic legislation affecting industry now under consideration at Washington, the possibility of a crisis this autumn when the movement of crops of record size makes its annual strain on the financial situation here, and the unfortunate experiences which European holders of American railroad securities have gone through in the past few years, all tend to discourage investment of European money in the United States at this time, while imports of European merchandise have been stimulated by the recent decrease in the import tariffs.

There are other factors in Europe which enter into the situation as well. The specie holdings of the banks in Russia have been increased by $92,500,000 in the past year, standing at $902,113,000 on May 21. The holdings in Germany have been increased to almost an equal amount and now stand at a sum approximately one-half that of the banks in Russia. The adjustment of the Balkan trouble resulted in the practical removal of Turkey from Europe, but at no marked advantage to Russia; a country which urgently needs to gain an outlet to the Mediterranean sea, through the absorption of the territory which stands in her path, or otherwise. Russia has recently made a tremendous increase in the peace footing of her army, and there are those who see in these events the imminent possibility of war between Russia and Germany, the latter country being a strong factor in the political readjustment recently concluded in the Balkan peninsula. This view is certainly not without the bounds of possibility, though we profess no such familiarity with the inner workings of the chancelleries of Europe as would permit us to express a well informed opinion. Austria has also made large increases in her specie holdings, possibly also in preparation for war, as Austria would inevitably be drawn into such a conflict. In France a national loan of $350,000,000 has been authorized to provide, among other things, for military expansion, and the French banks have been building up their gold reserve in preparation. All in all, Europe does not seem at the present moment a desirable feeding ground for the dove of peace. In the face of these conditions, the reserves of the Bank of England have shrunk some $6,000,000 in the past year, although the receipts of bar gold and coin in England for the year ended in April amounted to $300,000,000. The view generally expressed in New York financial circles is that the present movement of gold to Europe practically came to an end with the shipments of specie which arrived in Europe in time for the interest payments due on July 1. Those who think the business situation in America one of extreme difficulty have at least the consolation that the clouds on our financial horizon are not so threatening as those on the other side of the Atlantic.

Methods of Testing Placer Gravels

By W. J. RADFORD

In the bonanza days of placer mining, when only such gravel tracts as were of 'picture book' value were worked, with a no greater monetary outlay than was necessary to build a few sections of sluice box and purchase tools, a very rough pan sampling sufficed to determine whether the gold was present in paying quantities. These days, however, have passed and the present day placer miner is forced to consider the lower grade gravels. To operate low-grade deposits at a profit requires the erection or purchase of plants costing many thousands of dollars. With large sums involved and the lowness of grade to be considered, the examining engineer of today has a much greater responsibility thrust upon him. To meet these new conditions more scientific and accurate systems for testing have been evolved, which are the outcome of years of experiment and experience. Where, in the early days, assays were stated in dollars, they are now estimated in cents per cubic yard, and a few cents difference, one way or the other, may mean the success or failure of an enterprise involving the investment of large sums.

On many occasions I have been asked such questions as the following: 'Of what degree of accuracy are gravel tests?' 'How closely will the estimated gravel value, as determined by examination, check with actual value, as found by operation?' To answer questions of this nature without an intimate knowledge of the tract to be tested is to a certain extent impossible. In such case, one can but refer to the results of operating concerns, each operation having its own peculiar conditions.

Estimated and Actual Value

Before proceeding with a discussion of this subject, it would probably be advisable to explain the sense in which the terms 'estimated value' and 'actual value' are used. By 'estimated value', is here meant the value per cubic yard of the gravel as determined by a series of tests. From this is deducted a certain varying percentage for loss in operation, the result being the estimated value of the gravel in dollars and cents. 'Actual value' is the value per cubic yard as computed from the gross bullion return and the yardage treated.

Theoretically, 'estimated value' and 'actual value' should be the same, but in practice there is found to be a varying percentage of difference. This variation is dependent upon many factors, one or more of which may be the determining cause of the variation in any given case, such as local topography, character of metal content, character of gravel, presence of water, and methods of testing. Yet, even with these changing conditions, a certain uniform ratio should be maintained by adapting the method of testing to local conditions, that is, the method of testing one tract of gravel would not necessarily apply to another. It is here that the personal equation enters into the question, the experience of the examining engineer, together with his faculty for judging conditions, goes a long way toward reducing the difference between 'estimated' and 'actual' value. I shall briefly review the several methods generally used in testing placer deposits, and attempt to show what degree of reliability may reasonably be expected from each, as inferred from experience in placer mining examinations in both North and South America.

Preliminary Pan Testing

This method is used primarily for determining the gold content of a gravel deposit to learn if it will justify further and more careful testing.

The only tools necessary are a standard gold pan, a pick, a shovel, and a two-foot rule or steel tape line. The fundamental requirement, however, is one that the engineer himself must possess, namely, the knowledge requisite to estimate accurately by observation the number of pans of gravel that will equal a cubic yard in place. The number of pans, filled evenly with the top, which will constitute a cubic yard in place varies from 20 to 160, depending upon the degree of coarseness or fineness of the material. About 150 or 160 pans of sand are required to make a cubic yard, while for a very coarse gravel, not more than 20 or 30 are required. An average gravel runs about 60 or 70 pans to the cubic yard. It is upon this point that the secret of obtaining accurate results largely depends, and this knowledge comes only from field experience and experiment. The bank in question may be dealt with as a whole and a figure representing the number of pans to the cubic yard determined, or if there is a very decided variation in the character of the material, as is sometimes the case, it may be treated by strata, in which event each stratum will have its own factor to be applied when that particular stratum is tested.

The method of procedure is as follows: Clean off a face on the bank, say two feet in width and extending from bedrock to top, removing the gravel to at least 6 or 8 inches in depth. This is a precaution that should always be observed if accurate results are desired. In case of leaching or surface concentration, this method insures more correct results, and if there should have been an attempt to salt the gravel, it tends to prevent fraud. For this work, in some cases, it will be convenient to have a ladder, or it may even be necessary to use a rope, allowing one's self to be raised or lowered from above. If the test is to be rough, the samples may be taken in a succession of steps at easily accessible points. Should this method be used, care must be taken not to skip sections of the bank or to overlap, a feature

which it is especially necessary to guard against. Gold, owing to the manner of its deposition, has a very marked tendency to lie in longitudinal streaks, more or less paralleling the bedrock. These streaks may sometimes be exceptionally rich and yet be not more than one or two inches in thickness, hence missing or overlapping will give false results. It is advisable when removing the outside gravel to leave the face as smooth and even as the character of the gravel will permit, thus greatly facilitating the taking of the sample.

Sampling

When the gravel face has been satisfactorily prepared, start on bedrock and measure up one foot, putting a small wooden peg at that point, then, holding the pan on the bottom so as to catch all loosened gravel, start to remove the sample by means of a small pick, working from the bottom up to the height marked by the peg. The sample should be taken up and down the first foot section in as nearly a straight line as the formation will permit, care being taken that an equal quantity of the gravel is removed from all portions along the line of the cut. This method prevents obtaining a false result which would ensue from taking too much or too little of any rich streak that might be present. Take sufficient gravel to fill the pan evenly, allowing all rocks which may be included to remain in the pan.

The full pan of gravel is then taken to a convenient pool and carefully panned, colors being counted. Record the number of colors, position of the sample, and the estimated number of pans to the cubic yard for that particular stratum. Sample the next foot in a similar manner, continuing the work until the bank has been sampled a foot at a time. When the sampling is completed, a small cut will have been taken from top to bottom.

If the gravel in the bank is fairly uniform and is to be treated as a whole, the colors from each successive foot may be put together in a small vessel for weighing, but if on the other hand, the bank has been divided into several strata, all colors from the same stratum should be put together, each stratum being figured separately.

The calculating of results is simple. The gold obtained is carefully cleaned and weighed and its value in dollars and cents determined. This sum is then divided by the number of pans taken and the result multiplied by the estimated factor which gives the value per cubic yard for the bank. The following is an example taken from actual work. The bank in this instance was 10 ft. high, and from it 10 pans were taken. The gold recovered weighed 30.4 mg. with value for this locality of 1.76c. or 0.176c. per pan. I estimated 70 pans to the cubic yard, giving a bank value of 12.3c. per cubic yard. The following may be given as another example in which it was found necessary to sample the separate strata owing to a very considerable difference in the character of the gravel. Height of bank 35 ft. divided into two strata of 14 and 21 ft. in thickness; for the 14-ft. stratum 40 pans to the cubic yard was allowed and 70 for the 21-ft. stratum; weight of gold obtained from the 14-ft. stratum 160 mg. with value of 9.25c.; fourteen pans were taken giving a value of 0.66c. per pan to which, applying the estimated factor of 40, gave a stratum value of 26.4c. per cubic yard. For the 21-ft. stratum the gold recovered weighed 64 mg. with value of 3.7c., giving a pan value of 0.18c., multiplying this by 70 gave a value of 12.6c. per cubic yard for the stratum. Now, to obtain a correct bank value the above results are averaged taking into account value and thickness of strata as follows:

$$14 \times 0.264 = 3.696$$
$$21 \times 0.126 = 2.646$$

$$35 \qquad 6.342$$

$6.342 \div 35 = 18.12$c. per cubic yard, value of the bank from top to bottom.

This method of testing, while rough, if carefully done will give fairly accurate results, as evidenced by the following: On one occasion I sampled a 17-ft. bank by the above pan method, obtaining a value for the gravel of 6.5c. per cubic yard. A few days later this same bank was tested with a carefully measured cut from top to bottom, washing, by means of a rocker 127.8 cu. ft. of gravel (measured in place) from which was obtained a result of 6.6c. per cubic yard. On several other occasions where I have checked my testing, results have been obtained which checked within one or two cents, showing that a fair degree of reliance may be placed on this method of preliminary sampling.

Advantages of Pan Testing

Pan testing is particularly useful in that it tends greatly to reduce the time and expense necessary for making a preliminary examination of an extensive territory. It enables an engineer to eliminate quickly those areas which are of too low grade to be considered. The saving in expense alone makes this method worthy of special consideration. I found, in the tropics, that with an assistant and possibly a native to carry pick and shovel, I could go over and test an extensive area of gravel in a single day, determining what parts should be abandoned and picking out those worthy of a more thorough examination. Often it would be found that whole areas did not deserve a second visit. To prospect this same area by one of the more elaborate methods would necessitate the transporting of rockers, tools, and other paraphernalia to the scene of the work, the employing of from five to ten natives with one or two extra white men to make the cuts and run the rockers, besides consuming from five to ten days in the performance of the work. The result of all such labor, time, and expense would merely prove that the gravel was not of sufficient value to warrant consideration. It is needless to demonstrate further the saving in dollars and cents that may be effected by

a thorough knowledge of the pan method of preliminary sampling.

Among the more thorough and reliable methods of testing, the next in order is somewhat analogous to the pan method, though considerably more exact in its results. It is that of measured cuts. Under ordinary conditions, if carefully done, this method is probably the most trustworthy, giving results as accurate as those obtained from actual placer operations. By this method the gold contained in a known volume of gravel, measured in place, is ascertained by careful washing. There are no uncertain factors to determine or estimate, such as the expansion in volume of gravel out of place, and by reason of the fact that the figures for gold obtained are based upon the gravel deposit, *in situ*, dependable results are by no means so difficult to reach.

Accuracy of the Method

The degree of accuracy is commensurate with the size of the sample, yet judgment must be used to keep the volume of the sample in proportion to the size of the bank exposure, with due regard also to the item of expense. Beyond certain limits, the results from an excessively large sample may not be more accurate than from one of smaller proportions, while to handle the larger sample will entail considerably more expense. The size of the sample to be taken will also greatly depend upon the character and distribution of the gold content. The average assay of a gravel deposit in which the gold is fine and evenly distributed throughout, may be determined by a much smaller sample than one in which the gold occurs as nuggets which are perhaps widely disseminated. When there is a reasonable doubt as to the volume of sample to be taken, it is far better for the examining engineer to take the sample too large than to run the risk of obtaining false results by taking too small a sample.

The volume having been determined, the bank is cleaned off from top to bottom as in the method of pan sampling, a sufficient width being taken to leave a foot on either side of the proposed cut. The gravel is then removed for washing. Too much care cannot be taken in picking out the sample in order to keep the cut of uniform size and to prevent caving or breaking of its sides. If the gravel is fairly compact and homogeneous, little trouble will be experienced. If, on the other hand, the gravel is loose, sandy, and interspersed with large sized rocks having a tendency to loosen easily and fall out, some difficulty may be encountered.

Assuming that the bank to be sampled is 35 ft. in height and that it has been decided to take a cut from top to bottom 2 ft. in width and 1.5 ft. in depth, begin on bedrock picking out the gravel, working from the centre of the cut toward both edges, but not approaching to within more than 2 or 3 in. of the final width and depth. This work may be done rapidly. When a considerable quantity of the gravel has been removed begin with great care trimming. Little by little the gravel is removed until the exact two feet in width has been obtained with a depth into the bank of 18 inches. For accurate work it will be found advisable to make a templet from a piece of board. This, in the hands of a careful workman, will give very good results. Sometimes in removing gravel a large sized boulder extending partly into the cut may be encountered, a portion of it being firmly imbedded in the surrounding gravel. To remove this boulder would probably bring into the sample a quantity of excess gravel. In such cases, it is advisable to pick carefully around the part projecting into the cut and allow it to remain, because, as can be readily seen, this will not in any way affect the results of the test. In this manner proceed to the top, at all times keeping the depth of the cut exactly 18 inches. If the bank is higher than can be easily reached, a ladder or rope may be used to work from. When taking samples from a high bank it will be found advisable to use a canvas sheet spread at the bottom, as the gravel dropping from such a height will have a tendency to scatter. Often it is a good plan to use two pieces of canvas, one at the bottom and the other hung on the face of the bank over the cut. This precaution confines the loose gravel to the cut and it will drop to the bottom as through a pipe or shoot.

In some cases owing to configuration of the bank, it may be impossible to make a continuous cut from top to bottom in which event it can be taken in sections; care being used, as previously mentioned, not to omit or overlap any portion of the bank.

The gravel as removed is carefully washed by means of a rocker. When all gravel has been washed and the cut carefully checked as regards accuracy of measurements, the recovered gold is cleaned, weighed, and the gravel value calculated, as follows:

Cut $1.5 \times 2 \times 35 = 105$ cu. ft.

$105 : 27 :: 20.7 : X.$

$X = 5.3$c. per cu. yd., bank value.

Results by this method are as reliable as any that can be obtained, if work has been carefully and scientifically done. A deposit of gravel tested by a sufficient number of these cuts so as to obtain a fair average can be relied upon to yield results that will check very closely with those obtained by actual mining operations.

Deposits Suitable to this Method

The particular method of testing described above is only applicable to such deposits as have a fairly perpendicular bank exposure from bedrock to grass roots such as may be found on the stream side of bench deposits. Where no such exposures exist, resort must be had to another form of the measured cut system—that of shaft sinking. Where accurate results are desired, this method is limited to such areas as have little or no bedrock water. To sink a shaft where from two to three feet of water may be encountered on bedrock and to obtain results that will even approximate true conditions, is almost a physical impossibility; therefore,

when this condition exists, other methods which will be considered later should be adopted.

When testing by means of shafts, one of two systems may be used. The shaft may be sunk to bedrock, keeping it to an accurately measured size and washing all the gravel obtained; or, the shaft may be sunk to bedrock and made of such size that it can easily be worked in. When bedrock is reached, measured cuts can be taken from top to bottom in the sides. If all the gravel is to be washed, it is customary to sink the shaft of such dimensions that every three feet in depth will represent a cubic yard in place. Circular shafts should have a diameter of 3 ft. 5 in., while rectangular shafts are made 2 ft. 3 in. by 4 ft.; both of these sizes, while small, are sufficiently large for an experienced shaft man. Of the two styles, I prefer the circular shaft, as the gravel will stand better and there is less trouble from caving. Where timbering has to be done, the rectangular shape will, however, be found preferable. For the circular shaft, a templet made by nailing together in the form of a cross, two pieces of wood measuring 3.4 ft. in length is convenient. This templet may be suspended from the centre by a cord and can be raised or lowered in the shaft, thus keeping the shaft of a uniform size as sinking progresses. Care must be taken not to gouge the sides, but the shaft should be kept as symmetrical as possible at all times. When bedrock has been reached, it should be thoroughly and carefully cleaned. It is good practice to sink a foot or two into the bedrock in order to make sure that all gold has been recovered. All gravel as removed is carefully washed in a rocker. The washing should be kept abreast of the sinking in order that, by observing the returns, the depth and position of pay-streaks may be noted. The recovered gold is cleaned, weighed, and results figured. The depth of the shaft gives the yardage contained in the sample.

Prospect Shafts

When cuts are to be taken down the sides, make the shaft of such size that it will permit of rapid sinking. For this method the rectangular shape will be found more convenient than the circular. After the shaft has reached bedrock, carefully remove all loose material and pick down the sample from one of the sides or ends, keeping the cut to exact dimensions as previously described. The sample is hoisted out by bucket and carefully washed, the value per cubic yard being determined as already described. If the testing is to be thorough, two cuts may be taken, one from either end, or one from a side and one from an end, or any such combination as the man in charge may elect. The work of taking the cut can be greatly facilitated if, when sinking the shaft, care is taken to keep the side or end from which sample is to be taken as true and uniform as possible.

Of the two methods, that of washing all the gravel removed, is the more reliable, owing to the larger volume of the sample and the proportionate reduction in error due to possible loss of gold. Against this, however, must be considered the increase in time and expense incident to the handling of a greater volume of gravel. Furthermore, if the gravel has a tendency to loosen and cave, it is sometimes impossible to pick an accurate cut down the sides; often a circular shaft, if quickly sunk, will stand sufficiently long to reach bedrock and obtain the complete sample. In recent testing, in a somewhat loose and sandy gravel, I found in every case that a fairly uniform circular shaft could be sunk to bedrock and a complete sample obtained where my attempt to take a cut in the sides resulted in extensive caving and the ultimate loss of the shaft.

Another form of testing which should be properly classed under the head of measured cuts, is that of bedrock driving. This is applicable to bench deposits where it has been determined that all gold lies in the foot or two of gravel resting on bedrock. To prospect such a deposit across the full width of the bench by pits, would entail the sinking of several very deep and expensive shafts, while much more reliable results can be obtained at much less expense by driving on bedrock. Care should be taken in all such cases to have the drift at right angles to the line of flow, otherwise erroneous results will be obtained. As samples of this nature are necessarily large in volume, the same degree of care in washing and handling is not required as for those of lesser volume. To save time, the gravel may be washed by means of a small and carefully constructed series of sluice-boxes, the boxes being of sufficient length to ensure complete recovery. This method very closely approximates actual operating conditions. In obtaining results by this method, it is the general practice to base figures upon the value of gold recovered per square yard of bedrock uncovered, from which, when the average height of gravel on bedrock along the line of the drift has been determined, the value per cubic yard is computed. The one measurement to be watched in this work is the width of the drift. This should be uniform and great care should be taken not to gouge into the sides and thus obtain an excess of the rich pay-streak.

The following case, from my experience, will serve as an example of the above method. There was a bench deposit which on the stream edge measured 24 ft. in height, increasing rapidly but uniformly to 39 ft. on the inside. The gold lay in a streak on bedrock varying from 18 to 24 in. thick, everything above this streak being practically barren. It was obvious that the most accurate and the quickest way of testing this deposit was by means of a bedrock drift at right angles to the line of flow. A drift of uniform width (4.5 ft.) was maintained and all gravel removed was washed through sluice boxes which were cleaned up every evening. After driving 52.5 ft. the other rim of the bench was reached. From this drift gold to the value of $131.40 was obtained and 26.25 sq. yd. of bedrock uncovered, which yielded assays of approximately $5 per sq. yd. of bedrock cleaned. By survey over the line of the drift, I found the average depth to be 10.3 yd., which gave a value to the gravel in the deposit of 48.5c. per cubic yard.

For such gravel areas as are swampy, or that contain underground water, or in which the gravel is too fine and loose to admit of shaft sinking, the before described methods are not applicable and resort must be had to mechanical means for obtaining samples. The most widely used mechanical method adapted to this kind of work is that of churn-drilling. Much has already been written regarding this method of testing gravel deposits, and the process will not be described in detail here.

Use of Power Drills

Briefly, the drill method consists of forcing a pipe or casing through the gravel to bedrock, removing the gravel from the interior as the casing descends, the removed gravel being carefully washed and gold recovered. For this work two sizes of casing are employed, of 4 and 6 in. diameter, casing of greater diameter being rarely used. The area enclosed by the cutting shoe on the end of a piece of 6-in. casing varies from about 0.196 to 0.25 of a square foot, which is equivalent approximately to the 0.000005 part of the area of an acre, an infinitesimal quantity. In the same way, the volume of gravel removed from a drill-hole is relatively very small as compared to the volume of gravel contained in an acre, which goes to show what a very small proportion of the metal contents of an acre one hole would give. Should the character of the gravel in the acre be entirely homogeneous, with gold distributed throughout every part and all particles of equal weight, then one hole to a given tract would afford an accurate determination of the gravel value for that tract, as every other hole put down would be but a repetition of the first. Such conditions unfortunately rarely, if ever, exist. A hole might descend into an almost barren region which would not, perhaps, be more than 7 or 8 inches in diameter, while the adjacent gravel would be of high grade; or, on the other hand, the pipe in its downward course might enclose within its 0.25 sq. ft. of area the only existing nugget within the whole tract. In the one case a negative result would be obtained where it should be high, while in the other case, a high result where it should be low. This brings out a point of prime importance, namely, that the value of the gravel in any given tract cannot be determined by the results from individual holes but must be based upon an average of results from many holes. I have in mind a piece of dredging ground now under operation which aptly illustrates the above. The gold in this property was coarse and nuggety, with areas of high and low value. During the dredging operation careful watch was kept to determine, as closely as conditions would permit, the degree of variation between the actual value as shown by the dredge operations and the estimated value as determined by the drill tests. It was found that this variation in a great many cases amounted to 10c. to 15c. per cubic yard as shown by individual drill holes, yet the dredge returns for the whole area gave an average value per cubic yard which approximated within 2% of the average value of the gravel as computed from the drill tests.

In a preliminary drilling it is customary to place holes in lines sometimes 500 or 1000 ft. apart with 200 or more feet between the holes. This would mean an average of two holes or less to the acre. In the final drilling, holes may be placed 50 ft. apart with a distance between lines of 200 ft. This would only make a possible 8 holes to the acre, yet such is the law of compensation that an average of all holes will give a fairly reliable idea of the gold content of the gravel. The average value shown by the eight holes to the acre would be far more accurate than that of the two to the acre. The degree of reliability of results obtained by drilling a given tract is largely dependent upon the number of holes drilled in that tract.

Besides the above, another feature greatly affects results and that is the amount of care and thought used in putting down holes. In drilling placer deposits, owing to their generally shallow nature, it is easy enough to put down a hole to bedrock, but to put that hole down in such a manner as to obtain at all times an accurate sample of gravel for every foot is quite another matter. Great care must be taken when in tight or hard driving ground, not to force or push out of the way gravel which rightfully belongs within the sample or, on the other hand, when in loose running ground, not to include gravel which does not belong in the sample. These are points which must be carefully watched and steps taken to prevent their occurrence or, if unavoidable, the excesses or discrepancies in volume noted and allowed for when final computations are made. It is here that the skill and experience of the examining engineer enters into the reliability factor.

Use of the Hand-Drill

Much consideration also must be given to the type of drill used. Some machines, because of their method of operation, naturally give more trustworthy results than others. Of the types now on the market, probably the most reliable, and one which more nearly approaches the ideal method of sampling, is the hand drill. This with its rotating cutting shoe, which bores into the gravel descending by its own weight, comes as near cutting out a true cylindrical sample of the gravel from top to bedrock as it is possible to obtain. Steam machines which depend on heavy blows to drive down the casing, with the accompanying dropping of the heavy stem, cause such a loosening and disturbance in the surrounding gravel that an increase in the volume of the sample extracted is nearly always found. However, it has been demonstrated that in a carefully drilled piece of placer gravel, the estimated gold content in dollars, as based on drill-hole results, will approximate within less than 5% of the actual bullion value as extracted by the dredge.

In conclusion, when asked the degree of reliability to be placed on any placer examination, it is necessary to first know the general characteristics of the deposit to be examined, secondly, the method of testing to be employed, and, thirdly, the care and experience of the examining engineer.

THE WATER FRONT AT KETCHIKAN, ALASKA.

Mining Revival in the Ketchikan District, Alaska

By E. E. HURJA

The Ketchikan mining district, southernmost of Alaska's mineral belts, comprises 9370 sq. mi. of territory, of which about half is represented by islands. The largest insular body is Prince of Wales island, the next is Revillagigedo island, the one with an area of 2800 and the other with 1120 sq. mi. Although prospectors, attracted by the Klondike and Juneau goldfields, have passed through the Ketchikan district for nearly two decades, no real exploration was done until about 1900. So far as known, no attempt was made to seek mineral wealth during the Russian occupation of the territory. Charles Baranovich, a Russian merchant, is reported to have prospected for copper near Kassan village soon after the American occupation of Alaska, but nothing further is known. James Bawden, still a resident of Ketchikan, discovered workable deposits of gold on the eastern side of Annette island in 1892. William Barnard found gold and copper near Kasaan village in 1893; other discoveries were made in 1893 and from 1899 to 1901 there was considerable mining activity. Many hundreds of claims were staked. Ketchikan is the supply centre for the entire district. It is situated on the west side of Revillagigedo island and on the east side of Tongass Narrows. It is 660 miles northwest of Seattle and 240 miles southeast of Juneau. Salmon canneries, sawmills, fertilizer factories and other minor industries supplement mining. It has a number of stores, is a port of entry, and has a population of about 1500.

Copper in the Ketchikan district occurs in irregular lenses and is mined generally by following the orebody. The bulk of the copper ore is chalcopyrite and cupriferous pyrite, accompanied by magnetite, pyrrhotite, and other sulphide minerals. Development has been slow and there are not many producing mines in the district. Abundant water-power is available on nearly every island, while the resources of hemlock, spruce, and cedar furnish ample timber for present needs.

The oldest regular producer in the district is the Jumbo property near the head of Hetta inlet, on the west coast of Prince of Wales island. It is operated by the Alaska Industrial Co., of New York, of which Charles A. Sulzer is manager. A depth of 800 ft. has been attained on the orebody, with a winze put down 200 ft. below the lowest working level, No. 4. Shipments to the Tacoma smelter are being made at the rate of 1000 tons per month. The Copper Mountain group of claims at Hetta inlet have been taken over by the Alaska Consolidated Mining & Smelting Co., of Duluth, Minnesota, and are being developed under the direction of R. L. Kilpatrick, superintendent. A smelting plant of 250 tons daily capacity has been idle since 1907. Prospecting is being done on the Red Wing group of claims, near the entrance to Hetta inlet. Small shipments of ore from the vein deposit on the Red Wing claim have been sent to the smelter at irregular intervals since 1903.

Kasaan Bay Claims

Rush & Brown, operating on a group of claims near the head of Kasaan bay, have been shipping at intervals since 1906. Regular shipments are now made at the rate of 300 tons per month. A depth of 184 ft. on the orebody has been increased by 50 ft. during the past year. Ore is being mined from both the magnetite and sulphide orebodies. A railroad 3½ miles in length con-

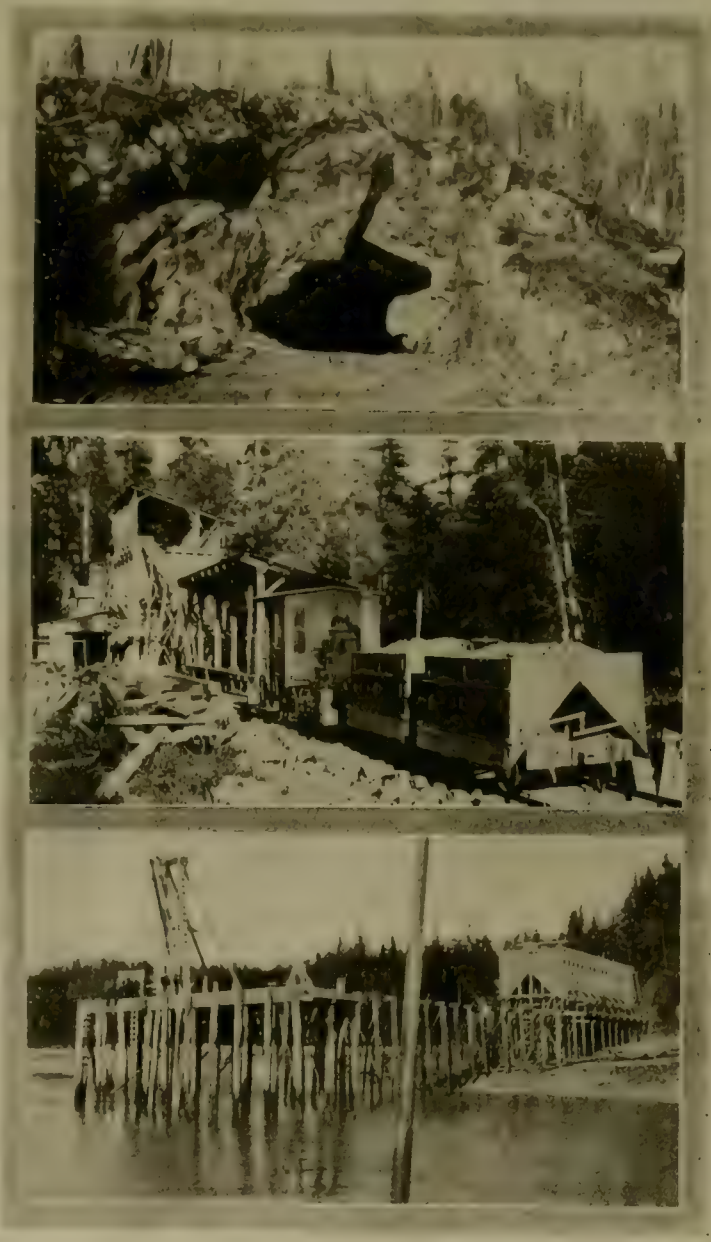
nects the mine with the ore bunkers and wharf. The Goodro claims at the head of Karta bay are being developed. Native gold and chalcopyrite occur in the bornite ore mined from this property. A shipment is being prepared now for smelting. Development work on the Mt. Andrew property, at the head of Kasaan bay, 27 miles from Ketchikan, was resumed in January, under the direction of W. J. Rogers, superintendent. The claims are being surveyed for patent. The property is owned by the Andrew estate of England and has made numerous shipments. A cable tramway 3600 ft. long connects the mine with the wharf. Six different and irregular ore masses have been opened.

Due to the advent into the Ketchikan district of the Granby Consolidated M. S. & P. Co., work will be resumed on the Mamie group on Kasaan peninsula, near Hadley, 30 miles northwest of Ketchikan. The Granby company has bought and paid for the property, and has started to place the buildings and trams in condition for a resumption of active development. A contract to explore the claims with a diamond-drill has been made. The other acquisitions of the Granby company in the Ketchikan district are the It and Dean mines, near the head of Kasaan bay, three miles from Kasaan. The It property is equipped with a steam power-plant, ore bunkers, dock, and tram. The new owners expect to start work July 1. The Dean group, adjoining the It, will be worked in conjunction with the It. Four hundred feet of development work has been done on the Dean and a depth from the surface of 80 ft. attained.

The Valparaiso Claims

Plans to resume work on a large scale on the Valparaiso group of claims, a mile and a half from Dolomi, and owned by the Princeton M. & M. Co., have been completed and are being carried out under B. A. Eardley, manager. On June 11, fifteen tons of machinery left Ketchikan for the property. Work on the claims was discontinued in the fall of 1913 because of water; but during the winter a 600-ft. drainage adit was driven, so the mine again is unwatered. A five-drill water-operated compressor will be used in supplying ore for the 10-stamp mill, which is operated in connection with a Chilean mill, giving a capacity of 50 tons per day. The ore is a gold-bearing quartz in a fissure vein.

The Alaska Venture Syndicate, Ltd., of London, a subsidiary of the Great Boulder Proprietory of Australia, has acquired the Old Glory group of claims on Smuggler's cove, Cleveland peninsula, 25 miles north of Ketchikan, from Martin Bugge and associates. The final payment was made in February. J. T. Hollow, of London, engineer for the Company, is now at Ketchikan, preparing to install the prospecting plant on the claims. The improvements include a three-drill com-



1. ENTRANCE TO RUSH AND BROWN MINE.
2. MINE TERMINAL OF RUSH AND BROWN RAILROAD.
3. RAILROAD TERMINAL AT HEAD OF KASAAN BAY, PRINCE OF WALES ISLAND.

pressor and a dam for the power-plant. Forty thousand dollars has been allotted by the Company for preliminary prospecting. Work has been resumed 1000 ft. below the old adit. Fifteen hundred feet of adit has been driven and two small low-grade orebodies have been cut. The adit will be continued 600 ft., to cut the main orebody. E. T. Leahy is superintendent for the Company. The ore is free-milling. The Alaska Venture Syndicate has taken an option on the Goldstream mine on Gravina island, three miles from Ketchikan, and is preparing to resume development work on the claims. Owing to a lack of funds, the Moonshine silver-lead property, on Cholmondeley sound, owned by the Sunshine Mining Co., is idle. One hundred and fifty tons of ore is on the dump awaiting shipment.

A thorough sampling and examination of the Julia group and Humboldt claims, on 12-Mile arm of Kasaan bay, 40 miles from Ketchikan, has been made by engineers of the Alaska-Gastineau company. The property is owned by M. K. and J. H. Rodgers and has been operated for a year and a half under bond and lease by M. M. Reese and H. Webber. The vein is from two to 12 ft. wide. A small compressor plant and a five-stamp mill, both operated by water-power, are at work on the property. Mr. Reese is now at Juneau, conferring with the Alaska-Gastineau company officials over the possible sale of the claims.

The Crackerjack Property

The Crackerjack group of gold claims, but recently out of litigation, and which has been idle for a number of years, is being developed by the owners, James Bawden and Morris McMicken. The property is a mile north of the Julia group. The vein has a width of from 2 to 14 ft. and assays from $8 to $15 per ton. The underground development work aggregates 2864 ft. A preliminary sampling was completed last week by M. Nash, of Juneau, reported to be acting for foreign capital. Adjoining the Crackerjack is the Ready Bullion property, on which a five-stamp mill is operating. The property is owned by Webber & McKenzie. A new level has been opened up, at a depth of 170 ft. Three hundred feet of drift has been driven on the vein. Mill runs show a value of $30 per ton. The vein is narrow. The Cascade property, four miles from Hollis, has been examined by engineers and is under bond. The claims are owned by C. Radenbaugh, who has operated an arrastre and a two-stamp mill successfully on the property during the past two years. Eight miles from tidewater at Hollis, and west of the Crackerjack group, is the Lucky Nell group, owned by G. W. and Fred Gervais. Thirty tons of ore was shipped out last winter to the smelter. Forty-six dollars per ton was obtained, which netted $33 per ton after smelting and freighting charges had been paid. Adjoining the Lucky Nell group are the Commander claims, owned by Gust Detlefson. Development in a small way is being carried on.

O. Jacobsen and E. Olsby are prospecting the Bruce group of seven copper claims, four miles from Sulzer. The property has on it two 60-hp. boilers, one six-drill Rand compressor, and other machinery, as well as buildings. Since the dock collapsed in 1913 when a 300-ton shipment of ore was being loaded on a ship, nothing has been done. Wright & Reynolds, working on Nutqua lagoon on the west coast of Prince of Wales island, have a vein varying in width from two to six feet. An adit 200 ft. long has been driven and 180 ft. from the portal, a winze sunk on the vein. Work on the big adit of the Northland Development company at its copper property 10 miles from Craig is progressing. Stoping on the orebody has been started. B. Tucker is manager.

A group of seven claims is owned by Richard Nuckolls and Gundar Nygard on Revillagigedo island at Thorne arm, 25 miles from Ketchikan. Open-cut prospecting has uncovered a vein 15 to 30 ft. wide for a distance of 3000 ft. King & Gilmour are developing the Sea Level claim, one of the first in the district, on which a 30-stamp mill was erected after 50 ft. of shaft had been sunk. Development work on the Wild West group, owned by Mrs. Al. Smith, is going on. The Gold Banner claim, owned by Bert Steers, has an adit 80 ft. long which cuts a vein six feet wide. The owner is prospecting on the surface at present.

The Gold Standard was the first claim discovered in the Helm bay district, having been found in 1900 by Johnson and Dyer. It is owned by Nuckolls, J. E. Chilberg, and C. E. Ingersoll. A test shipment made last month has shown a value of $5 per ton said to represent a face 130 ft. wide. Two miles north of the Gold Standard is the King & Elliott group, recently discovered and under bond for $60,000. The group consists of four claims. Several shipments of low-grade ore have been made from the Gold Mountain group, owned by Richard Nuckolls. Three hundred feet of adit has been driven along the vein at a depth of 200 ft. The vein is 30 ft. in width. The tests show ore worth $6 per ton. Polson & Ickis have a copper and gold property on McLean arm, 40 miles from Ketchikan, known as the Veta group. Two chalcopyrite deposits have been developed for a total distance of 265 feet.

Marble Deposits

In addition to copper and gold, marble forms one of the mineral resources of the Ketchikan district. The Vermont Marble company owns a total area of 703,246 acres of land, and operates a quarry at Tokeen, near the northern end of Prince of Wales island. Edward Brown, an assayer, who has been in Ketchikan for 11 years, says he has examined specimens of chrome iron, manganese, tin, scheelite, and platinum which were brought in by prospectors from different parts of the Ketchikan mining district. The United States recorder for the Ketchikan district reports that since 1902 a total of 4250 claims have been staked in the district, of which a larger portion has lapsed. Thirty placer claims have been recorded on the Unuk river, about 60 miles from Ketchikan.

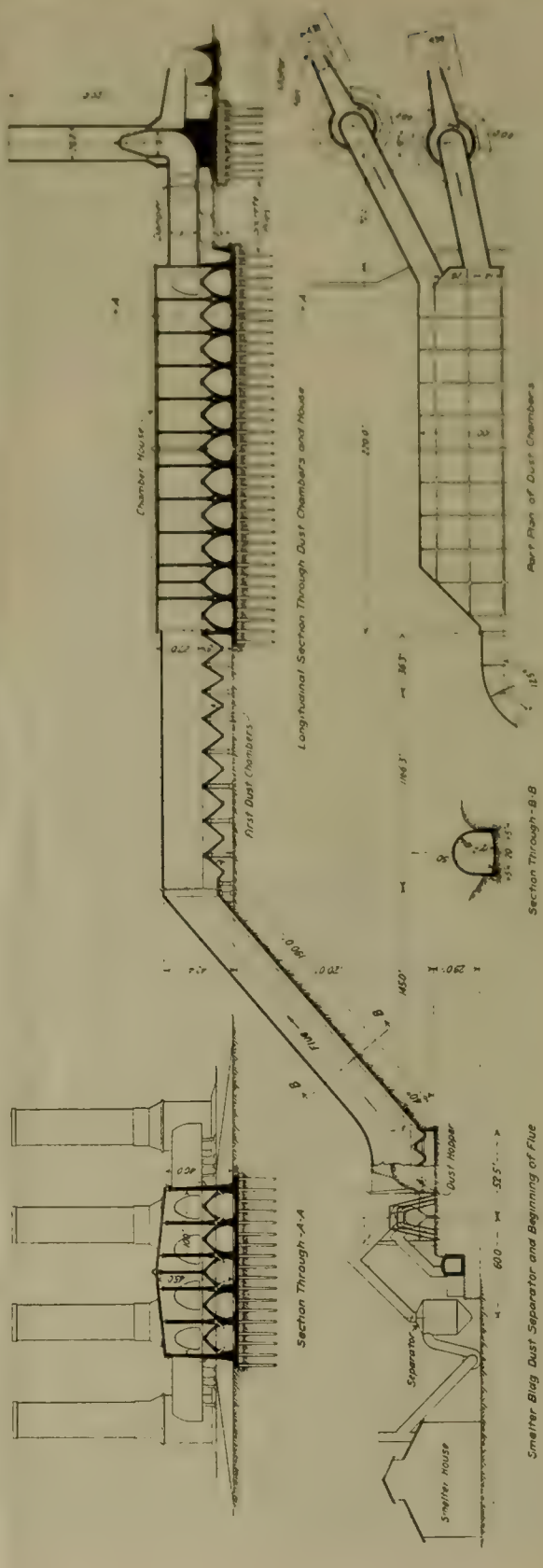
Dust Chambers at the Ashio Smelter, Japan

On June 15, 1912, the Imperial government of Japan passed a bill requiring the Japanese smelters to install equipment for the elimination of smelter dust and fume, which in many instances had become a menace to agriculture and had destroyed the vegetation in the vicinity of the smelters. This bill affected five smelters in Japan, and equipment is now being installed at the different plants to meet the requirements of this law. In the accompanying drawings there is presented two sections through the new reinforced concrete dust-chambers at the Ashio Copper Co.'s smelter and a part plan of the chamber building. This work, which is in course of construction, will probably be finished by the first of November.

At the Ashio plant there are three furnaces in operation, with an output of about 50,000 lb. of copper per day. From a charge made up of 11.5% Cu, 24.4% Fe, 23.8% S, 0.65% As, 30% SiO_2, and 7% Al_2O_3, a 94.4% extraction of the copper is obtained. The gases from the furnaces were formerly allowed to escape directly into the air, which has resulted in the killing of all vegetation within an area of one-half mile radius from the plant and permitting of but little vegetation within a mile from the plant. The volume of SO_2 escaping into the air is over 2400 cu. ft. per minute. The smelting plant is an interesting one since part precipitation of the SO_2 is effected by the use of lime water.

The flues and dust chambers are built of reinforced concrete with but little metal exposed to the action of the fumes. The gases from the furnaces pass through a dust separator as shown in the diagram. Here a spiral motion is imparted to the gases and a large per cent of the dust is deposited and drawn from the cone-shaped hopper in the bottom. From the separator the gas passes up an incline flue, in the lower end of which are several hoppers in which the dust collects. At the top of the flue the gas passes through a series of chambers before it enters the main chamber house. Up to this point and in the first few hoppers in the chamber house the dust that is collected in the hoppers will contain copper in sufficient quantity to make it of commercial importance and will be subsequently recovered. In the chamber house proper the dust will contain such a high per cent of arsenic, zinc, and other impurities that it will be of no value and will be discarded.

The chamber house is subdivided into many compartments and the gas as it passes through meets many obstacles in the shape of concrete partitions, baffles, and wires. Wires, as has come to be the common practice in the United States, will be used in these chambers for the separation of the dust from the furnace gas. The main building as shown in the diagram is 220 ft. long by 100 ft. wide. The chambers are connected with four stacks, three of which will be in constant use, the fourth being held in reserve. As the gas emerges from



the chamber room it passes through flues to the stacks, which flues end in dome shaped structures as seen in the diagram, which have numerous openings causing the gas to be disseminated and mixed with the air before passing to the open. The stacks are connected with fans as shown in the cross-section, which fan blows air into the stack around the openings from the flue, where it mixes with the escaping gases. Besides adding air to the gas before it passes into the open, it of course reduces the pressure in the chambers and forces the draft. The velocity of the gas through the chambers will be about three feet per second. Dampers are placed in the flues for the regulation of the flow of gas through the chambers. The chambers and stack are supported on concrete piles.

Eliminating the Mosquito

Effective methods of getting rid of mosquitoes can never be too generally known, and the following account by Lloyd Noland, superintendent of the health department of the Tennessee Coal, Iron & Railroad Co., Birmingham, Alabama, of the methods used by that Company, as reported in the *Bulletin* of the American Iron and Steel Institute, will be of interest.

A careful inspection of all streams, ponds, pools, and springs, both within and for a distance of one mile around each camp, was made early in the spring. *Anopheles* larvæ were found in practically all places of this character. *Culex* larvæ of several types were found in rain barrels, tin cans, fire barrels, septic tanks, collections of dirty water around houses, and even in mines at some points.

The work accomplished consists in draining and filling all pools and swamps, where practical; the weekly spraying with crude petroleum or larvacide of such pools or swamps as cannot be filled or drained; the clearing of vegetation in swampy spots; the maintenance of drainage ditches; and the installation of automatic oil drips at the head of sluggish streams. All rain-barrels are destroyed or removed; tin cans and bottles are carefully removed from all parts of the camp; and larvacide, manufactured by the Company, is added to water in fire barrels. General screening of all houses, while ideal as a protection, is too expensive to be considered. Screening has been resorted to only as a protection against mosquito infection in houses where there are actually cases of malaria.

Filling and draining of swamps and pools is by far the most logical and economical method of destroying these breeding places. The first cost of such work may be a considerable item, but this is more than balanced when the yearly cost of oiling is considered. Oiling has been accomplished by the use of drip barrels or larvacide. The first, a closed barrel, containing 10 to 15 gal. of ordinary crude petroleum, is equipped with an ordinary ⅜-in. gate valve and mounted on a small platform at the head of such sluggish streams as are found to contain larvæ. The valve is cracked sufficiently to allow a regular drip, rapid enough to give a light film on all water running through the ditch. A surprisingly small amount of oil is required for this purpose. It is necessary with such streams to straighten the banks to remove obstructions such as trash, grass, etc., that may hold back the descending film. Very little work is required to keep these drip barrels in operation, a weekly inspection and refilling being about all that is necessary.

In the second method, isolated pools are sprayed with oil or larvacide, as the case may be. There are many sprays on the market of the knapsack type that answer excellently for this purpose. Pools of large size that are exposed to the action of the wind and that contain much vegetation are difficult to handle because of the fact that the oil film is frequently blown entirely away from a large part of the pool. In order to handle situations of this kind properly, a larvacide developed at Panama is used. This larvacide we manufacture in the following way: One hundred and fifty gallons of crude carbolic acid is heated in an iron tank having a steam coil at 50 lb. pressure. Two hundred pounds of finely crushed and sifted common rosin is dissolved in the heated acid, and 30 lb. of caustic soda dissolved in 6 gal. of water is added. A mechanical stirring rod attached to the tank is used constantly during the process. The product is prepared in a very few minutes, yielding about three and one-half barrels of larvacide, the cost being approximately 19c. per gallon.

A dilution of larvacide of one to ten thousand is amply sufficient to kill all larvæ in pools; a certain amount of care, however, has to be exercised, as this material is somewhat poisonous to stock and will quickly kill fish. Inspectors are required to have sufficient knowledge of mosquito larvæ and of adult mosquitoes to differentiate types. Careful inspection is insisted upon, and complaints of householders of the presence of mosquitoes is investigated. The work already done has shown surprisingly good results, the number of cases of malaria being enormously reduced and the comfort of the people greatly increased.

The following accounts of actual results attained, reported in the *Bulletin*, are encouraging. W. G. Kranz, manager for the National Malleable Castings Co., Sharon, Pennsylvania, reports that the greater portion of the Shenango valley at one time was swampy and malaria was very prevalent; but in recent years, as a result of the industrial development, the lowlands have been filled in and malaria has disappeared almost entirely. Walter Wood, managing director of R. D. Wood & Co., Philadelphia, Pennsylvania, states that in the ordinary development of the land around that plant they have naturally and properly made a point of filling in all low spots. This has been so efficacious that the report comes from the Camden Works that "our wharf watchmen and various boat captains at the wharf state that they are not bothered at all" by mosquitoes. Many other successes of this nature have been reported from other parts of the country.

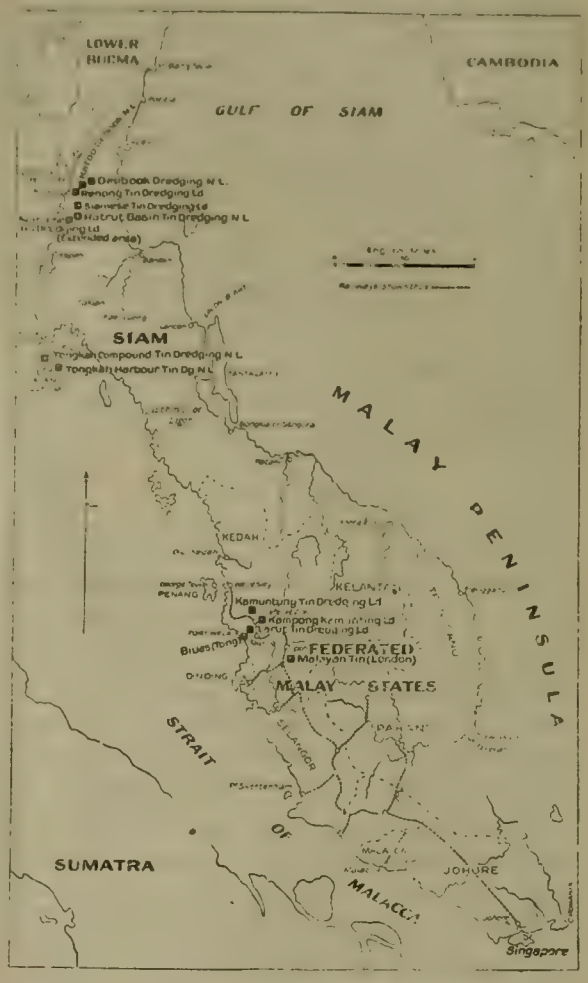
Australian Jam and the Malay Tin Industry

The recent arrival in San Francisco of Henry Jones, a well known jam manufacturer and mining man from Tasmania, brings to mind the relations of fruit canning to tin mining. The following notes, prepared mostly from a recent issue of *The Daily Telegraph*, Sydney, New South Wales, show how close the relation is. In the November and December issues of *The Mining Magazine*, notes were published on how experience in the banana trade of Fiji qualifies anybody for the management of a copper company. The editor of *The Mining Magazine* could not see any relation, although a correspondent thought he could. In the case of jam and tin brilliant results in tin mining have followed the incursion of jam manufacturers into the Malay States.

The world's production of tin in 1913 was 119,000 long tons, of which 62,500 tons was from the Malay Peninsula, 24,850 tons from Bolivia, 17,000 tons from Banca and Billiton (Dutch East Indies), 5800 tons from Cornwall, 3200 tons each from Australia and South Africa, and 2450 tons from China. This is recovered mostly from placers in the Orient, from lodes in Bolivia, Cornwall, and South Africa, and by lode mining, and by hydraulicking, and dredging in Australia. Although tin production in the United States is negligible, yet this country consumed 45,551 tons of the metal in 1913, equal to about 38% of the world's output. This is used mostly in the manufacture of so-called tin plate, which consists of from 2 to 2.5% tin, the remainder being sheet steel, and is used for making cans for jams, preserves, fruit, salmon, and other foods. The average price of tin in New York in 1913 was 44.32c. per pound.

The I. X. L. Syndicate

Nearly ten years ago E. T. Miles went to the Federated Malay States with a commission to sell Australian jam, fruit, timber, and even old steamships, when buyers were offering. He had a little tin-mining experience in Tasmania, and the Chinese who owned the Eastern Shipping Co. are said to have attracted his attention to the tin deposits of Tongkah harbor. Convinced of the suitability of the locality for bucket-dredging, and satisfied of the profitable character of the ground, he returned to Tasmania with the idea of forming a tin-dredging company among local capitalists. Messrs. Jones and Peacock, two well known Tasmanian jam manufacturers, heard the returned traveler's tale, and were convinced. The high price of tin was the very bugbear of their existence as jam manufacturers, and they willingly found support for what came to be known as the I.X.L. Syndicate, taking the trade-name of the Jones jam factory products. The jam people are said to have actually found all the original capital. In November, 1906, the Tongkah Harbor Tin Dredging Co., N. L., was registered in Tasmania, with headquarters at Hobart. Its location is still jealously guarded there by the island capitalists who thus dared to pioneer what has become, or is rapidly becoming, a great industry. The Tongkah Harbor is now a company of £150,000 capital, in £1 shares, all fully paid. A first dividend of 1s. was paid in August 1909, three amounting to 5s. in 1911, four 9s. in 1912, and quarterly dividends of 2s. ever since. Six dredges are at work, and another under construction.



THE MALAY PENINSULA.

All were paid for out of profits. The latter amounted to £78,304 in 1912, and to £80,024 in 1913. Put another way, the Company has returned its shareholders 28s. per share to date, or £217,500; and the market value of the shares is still today about 41s.6d. each.

Melbourne jam men, including A. W. Palfreyman, could not afford to let their Hobart rivals scoop up all the tin. With a certain amount of assistance from Sydney capitalists, they formed Tongkah Compound, N.L., registering the Company in Victoria in 1910. The

capital authorized, and issued, is £50,000, in £1 fully paid shares. The first dividend was paid in June, 1912, and regular distributions have followed since. The twenty-fourth was paid in May. Shareholders have received 49s. per share, or £122,500 in profits; and the Company's shares are still worth 66s., or well over three times their par value, upon the open market.

Small wonder that Sydney mining men declined to leave the exploitation of this wonderful profit-producing Malaya tin country to their Hobart and Melbourne friends. And it was only in accord with the earlier chapters that H. E. Pratten, a representative Sydney jam man, should pioneer Sydney operations. Mr. Pratten was one of the lucky original shareholders in the Tongkah Compound, and, realizing the potentialities of Malaya in the direction of bucket-dredging for tin, he stayed there a few weeks en route to England, in 1911. Becoming interested, he returned there again in 1912, having, prior to his departure from Sydney, formed the Austral Malay Tin, Limited, with a nominal capital of £50,000, £20,000 of which has been called up, and the £1 shares in which are today quoted at 90s. The result of that English trip was the successful flotation of the Kamunting Tin Dredging, Limited (London), with a paid-up capital of £130,000; Kampong Kamunting Tin Dredging, Limited (Sydney), capital paid up £130,000; Larut Tin Dredging, Limited (Sydney), capital paid up £50,000. Mr. Patten is president of the New South Wales Chamber of Manufactures.

Dredging at Gnow

But meantime events had been moving on the Malay Peninsula. Away up north in Siam, at a place called Renong, the English administrator of the Mines Department for Western Siam had been approached by English capitalists with a view to obtaining suitable dredging ground. He took up an area at Gnow, 10 miles south from Renong, where a dredge with 7-cu. ft. buckets started work for the Siamese Tin Dredging Syndicate about 1909. That dredge has won up to 60 tons of black tin per month, and held the record for production until last year, when the Tongkah Compound started its big returns. The Company is now erecting two dredges with 15-ft. buckets at a cost of £30,000 each.

Following the example of the Siamese Tin Dredging Syndicate, another British company, Scotch people being largely interested, sent out a representative, who acquired other areas near Renong. They built their first dredge there in 1910, and while paying their shareholders 20% per annum they have also made sufficient money to buy two large dredges, which are in commission now.

The Malayan Tin was the next English (London registered) bucket-dredging company of importance to start operations. It acquired ground which the natives had already worked in Kinta valley, near Ipoh, capital of the Federated Malay States. One dredge started in 1912, and a second was recently put into commission. The nature of the country in Kinta valley is entirely different from that of the more northerly areas. It is limestone country, and it remains to be seen whether bucket-dredging can be carried out successfully on the uneven botto mcommon to such formations. So far, the first dredge operated by the Company is doing fairly well.

Dredging in Siam

Australian associations were not nearly finished with the establishment of the Tongkah and Austral-Malay mining groups. Mr. Miles retired from his Tongkah associations, and struck out north in Siam during 1912. He had no difficulty in securing backers upon that occasion, and, selecting concessions to the north of Renong, established the Deebook Dredging, Ltd., and Katoo Deebook companies. They each have a capital of £100,000 in £1 shares. The Deebook has issued 52,000 fully paid shares, and 38,000, now paid to 19s., holding 10,000 in reserve. The Katoo Deebook has issued 43,000 fully paid and 42,000 paid to 13s. The directors are worth noting as showing how the native element is alive to the importance of the new mining development in its midst. The directors are: E. T. Miles, A. W. Palfreyman, Khan Joo Chie (Penang), A. Temple Miles, and Khan Joo Tok (Penang). Khan is practically the native equivalent of mister or gentleman, and Joo indicates a member of the native ruling family.

Among the last, but by no means least, of the Australian-controlled companies stands the Malaya Tin Corporation. Like its Sydney forerunner, Austral-Malay Tin, Ltd., it was organized to promote the flotation of sub-concerns, rather than the working of mining areas. Originally the Malay Peninsula Syndicate was formed early in 1913 at the instigation of a visitor from Siam, who offered to introduce suitably any representative man who went back with him, with a view to obtaining desirable concessions. Ultimately, T. H. Martyn, a prominent member of the Sydney Stock Exchange, whose active association with Australian dredging companies is well and widely known, was induced to undertake the expedition. He personally visited Siam and Burma, and secured valuable interests in both countries. Some of these areas have been prospected with success, while one in particular, situated in the Renong valley, 10 miles south of the Siamese Tin Syndicate leases, is said to have been proved to carry over 2 lb. of tin per cubic yard. According to official reports, about 150 acres of that lease, known as the Basin property, have already been developed, and operations are being continued on an extensive scale with boring plants over the rest of the area. The Ratrut organization is a matter of the present time; but it is not a matter of flotation, at least, in the ordinary sense of the word. Holders of shares in the Malay Tin Corporation are entitled to a preferential allotment of shares in the new Company, five for one, *pro rata* to their present holding. The £5 shares of the Corporation, it has a nominal capital of £42,000 in 8400 fully paid shares of £5 each, were quoted on April 28 at £12.

Other Australian concerns interested in Malaya, and worthy of more or less attention, include a Sydney venture known as the Kulim Malayan Tin Syndicate, £10,000 in 1000 shares of £10 each, and a Melbourne company known as the Trong Tin Mining Co. The former is situated in the Malay state of Kedah, while the latter holds property about 25 miles south of the Larut, near the town of Bruas. The Trong has a capital of £80,000 in £1 shares, of which 30,000 were issued fully paid to the vendors, and 30,000 to subscribers at 5s. paid, leaving 20,000 in reserve.

But, as *The Daily Telegraph* says, all is not gold that glitters. Many Australian syndicates have sent representatives to Malaya, and in not a few instances the results so far have not been satisfactory for shareholders. There are, for instance, such Victorian concerns as Sungei Raia, Salak South, North Tambun, and the Hindu Chong mines. And there are others, not nearly all Victorian. The 'wild-cat' is always present when mining successes have been achieved. It is for prudent investors to weigh every statement made, and, above all, rely rather upon the reputation of the promoters than the statements made by mining nonentities.

New Dredges

A contract for the construction and erection of two large bucket dredges, at a total cost of £40,000, for equipping the property of the Kampong Kauranting Tin Dredging Co., mentioned above, has been placed in Melbourne. The specifications and design are the work of J. S. Henry, and the dredges contracted for will, it is officially stated, be easily the largest ever built in Australia. The material and workmanship will be as far as possible Australian. The latest improvements found necessary as a result of tin-dredging experience in Malaya, including the most recent type of revolving screen, will be fitted in these dredges. Large tin-saving tables are another feature, the pontoon being specially large, namely, 130 by 44 ft. by 8½ ft. deep to carry them. The boats will be fitted with close-connected 6-cu. ft. buckets, which will have a theoretical capacity of 35,000 yd. per week for each dredge, and effective capacity of 20,000 to 25,000 yd. of tin-bearing material per week. The plant specified is designed to dredge 45 ft. below water-level. The main engine is of 120 hp., and the pump installed for sluicing has a delivery of 6000 gal. of water per minute. The cost of the two dredges erected and in good working order at the property, together with the spares, tools, tin dressing sheds, and buildings, will exceed £40,000. The total weight of the dredges, with machinery, will be over 625 tons, which is considerably over 100 tons heavier than the largest dredge yet sent from Australia to the Orient. The contract time for delivery for the first dredge is eight months, and for the second eleven months from the date of signing the contract.

All tin recovered in the Malay States is smelted at Penang and Singapore. An export duty of 12.5% is levied on the tin leaving the country, and in 1912 the Government, under British control, received duty amounting to about £1,300,000.

From the above notes it must not be inferred that Australians are not paying attention to their own tin properties, as is shown by the work in sluicing at Brisees, and lode mining at the Anchor, Pioneer, Mt Bischoff, and others in Tasmania, lode mining in Queensland, dredging in New South Wales, and lode mining in Western Australia.

Mining in the Argentine

Mining has made but little progress in Argentina. While copper, lead, silver, gold, wolfram ores, and borax salts, as well as small quantities of other minerals, are scattered over the Provinces of Mendoza, San Juan, La Rioja, Catamarca, Salta, Jujuy, Tucuman, Cordoba, and San Luis in the northern consular district, great distance from the coast and difficulty and expense of transporting supplies and ore make mining in most instances unprofitable. According to official information obtained from the Bureau of Mines at Buenos Aires, there are three copper, one borax, one wolfram, one silver, one onyx, one lime and cement, and a petroleum company now operating in this district. Two of the copper mining companies, the Famatina Development Corporation, Ltd., province of La Rioja, and the Compañia Minera Nueva Concordia, Territory of Los Andes, failed recently. From reliable private information it appears that the only mining venture conducted on any considerable scale at present in this district is the Hansa Sociedad de Minas, which works valuable wolfram deposits in the Province of San Luis. According to official statistics supplied by the Bureau of Mines, the following quantities, in metric tons, of ore were exported in 1913: onyx, 281; gypsum, 174; mica, 6; borate of lime, 958; wolfram, 536; copper, 310; and lead, 7 tons. These figures may be taken as indicative of production, as there is no ore reduction in the country. Practically all of the ore exported is mined in the northern consular district. The Sierra de Cordoba possesses rich stone deposits, the more valuable because of the small quantity in many parts of the country in building materials. According to official statistics, 11 different companies are now exploiting quarries, principally granite and limestone, in the province of Cordoba, in addition to other smaller concerns.—*Daily Consular Report.*

Indian Coal Output

The chief inspector of mines in India reports the output of coal in British India during 1913 as 15,486,318 tons from the following districts: Bengal, 4,649,852; Behar and Orissa, 10,226,389; Punjab, 51,040; Assam, 270,364; Baluchistan, 52,932; Central Provinces, 235,651; and Northwest Provinces, 90 tons. In addition, 600,000 tons was imported. Exports were 3,000,000 tons, leaving about 13,000,000 tons consumed in India, of which the railways took 4,500,000 tons.

A Michigan Stoping Method

In the accompanying diagram, Fig. 1, is shown a peculiar condition which occurred in a Michigan mine. The deposit was being worked from the lower levels up, as it was discovered by a raise from lower workings, the orebody was irregular, but for the most part was 12 ft. wide and had a dip of 45 . With so shallow a dip, the stoping could be easily accomplished from one level to that above, by merely standing on the foot-wall, as is customary in mines of low dip. The slices for stoping were mined in several different ways, according to the nature of the ore. The raises were driven straight up the dip of the deposit, as shown in the lower portion of Fig. 1. But higher up in the ore-

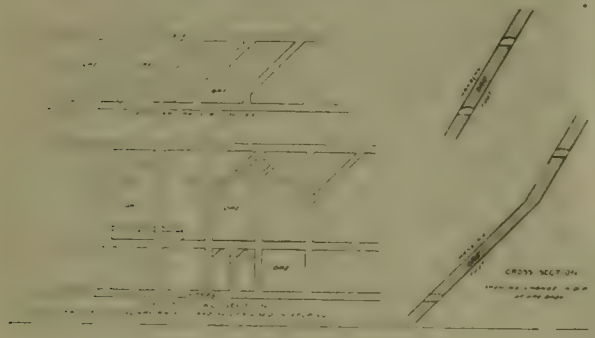


Fig. 1.

body the dip became nearly vertical, so that a miner could not stand on the foot-wall to set up his drill. It would have been possible to let a large quantity of broken ore accumulate in order to stand on while working, as is done in back stoping, dry-wall methods, etc., but the manager did not want to tie up money by keeping, as is done in back stoping, dry-wall methods, etc., to make it possible to stand on the foot-wall, the raises were no longer put in along the dip, but diagonally, as shown in the upper part of Fig. 1. It is evident that any angle of raise desired can be obtained by driving foot-wall raises across the dip of the deposit instead of at right angles with the drift. Secondary vertical raises were also used, when desired for ore-chutes, but the men stayed in the inclined raises. This brings out the point that raises, in stoping methods, are used for two purposes, for men and timber and as ore-chutes. Thus in the illustration the men stay in the diagonal raises and blast ore down either the diagonal or the right-angled raises. In some mining methods the raises for men and timber are kept in good condition and are cribbed and no ore is dumped through them, except when driving them and in cross-cutting over to an ore-chute raise at their completion.

In Fig. 2 a system of raises is shown which illustrates some of the variations used in an iron mine at Negaunee, Michigan. With one-man stoper drills in soft or medium ore, raising is not expensive, and getting ore out by raises is convenient for the loading of tram cars on the level below, as ore-chutes can be constructed at the bottom of the raises. In the method shown in Fig. 2, wheelbarrows are used in the stopes for getting ore to the raises, although some of the ore falls directly into the raises, when blasted. Sub-levels and raises are popular in many of the mining methods in the Michigan iron mines for soft and medium ore.

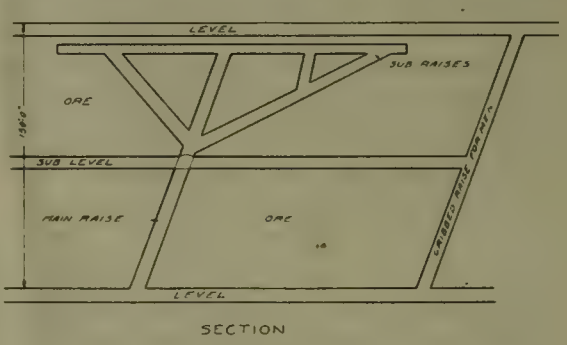


Fig. 2.

Coal Production of West Virginia

With a production in 1913 exceeding for the first time in its history a total of 70,000,000 tons, West Virginia became firmly established as the second in rank among the coal-producing states. According to Edward W. Parker, of the U. S. Geological Survey, the production in 1913 was 71,308,982 tons, showing a gain of 4,522,295 short tons, or nearly 7% over the output of 1912, up to that time the record tonnage. The increased production was accompanied by a considerably larger gain in value, which showed an increase over 1912 of $9,079,931, or 14.46%. The value of the output in 1913 was $71,872,165. The average value for the first time in ten years exceeded $1 per ton. The production increased in 1913 in spite of the facts that the labor troubles in the Paint Creek and Cabin Creek districts of the Kanawha field, which began in the early part of 1912, were not settled until well into the spring of 1913, and that the unprecedented floods in the Ohio valley in the spring reduced shipments to the west for a considerable time. A few of the mines that were closed by the strike were not reopened during 1913, and the total production from the two districts affected was much below the normal output. The increased production was well distributed over the state, there being but three counties out of thirty where decreases were shown.

According to the Bureau of Mines, the number of fatal accidents in the coal mines of West Virginia showed a decrease of 22, from 359 in 1912 to 337 in 1913, although there was an increase of nearly 10% in the number of men employed. Labor troubles caused the loss of 377,405 working days.

DISCUSSION

Readers of the MINING & SCIENTIFIC PRESS *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Simplification of Gold Ore Treatment

The Editor:

Sir—Probably the most refractory 'versus' in controversial metallurgy is 'crushing in water and amalgamating v. crushing in solution without amalgamation.' In the *Press* of May 30, A. W. Allen cites data to prove that crushing in solution without amalgamation involves excessive precipitation with consequent fouling of solution. He instances the Dome and Hollinger mills, and probably no better opportunity has ever been afforded for comparison. As Mr. Allen points out, these mills are working side by side on ore differing essentially only in grade, the Dome crushing in water and amalgamating, while the Hollinger is crushing in solution without amalgamation. Both have been dropping 40 stamps on about the same tonnage, and both started during the summer of 1912. Mr. Allen's comparative table refers to approximate data of mill operations obtained in August 1912 while both mills were in the tuning up process, and hence should not be considered. The results during the first part of 1913 are also affected by the fact that the companies were fighting a serious labor disturbance which entailed erratic work in the mills. Hence the only figures which are of any possible value for comparisons are those from the working of the mills during the latter part of 1913 and during the present year. Accurate figures from Hollinger operations for 1913 and 1914 to date are given in the following table, and also those approximating closely the Dome present practice, as well as Mr. Allen's tabulation:

Treatment.	Hollinger Mill: (Exact figures from records.) 1913.	1914 to date.	Dome Mill: (Approximate present practice.)	As cited by Mr. Allen: Hollinger.	Dome.
Solution precipitated per ton of ore...	3.16	2.67	1.70	4.0	2.00
Zinc consumption per ton of ore.....	0.66	0.59	0.34	0.8	0.25
Cyanide consumption per ton of ore...	0.46	0.46	0.75	..	0.80
Cyanide added	Tube-mill feed.		Before agitation.	Before precipitation.	Before agitation.
Total recovery	96.10	96.00	95.00	93.0	95.00

It will be noticed that Mr. Allen's figures are sufficiently incorrect to prove his point, but that by applying his own line of reasoning to the actual figures, the exact reverse is proved, namely, that in this instance crushing in solution without amalgamation is superior to crushing in water and amalgamating.

A point of which Mr. Allen seems to lose sight is that tons of solution precipitated per ton of ore ('precipitation ratio') is a factor of the grade of ore. I quote from Mr. Allen (referring to the Esperanza): "and the amount of solution precipitated is only 3 tons per ton of ore as against twice or three times that amount in cases where ordinary stamp-milling is practised." Now at the Hollinger 2.7 to 1 is being precipitated, against 1.7 to 1 at the Dome, while the grade of the Hollinger ore milled is about three times that of the Dome. Assuming that we were amalgamating at the Hollinger and that we could make the same extraction by amalgamation that the Dome makes, our cyanide 'heads' would still be three times those of the Dome, and a precipitation ratio of 5 to 1 (3 times 1.7) would be justifiable. In other words, we would be precipitating about twice what we do now. Again assuming that the Dome ore was crushed in solution and not amalgamated, the cyanide 'heads' would be one-third of ours, so that the precipitation ratio should be one-third that of the Hollinger or 0.9 to 1. Thus the Dome is precipitating twice what would be necessary were they crushing in solution and not amalgamating.

At first sight it would look as if Mr. Allen's point is well taken, and that if the gold going into solution can be reduced, the precipitation ratio can be reduced proportionately, but actually the reverse is the case. On account of crushing in water, an excess of solution is made and a corresponding amount must be precipitated and thrown away. This precipitation of 'waste' solution added to the high-grade solution precipitation, makes the precipitation ratio greater than it would be were cyanide solution instead of water used in crushing—at the Dome twice as great. Discarding any solution from the mill other than with the tailing is poor practice if it can be avoided. One never knows whether a careless operator on night shift is not habitually opening the wrong valve and allowing good solution to get away; especially with zinc-dust a sudden loss of precipitation may run up the grade of the 'waste' solution; the cyanide loss is greatly increased and it may be necessary at any time to have to charge up a herd of sheep or a dozen cows to operation. The only point which Mr. Allen can make in favor of 'waste' solution

is that fouling is reduced, and I must say that to precipitate and throw away solution is a crude method of avoiding this difficulty. There is always a loss of solution in the tailing, so that new solution is being made all the time sufficient to offset fouling with careful operation on normally clean ore. I say most emphatically that the slogan of a good mill superintendent should be 'Not a pound of water into the mill without getting a wash with it, and not a pound of solution out of the mill except with the tailing.' If a recovery of about 80% is possible by crushing and amalgamating in water, as at the Homestake, I admit that this principle does not apply; but with only 60% as at the Dome, it does apply, and I should say that with about 63%, which Mr. Allen's figures show to be the Rand recovery by amalgamation, I would even risk a charge of heresy in hinting that it is mighty close.

NOEL CUNNINGHAM.

Timmins, Ontario, June 14.

[That it is extremely difficult to draw parallels between the practice at any two mills, it goes without saying. The innumerable factors which enter into the making of an economic ore treatment differ so widely at different properties, even in the same locality, that to state that the practice at one mill should be recognized as standard and another as deficient is misleading, even though results would seem to warrant such a statement. The discussion on 'Simplification of Ore Treatment' has been a most interesting one, in that the subject is one toward which all metallurgists are making efforts, but we believe that only a very general simplification is possible of attainment in metallurgical practice. Those details and refinements which go to make up individual efficiency will continue to depend entirely upon local conditions which cannot be changed. The questions, however, which have been raised in this discussion have been timely, and we trust may lead to a better understanding of the subject.—EDITOR.]

Platinum Assay

The Editor:

Sir—Before rational steps can be taken to conserve our platinum resources and to recover that metal from the usual run of commercial ores, it is essential to develop simple and accurate methods for the determination of the metal that may be successfully applied by general commercial assayers with the limited equipment usually at hand. I would, therefore, direct attention to certain difficulties in the three methods published by you in tabular form on page 814 of the May 16 issue.

The first method requires the use of a reagent, H_2O_2, which is not ordinarily carried by assay offices. I may also add that perhaps the limits of accuracy of this separation when considerable relative quantities of Au are to be separated from small amounts of Pt have not yet been sufficiently worked out. In the second method there are two points where great care and attention to details are required to secure anything like a clean separation. To dissolve the Ag in HNO_3 and to leave the Pt undissolved requires extremely close work, which cannot ordinarily be given in a commercial assay office, while it is practically impossible so carefully to adjust the strength of acid and temperature as completely to dissolve the Au in aqua-regia and leave the Pt unattacked. As to the third method, some tests made in the New York assay office have shown that Cd does not always prevent the solution of some of the Pt in assay buttons and this separation cannot be relied on.

FREDERIC P. DEWEY.

Washington, D. C., May 26.

Diffusion of Ore Deposits

The Editor:

Sir—R. A. F. Penrose's valuable paper on 'Certain Phases of Superficial Diffusion of Ore Deposits' in the January number of the current volume of *Economic Geology*, recalls a matter in which I have been interested for some years. The secondary enrichment of orebodies by the downward migration of salts of the metals formed in the gossan is only one phase of a general process. From the miner's point of view it is perhaps the most important phase; but, as Mr. Penrose points out, the emphasis which has been placed upon it for practical reasons should not blind us to the more general aspect of the process. The diffusion of orebodies throughout a larger volume of rock than that in which they were formerly contained is doubtless of common occurrence. In 1910 I called attention to the diffusion of ores at a meeting of the San Francisco section of the Mining and Metallurgical Society of America.* The summary report of my remarks is as follows:

"1. The ore at Ely is a secondary deposition due to downward leaching from pre-existing orebodies at higher levels, now removed by erosion. These vanished orebodies may have been more concentrated as regards copper content than the present ores, which may be due to a process of diffusion rather than concentration.

"2. The mode of occurrence of the massive orebodies in the rhyolite of Shasta county indicates how such a derivation of the Ely ores could come about.

"3. These Shasta ores are chiefly massive bodies of pyrite with admixtures of chalcopyrite. If these, by erosion and favorable relation to the groundwater, should have come into the zone of active oxidation, the copper might well have been carried to lower levels and diffused as chalcocite and pyrite through the rhyolite, and the resulting gossan might subsequently have been removed, leaving a disseminated porphyry ore of the Ely type and no trace of the massive ore of the Shasta type."

At the Toronto meeting of the International Geological Congress, 1913, I again called attention, in the

*M. & M. S. A., *Bull.* No. 23, May 1910, pp. 263, 264.

section dealing with questions in economic geology, to the need of recognizing by an appropriate name the general process of which both secondary enrichment and diffusion are but particular phases. Another phase of the process is that which is concerned with the primary concentration of ores from the minutely disseminated particles in both sedimentary and igneous rocks, in accordance with the view held, for example, by many geologists as to the origin of the zinc-lead deposits of the Mississippi Valley. I am satisfied that many of the shallow, rich ore deposits of Nevada are due to a process of concentration from decomposing igneous rocks. The rocks from which these ores are abstracted may, in a sense, be regarded as the gossan of an extremely lean ore from which the salts of the metals are carried down by permeating waters to be deposited in favorable situations, determined by fractures, gouges, etc. The process is identical with that usually described as secondary enrichment and yet this term cannot be applied to it, since it results in primary concentration. This phase of the process realizes some of the ideas involved in the old theories of ore deposition from descending waters and by lateral secretion, but it differs from both. The important matter, as it seems to me, is that we should regard secondary enrichment, diffusion, and certain primary concentrations of ore, as phases of a general process the importance of which has not yet been fully recognized in economic geology.

ANDREW C. LAWSON.

Berkeley, California, June 23.

Revision of the Mining Law

The Editor:

Sir—Regarding the question of the 'Revision of the Mining Law,' I think it would be well for the mining world to first analyze our present mining laws thoroughly and find out why they are inefficient. The present claim of 600 by 1500 ft. is just as good as a claim would be if it was 660 by 1320. I think a claim following the dip of the vein is better than one with perpendicular lines in so far as it has a tendency to keep a miner from locating unnecessary surface land with no outcrops. But in revising a law that would make vertical lines, let it apply only to such lands as are known to have mineral or a possibility of mineral with no outcrop and then let the claim be 1500 by 1500.

If one looks into the present mining laws, there is nothing much to condemn, excepting that there should be some regulation regarding assessment work, and the mineral lands should be classified; that is, gold and silver. A claim under the present law should cover all that a prospector could ask for. If he cannot do an honest $100 worth of work per year upon such claims, he should forfeit them.

On copper and baser metals, when a prospector holds from 6 to 12 or more claims as a group, I think $25 per year of honest work performed should be sufficient. The mining law is plain and concise, but it has never been upheld or enforced. A man must make a valid discovery, he must have mineral in place, he must tie his claim to permanent monuments and objects, he must stake his property. Now what more can you ask? But the law is not carried out, and why not? Why has the Government been so slow in asserting its right to the mineral upon all grant lands? Why has it allowed timber claims to be located on mining claims and mineral lands, thus giving the miners' territory away? The reservation of the Government's mineral right upon grant lands has never held. I know that the old canal grant in the Lake Superior country had about the same recognition that the railroad grants have had. An individual buying land always found that exception in the deed, but mining corporations somehow obtained the land and mineral. Is it this that has caused the Government to be so slow about asserting its right to the mineral on railroad grants, from the fact that there was hundreds of millions at stake in the Lake Superior country?

One can forget the old canal grant, but it is time for the mining public to get together and not only recover the mineral upon all subsequent land entries, but to demand that which is theirs, that is, the mineral on grant lands and timber lands. Then frame laws that will not have a tendency to land monopoly. The law says honest discoveries must be made, but you cannot enforce these laws to the letter when the Government has been a half century trying to find out if they have the mineral on grant lands, which they explicitly specified they did have; yet officials seem afraid to reclaim that which belongs to the public.

Do not reserve anything more from the poor homesteader unless you take that which belongs to us from the grant lands. The farmer and miner have both been imposed upon. They are willing to meet on an equal footing. There has never been any trouble between them, and you will find if the miners will get together and demand the mineral belonging to them the old homesteader and farmer will be right at our backs making as much noise as any old prospector, miner, engineer, or mining professor.

I oppose an annual tax of $10 per claim; after a man patents he might be able to pay tax, but while he holds his claim under location, I believe in annual work—$100 per claim on precious metals and $25 per claim upon semi-precious metals. Let this be done upon the property. When patent is granted, it should be at $2.50 per acre and carry annual work of $25 per claim on precious-metal claims and $12.50 per claim on semi-precious claims; or privilege to pay the amount to state or Government. On failure to pay or work for a period of three years, let the land go back to the state, to work, sell, or open for relocation. Each state should be divided into mining districts and each district have a recorder of all transactions in mining. Only claims on record should be valid.

C. J. FRY.

Hutton, California, January 19.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

CARBIDE LAMPS are rapidly displacing other types in Lake Superior iron mines.

THE MASS of the sun is 332,800 times the mass of the earth, the respective diameters being 865,000 and 7918 miles. A body weighing 100 lb. on the earth's surface, would be about 3000 lb. on the sun.

AN ALLOY composed of from 85 to 87% of aluminum, 9 to 11% of zinc, 2 to 4% of lead, and 1 to 3% of a strengthening element has been patented by Charles P. Van Gundy, of Catonsville, Maryland.

TO FEED an average of 800 natives at the Lonely Reef mine in Rhodesia, in 1913, with bread, beans, mealies (corn), monkey nuts, rice, green vegetables, rations, salt, meat, sugar, cocoa, kaffir corn, milk, and maizena, cost a total of $36,500, equal to about $46 per head per year.

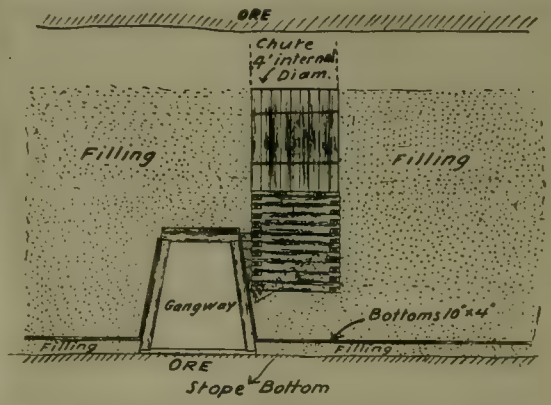
ELECTRIC POWER generated by mine power-plants of the St. John del Rey Mining Co., Brazil, during the past financial year, averaged 3314 hp. per day, at a cost of 3.2c. per 24 hours. The total output was 26,429,006 hp. hours. The mine used 60% of the power, and the mills and machine shops 36.81 per cent.

A PROCESS for the separation of bismuth and copper, which consists in reducing the bismuth copper product, consisting chiefly of bismuth and copper, to a fine state, intimately mixing therewith a suitable compound containing combined sulphur, smelting said mixture to provide crude bismuth and copper matte, and separating the copper matte from the said crude bismuth, has been patented by William Thum, of Hammond, Indiana.

TUBING for boilers consists of three classes, lap-weld charcoal iron, lap-weld steel, and seamless steel. For tubes to withstand corrosive action, lap-weld steel tubes are satisfactory, they being manufactured by a process known as roll-knobbling whereby the steel receives a kneading action, making it uniformly dense, in being worked down from the bloom to the plate. By this process it is more resistant to corrosion. The well known 'National' tube is made this way.

DUST-FALL in the neighborhood of cement plants has become a matter of considerable importance of late, as a result of litigation between certain cement companies and owners of land in the vicinity. According to J. P. Mitchell, of Stanford University, tests made at distances of from 1.2 to 2.8 miles from a plant showed the amount of cement dust falling varied from 0.4 to 10.4 lb. per acre per day, and field dust from 0.3 to 0.9 lb. per day.

'PICKING-UP BOTTOMS' is a phrase used in mining to describe the operation of removal of the last slice of ore in a stope, that is, the ore lying immediately under a level and forming the back of the overhand stope. The



SECTION OF MINE SHOWING METHOD OF PICKING-UP BOTTOMS.

figure herewith illustrates a method of mining this ore adopted at Broken Hill and described by Andrew Fairweather. Since the slice supports the bottoms of the level above, its removal necessitates picking them up; hence the phrase and its use in this connection.

MANY MINE OFFICIALS, foremen, or bosses who have spent years at a single mine do not see readily the necessity for mine signboards; because they are entirely familiar with the mine workings, it does not occur to them that the average miner cannot in a short time acquire the same familiarity with conditions. In the United States today, both metal and coal miners are largely of a roving disposition. Many of them are foreigners who are more or less ignorant of English. As a class, they require guidance in the matter of protecting themselves from accidental injury. Mine signboards are in use in many mining districts of the United States, according to Edwin Higgins and Edward Steidle of the Bureau of Mines. Although in no part of the country has the practice become general, there are isolated mines that have worked out an elaborate system of signboards. There has been no concerted action looking to the adoption of certain universal symbols or signs, although there are manufacturers of signs, and some local mining organizations now working toward this end.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents

LEADVILLE, COLORADO

Present Condition of the Mining Industry, and Factors Contributing to Important Development.—Mt. Champion, Minemo, and Virginius Mines.—Zinc Smelter.—The Down-town Area.

Mining development in the Leadville district this summer shows a marked increase over that of the past several years. Three new factors have helped to this end, which combine to form the beginning of another of the great revivals that have occurred periodically in the mineral activities of this area, namely: (1) two outlying districts, which for a number of years have been considered as barren ground, are now producing a large tonnage of high-grade gold and silver ores. (2) a plant for the manufacture of zinc oxide from the lower grade carbonate ore is being constructed by the Western Zinc Mining & Reduction Co.; and (3) a leasing consolidation for unwatering the flooded area known as the 'down-town mining district' is rapidly nearing completion, and a similar enterprise is being promoted for pumping the water from the old famous Fryer Hill territory.

In the Lackawanna area and the upper Half-Moon gulch, several new mines have been opened within the past year. The Mt. Champion property is now one of the largest gold-producing mines in the Leadville district. It is situated about 15 miles from the nearest railroad, in a locality that has long been looked upon as most unpromising. Obstructions of every kind confronted the men who knew they had a mine, and were determined to develop it. A good road, eight miles long, had to be built, and machinery had to be transported to the ground, and buildings erected in a district that is noted for its severe winters and short summers. After the mine had been opened, and shipping had been under way for a few weeks, it was found that the character of the ore demanded mill treatment in order to obtain the best results. A 50-ton mill was then erected at the foot of the range, about five miles from the mine, and a tram constructed to carry the ore. It seemed impossible that a mine could be made a success under such conditions, but it is now working steadily with a force of 75 men, and producing regularly 50 tons of ore per day which averages between 30 and 50 oz. gold. The mine is now developed by three adits, all on the vein at various depths, and the manager stated recently that there was $100,000 worth of ore blocked out. Other properties are showing equally favorable results, and it will be only a question of time until there will be several large producers in this district.

The Sugar Loaf territory is the other 'no good' ground which has come prominently to the front within the last several months. Three important tunnel companies are now operating in this district, and each of them is shipping a good tonnage of silver ore. The Dinero is the most productive at present, 100 tons per day being shipped, all of which contains rich silver-lead content. The Siwatch tunnel has opened a large body of lower grade material which is being produced as fast as possible. The Virginius Consolidated properties recently developed the most important orebody that has been found for some time. A large vein of silver-bearing ore which assays up to thousands of ounces per ton was opened last month, and a steady tonnage is now being shipped. Other smaller properties are being developed, and it appears that a number of them will soon be in the producing list. The interest of mining men all through the state is centred on this and the Lackawanna country, and men who know the district say that the recent discoveries in these localities will cause a revival of mining in Leadville that will rival the palmy days of the early eighties.

The construction of the zinc oxide plant is probably attracting more widespread attention than any other work in the district. This smelter, when finished, will handle carbonate of zinc which contains as low as 14% zinc. It will give a much more satisfactory market for the ore, and allow a more favorable contract to miners of the camp. The plant will be erected in units of 50-ton capacity each, and the first is about completed. As soon as it is in good running order, and the management is satisfied as to its efficiency, the other units will be erected as rapidly as possible, until a complete plant of 200-ton capacity is reached. The last two units will be equipped with roasting furnaces to deal with sulphide ores, and there is little doubt that if the industry proves as profitable as it is expected to be, other concerns will enter the field with similar schemes. All this tends to throw a bright light on the zinc mining of the future. Leadville is fortunate in its deposits of zinc ores, both in the carbonate and the sulphide zones. At present, several of the properties that have been idle for a score of years are being put into shape to resume operations in their zinc stopes, and as the demand grows the mining industry will keep pace with it.

The third and perhaps the greatest factor in the advance of mining in the Leadville district is the proposal to dewater the mines of the down-town district. This territory covers an area one mile square, within which boundaries some of the largest mines of the district have been found. All of the properties have been worked out down to water-level, but heretofore no effort has been made to get at the orebodies that are known to exist below this point. Jesse F. McDonald, ex-governor, together with a number of Eastern capitalists, has secured a lease on all the ground within the basin, and is now preparing to start the actual work of unwatering and developing the formations at a depth of 1000 ft. Machinery is now being manufactured for the work, and all of the operations will be done along the most modern lines. This enterprise will do more to advance the general prosperity of the district than any other now under way. It will cause the reopening of numerous idle properties, and will give employment to probably 1000 men. The success of this undertaking will induce the final agreement for the unwatering of the Fryer Hill territory, if it is not done before, and the two together will make a new Leadville.

MANILA, PHILIPPINE ISLANDS

Dredges at Work, and Others Probable.—Colorado, Keystone, and Syndicate Mills.—Iron Mining.—Proposed Tax on Mine Output.—Bureau of Science Work.

Regardless of whatever else may be said regarding business in the Philippine Islands, the mining industry continues its steady development. With the starting of the new Umirai dredge, and of the new dredge on the Malaguit river, Paracale, there are now six dredges at work in the territory. Some attention has been attracted lately to the Bued river, where that river debouches into the central plain. Here prospecting has been conducted with encouraging results. One California mining man recently said that if the prop-

erty were in the Sacramento valley there would be no difficulty in securing capital to put several dredges on it at once.

An Australian, Mr. Murray, who has a patent device for saving black sands which collect on dredges, is visiting these districts. In several places black sands have been found to carry good gold content. August Heise, well known in Philippine mining fields, has returned from the United States with engineers to examine his placer properties on the Hibong branch of the Agusan river, northeastern Mindanao. Mr. Humphries, the engineer in charge, brought a steam drill with him.

Most encouraging reports come from the new Syndicate mill on the island of Masbate, as well as from the Keystone and the Colorado. The output of the Colorado is said to

SOUTHERN PART OF THE PHILIPPINES.

be a large increase over previous years. The Syndicate mill is now being enlarged.

Gold mining is still the most promising phase of the industry, but in the Angat iron-ore district conditions are favorable for a much greater production of iron and the establishment of that industry on a sound basis. On Calambayanga island, at the mouth of Mambulao bay, Mr. Cavender is erecting a cupola to smelt the iron deposits found on that island. This deposit is one of the most favorably situated of all those found in the Philippines.

Mining men have been deeply concerned lately with the attempt of the collector of internal revenue to place a tax of 3% on the gross output of the mines. Many conversant with the condition of the industry have felt that this is unjust, and would seriously cripple the industry at this time. The proposed tax was rejected by the commission. Failing in this, the collector has tried to class gold bullion as merchandise and thus bring it under a tax of 1.5%. A meeting of protest was recently held, and plans are under way to form a permanent mining association in the Philippines. It is fortunate in one way that this incident happened, as it has revealed the necessity for coöperation on the part of the mining men.

The Division of Mines, Bureau of Science, has recently lost the services of F. T. Eddingfield, mining engineer, who, after five years' service, now returns to the United States. The mining industry has profited considerably by his service in the islands, and appreciates the work he has done. Paul R. Fanning, metallurgist for three years in the division, is another good man whom the Bureau lost when the economy wave of the Democratic administration struck the islands. The two most important pieces of field work carried on by members of the Division of Mines lately are one by Warren D. Smith, chief of the division, who spent two months in north central Luzon making reconnaissances in hitherto geologically unexplored territory; and one by Wallace E. Pratt, who spent a long time on the Caramuan peninsula making silimar reconnaissances. During Mr. Smith's work, considerable mineralization was noticed in the region just east of the Cordillera Central. Whether these lodes will prove to be profitable remains to be seen.

Development work on the gilsonite deposits of Leyte has been actively started by the Bryan Landon company of Cebu and Iloilo. Fred Burdette, manager for the Camiguin North Mining Co., has begun operating on his sulphur property on the southern end of the island of Camiguin, north of Luzon. Some fine specimens of sulphur were recently exhibited by him at the Second Philippine Exposition in Manila. Mr. Seymour, a Wyoming coal operator at present in Manila, is looking into the coal situation.

KALGOORLIE, WESTERN AUSTRALIA

LABOR TROUBLES AGAIN.—GEOLOGY AND THE NEED FOR MORE INVESTIGATIONS.—EDNA MAY.—GOLDEN HORSE-SHOE AFFAIRS.

The labor unrest, which appears to be general in Australia, was in evidence in this state at the end of April. A dispute at the Edna May mine, as to whether the ground being worked was wet or dry, was settled by the manager, who agreed to wet wages; that is, above the usual rate for dry ground. Then the shovelers on the Trans-Australian railway went on strike for $3.20 per shift, the wage being paid by the contractors at the head of the line; but, though the Commonwealth Government offered an increase of 20c., from $2.80 to $3 per shift, the men are still out. The latest phase of the unrest is represented by the fact that the committee of the Federated Miners' Union unanimously passed a resolution that on and after May 1 no unionist was to work where non-unionists were employed. This step was taken in sympathy with the employees of Millars Karri and Jarrah Co., who are out on strike because four non-unionist carpenters are employed. The members of the Employers' Union promptly retaliated by passing a resolution that they would employ the best men offering, regardless of their politics or creeds, and, if any of the various unions withdrew their men on May 1, all employers of the state, in whatever industry engaged, would simultaneously close down and lock out all employees. The result of this prompt action was that the Federated Miners' Union held a general meeting on April 26, and decided to leave the question to be settled by the Australian Labor Federation at its meeting in Melbourne on May 11. It has just come to light that in two cases in which workers ceased work and broke the Arbitration Court's award, and were fined $48 and $480, respectively, by the magistrates, no fines had been paid. On this leaking out early in May, the Western Australian Government first stated that the fines had been paid, but finally admitted that they had not. Eventually the first sum was collected, but the larger one was reduced to $24 by the executive. So much for labor governments.

Ever since Malcolm Maclaren's visit to these fields in 1910, the Chamber of Mines has been urging on the state govern-

most the advisability of increasing the geological staff with the view to making an exhaustive examination of the gold bearing areas to aid prospectors. To meet this demand the government appointed five extra field geologists in 1911 but instead of attacking new ground, most of their investigations have been confined to old workings, or merely following prospectors to new finds, and drawing deductions from the few potholes sunk. The Chamber of Mines now says that 'what it wants is a systematic geological survey, as careful as thorough, as exhaustive, and as good as money can buy, and the best qualified, the best equipped, and the most widely informed expert obtainable to draw the deductions from the data obtained.' Most of the best known geologists of the world have at one time or other inspected our mines but only one of these visitors, Malcolm Maclaren, has published the conclusions he drew from the data obtainable. Against this we have had the experience of H. P. Woodward and S. Goeczel, who joined the government mines department in 1887 and 1890, respectively, and had mapped out the gold and mineral areas of Western Australia by 1893. In his Handbook of the Gold and Mineral Fields of Western Australia, published in 1894, Mr. Woodward wrote of the Great Fingall lode: "This mine is called the Day Dawn, after the first claim taken up on it. The stone is of a bluish mottled appearance, and the 'reef' is of great size and well formed. It is a true fissure vein, but does not follow any definite course, striking west-northwest, then north-northwest, and so on to the north; but this is not of the least consequence, as from its well defined walls there is very little chance of its cutting out." This mine was turned down in 1897 by the Day Dawn Co. of Adelaide, after producing £75,000 from 30,000 tons from a lens above 150 ft. It was then taken up by the Consolidated Murchison of London, and in 1898 passed on to the Great Fingall company as a derelict. A second lens was found at 460 ft. and cut out at 1370 ft., and a third at 1700 ft. which still continues. Mr. Woodward, in his 'Handbook,' pointed out in 1894 regarding the Golden Mile: "There is a large break in the country consisting principally of coarse-grained diorite extending over six miles from north-northeast to south-southwest, near the township of Kalgoorlie. Diabase (dolerite) dikes seem to have played an important rôle in the gold deposits here, and it is most probable that the gold emanation in the rich and extensive Kalgoorlie district took place in the period following these diabase eruptions." The Kalgoorlie district is the only one mentioned by Mr. Woodward and Mr. Goeczel as containing this quartz-diabase, or dolerite, and none of the other geologists who have visited the country has ever mentioned the presence of a similar area elsewhere in the state, and until that is found a second Kalgoorlie is unlikely to eventuate.

Since starting milling a year ago, the Edna May mine at Weston's, over 100 miles west of Kalgoorlie, has produced $364,000 from 16,766 tons of ore and paid $103,000 in dividends. As the residue contains $5 per ton of recoverable metal, the output and profit will shortly be materially increased when the sand and slime plants start operation. The present trouble is the fact that successive intrusions of granite eventually cut off the lode in the adjoining Greenfinch mine on the west, and similar intrusions are being encountered in the Edna May. The first bar appeared in the shaft at 124 ft., and the second has now been encountered at 200 ft. The first was only 18 in. thick, but the second is proving considerably thicker. The lode is erratic in strike, underlie, and thickness, but is wonderfully consistent in gold content, and is from 5 to 45 ft. wide in a generally east and west direction. Several adjoining claims on the east are looking promising, but the granite is making speculators shy of investing in them. No government geologist has visited the district, but other geologists wisely shake their heads and say nothing after inspecting the Edna May and Greenfinch.

In spite of the excellent developments recorded at the 2630 and 2780 ft. levels of the Golden Horse-Shoe mine, the Company continues to get deeper into debt. On January 1, 1913, the credit balance brought forward was $160,000. Since then, to the end of March 1914 the net profit earned was $105,000, a total of $265,000. Debenture interest has absorbed $25,000, debenture redemption $56,000, and dividend paid in October $288,000, a total of $369,000. This leaves a debit balance of $104,000. The position is unfortunate, and the London managing director, E. Protheroe Jones, is on his way to this country to investigate matters at the mine.

March gold returns from all mines in the state totaled $1,967,000, and dividends $578,200.

SALT LAKE CITY, UTAH

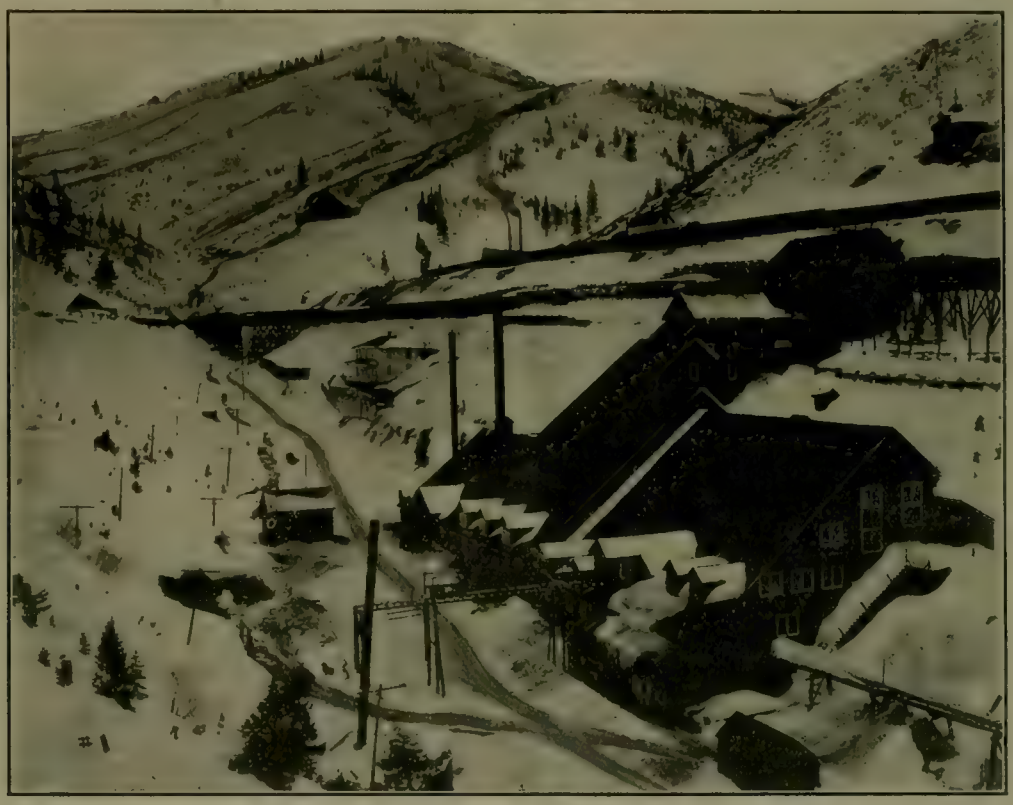
CHLORINATION APPLIED TO COMPLEX SULPHIDE ORES.—UNIVERSITY OF UTAH SOLVES METALLURGICAL DIFFICULTY.—CHRISTENSEN PROCESS.—HOLT-DERN FURNACES.

In the treatment of low-grade ore deposits Utah has long been in the lead, being the pioneer in the development of the porphyry deposits. At present it is solving the question of treating the low-grade ore containing a combination of lead, silver, copper, zinc, and gold. By July 15 there will be three mills in the state treating these ores by means of chlorination. The process is by no means new, but the methods employed are. They were worked out in the University of Utah experimental plant something over two years ago by N. C. Christensen, a post-graduate student, and T. N. Holt of the University staff. The first practical use made of the work was at the Mines Operating Co. plant at Park City, where George H. Dern and associates have a 10-year lease on the old stope fillings above the 900-ft. level of the Ontario mine. Here a great deal of experimental work has been carried out, especially in the mechanical end of the work. At present the Mines Operating Co. plant is running successfully on ore that will assay about 12 oz. silver, 2 to 4% lead, and 0.5 to 1% copper. A saving of 80% is being made. Recently a plant was built for refining the gold and silver on the ground. The second plant is at Silver City, where Jesse Knight is backing N. C. Christensen in a plant that is using the same method of treatment. The operators are just getting this mill over mechanical difficulties which caused it to run intermittently. The third plant is that of the Park City Milling Co., which, under the management of George H. Scibird, is remodeling the old Grasselli mill at Park City for the purpose of handling ores from the American Flag and custom ores. This plant it is expected will be in operation by July 15.

The method is a simple one. The ores are given a chloridizing roast by means of a mixture of salt and coal. The fumes from this roast are drawn into a condensing tower and later used for leaching the roasted ores. The chief trouble thus far encountered has been with the roasting furnace. As there was no one on the market that was satisfactory, it was necessary to devise a roaster for the occasion. At the Mines Operating Co. plant, hand-fed furnaces have been used which have been unsatisfactory in result and in economy of fuel. At the Knight-Christensen mill a round furnace with a flat revolving grate, heated by means of oil jets and a downward draft, is being tried. The roaster for the Park City Milling Co. mill has not been selected.

A new roaster known as the Holt-Dern furnace has been used for the past three months successfully at the Mines Operating Co. plant. This experimental furnace has 10 tons capacity, but has demonstrated that it eliminated dust or any volatilization of minerals. Besides that, it is declared it will save 50c. per ton in fuel. A new furnace along this line is being designed, and it is probable that all the furnaces at the Mines Operating Co. plant will, in the future, be

Holt-Dern machines, although it is declared that Dwight-Lloyd sintering machines can be used. The Holt-Dern machine it is declared roasts more evenly than any other, and actual tests have shown that a 10% greater extraction can be made from the ore. The furnace that is being designed will have a capacity of about 40 tons of ore per day. It is 8 by 10 ft., and has a depth of approximately 5 ft. The chief feature is the grates. The grates are about a foot wide each and extend the width of the furnace. Each grate is made up of iron strips or bars half an inch wide and set half



DALY-JUDGE PROPERTY, PARK CITY, UTAH. ENTRANCE TO MAIN TUNNEL ON LEFT.

an inch apart. The upper edge of the bars are equipped with half-inch teeth. Each grate is fixed to move over a roller bearing. The base for the bearing is also slotted so that the material drops down. Attached to each grate is an eccentric which has a movement or drag of 1¾ in. The eccentrics are run by the same shaft. When these are set in motion the roasted cake is practically filed off, falls down through the grates and into the hopper below. The grates are set a half-inch apart and adjacent grates have an alternate motion. Suspended through the centre of the length of the hopper below is the air-pipe which supplies the blast for the furnace. The feed is from the top, and the roast is made at the rate of about one foot per hour. Arrangements are also made for the automatic feeding of the furnace. At the top of the furnace, which has a movable cover, there is a flue through which the fumes are drawn off. This is operated by an exhaust fan.

The furnace is started by covering the grates with several inches of ore over which is spread chips soaked in oil. As soon as this is well under way, the feed, which is ore mixed with salt and coal, is started. This makes a continuous operation, with about four feet of ore and roasted material resting on the grates. As roasted ore is needed the shaking of the grates is set in motion and the ore drawn off from the hopper. Everything has been so arranged that the furnace is as nearly automatic as possible. One man can care for the feeding, the shaking, and the taking off of the roasted ore. The ore from the roaster is placed in open tanks at the Park City plant, while at Silver City it is removed to barrel tanks. The barrel tanks have a filter at one end through which the chlorine solutions are washed out. The barrel is then tipped the other way and the waste is placed on a conveyor belt and sent to the dump. The solutions pass through launders to precipitating tanks. The leaching by the barrel tanks takes about five hours.

SYDNEY, NOVA SCOTIA

GOLD MINING IN GUYSBOROUGH COUNTY.—WATER POWER AVAILABLE.—NEW RAILWAY.

Within the last few months, gold mining in this province has received a little more impetus from the steady yet quiet success of one or two operating companies situated mainly in Guysborough county. During the last year a total of 7324 tons of ore was mined and crushed, yielding on the average $6.14 per ton treated. This is about the same return as the previous year. Most of the gold extracted was obtained from four mines, and of these, three, the Beaver Dam, Caribou, and Gold River, had a profitable year, the yield being $12. $14.50, and $15 per ton, respectively. In comparison with these results, the remainder of the mines in operation show a low average return. Nineteen companies in all were at work throughout the year or during part of it.

A scarcity of fuel and the transport difficulties have always been drawbacks to gold mining northeast of Halifax.

In the general advance of systematic management, attention has been drawn to the water power of the province and although most of the catchment areas are limited, on account of the topography of the country, still an attempt is being made to use it to advantage to overcome in some measure the growing scarcity of wood fuel and the high cost of coal. At the mine of the Goldenville Mining Co., a dam has been built at the Liscomb falls which gives a head of 40 ft., and this together with one of about 15 ft. provides approximately 500 hp., used mainly in pumping and crushing operations.

The building of a branch railway to pass through the mining districts of Halifax and Guysborough, running from Dartmouth on Halifax harbor northeast, and passing the heads of all the harbors on the coast of Canso and Guysborough, on the Straits of Canso, has been started. When finished, this line will be a great boon to the mining companies in regard to the easy transport of machinery and supplies.

None of the recent discoveries of tin, tungsten, manganese, and antimony ores have proved to be of any great value. On the tungsten area, only about 10 tons of scheelite was extracted, although considerable development and prospecting work was undertaken by the company. Operations have ceased entirely on the antimony areas at West Gore. The discovery of manganese, recently reported in Guysborough country, is still unproved. The ore is a fine-grained pyrolusite.

DAWSON, YUKON TERRITORY

Silver-Lead Ore of the District, and Work on the Silver King, Adam, Web Foot, and Mable Claims.

Sixty-five tons of silver-lead ore, assaying $250 per ton has been hauled from the Silver King claim to Mayo landing on the Stewart river, for shipment to the Consolidated Mining & Smelting Co.'s smelter at Trail, B. C. The Silver King is situated 28 miles northeast of Mayo landing. The vein where opened is 4 ft. wide, striking approximately south 15° west with a dip of 62° east. Both walls are well defined. The hanging wall is schist, and the foot-wall quartzite. Development work is being done through an incline shaft, which has reached a depth of 70 ft. The owner of the property, H. W. McWhorter, intends to continue the shaft to the 300-ft. level this summer. On the Adam claim, 2300 ft. from the shaft on the Silver King, Mark Evans has uncovered a vein 5 ft. wide, with two bands of galena in it, varying from 1½ to 3 in. wide, which assay high in silver. As he is prospecting nearly in line with the strike of the Silver King vein, it is no doubt a continuation of the same. Owing to there being from 10 to 20 ft. of frozen gravel (glacial drift) to sink through before reaching solid formation, and which makes prospecting for the vein both slow and expensive, Jack Alvinson and J. E. Ferrel, owners of the Web Foot claim, adjoining the Silver King on the northeast, have fitted up a churn-drill to prospect with. Grant Huffman, on the Mable claim, has a shaft down 28 ft. and intends to drive and try to cross-cut the vein. Fifty-four claims have been staked and recorded in the vicinity of these properties; not having a summer road, quite a number had provisions and supplies hauled in before the snow melted and will prospect during the summer. The Yukon Council has voted for an expenditure of $17,000 for roads in this district this summer, $5000 of which will be spent building a road to the silver-lead properties. The appropriation of $17,000, while not sufficient to build many miles of wagon road in a country like this, is evidence, however, that the Dominion Government will be willing to do more as development of the district proceeds. The opening of rich silver ore has attracted a great many prospectors, and quite a number are out in the hills around here this summer. The outlook for the future is bright for this district. A stampede is neither expected nor desired. As yet the properties are in the earliest state of development. A prosperous and steady producing mining camp will be here in the near future.

NEW YORK

Connecticut Zinc Corporation and Chattanooga Copper Co., Two New Companies. More English Capital in Colorado.—Litigation.

Midsummer is always unproductive of news in New York, and the events of the week are of no great significance. The Connecticut Zinc Corporation of Wyandaugh has been incorporated, with a capital of $1,000,000, to mine zinc ores in New York and Missouri. The incorporators are William G. Phillips, who has promoted other zinc mines, Michael J. Riordan, a Democratic politician of Brooklyn, and Hugh J. Moran, of Port Richmond, Staten Island. The significance of Wyandaugh is not clear; the nearest approach to the name is the village of Wyandanch, not far beyond Hicksville, on Long Island.

The Chattanooga Copper Co., capitalized at $500,000, has been organized, J. I. Carter being president; John Stagmeier, first vice-president; G. H. Miller, second vice-president; S. E. Whitaker, secretary; and P. B. Carter, treasurer. The Company owns 200 acres of land a short distance northeast of the Ducktown Sulphur, Copper & Iron Co.'s property in the Ducktown district, Tennessee, which it has been exploring by diamond-drilling. Evidently the results have been sufficiently encouraging to justify further exploration. The Ducktown district is an old one, and it would be interesting if a new producer should be developed there. Those interested in the new Company are, as the name indicates, all business men in Chattanooga.

An American property of which we hear little on this side is the St. John Mines (Colorado), Ltd., on the west side of Glacier mountain, about one and one-half miles south of Montezuma, Summit county, Colorado. Last year E. J. and E. L. A. Munby sold a group of 19 claims containing silver-lead and zinc ores to English investors, who have formed this Company. E. H. Platt has estimated that the ore reserves amount to 93,000 tons of probable ore, and 23,000 tons of stope-filling which can be milled. The milling ore is said to contain a gross content of $30 of silver-lead and zinc, while the high-grade ore now being shipped to smelters is said to yield $35 per ton net. Development work is reported as showing good ore. The mill is being remodeled. The Company is capitalized at £75,000, and 255,000 out of the 300,000 shares have been issued. For the property, £3000 in cash and £30,000 in shares was paid, while £20,000 cash and £5250 in shares was paid to the promoters.

Several large companies have had a good deal of trouble with litigation lately, and the minority stockholders in the Alice Gold & Silver Mining Co. have started a suit against the Anaconda under the Sherman anti-trust law, as mentioned in this journal of June 27. Probably nothing much will come of the suit itself except to relieve the 'psychological depression' in the legal industry.——E. A. Wall has withdrawn his petition for a receiver for the Consolidated Coppermines, and the reports which are always circulating as to the plans of that Company now say that an experimental flotation plant will be built.——W. O. Allison has succeeded in his attempt to oust F. A. Heinze from the Ohio Copper Co. New rolls are being put in the Ohio mill, and its capacity after July 15 is expected to be 3000 tons per day. Just now 2000 to 2300 tons per day is being milled.——The Old Dominion litigation still drags on its weary way. Not long ago the Court of Errors and Appeals of New Jersey, the highest court in the state, issued a decision permitting the Old Dominion Copper Mining & Smelting Co. to pay a special dividend of $10 per share, amounting to $1,620,000, out of the proceeds of its action against A. S. Bingham. Godfrey Hyams, who sought to prevent this payment, is indefatigible in litigation, however, and will doubtless at once bring fresh suits.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

Chisana

Recent arrivals at Dawson state that there is nothing being found at Chisana outside of last year's discoveries. Wood

MAP SHOWING SITUATION OF CHISANA DISTRICT, ALASKA.

costs $100 per cord. It is doubtful whether there will be over 60 days' sluicing for the season.

Iditarod

A new dredge is being constructed on Otter creek for Riley and Marston.

ARIZONA

Cochise County

Large crushing machinery has been delivered at the Junction shaft of the Calumet & Arizona property. It will be ready for work in a month or so, and will handle about 1400 tons of sulphide ore per day from this and the Briggs shaft. Later on the Hoatson ore will be sent to the plant also. Cutting of the large pumping station at 1800 ft. in the Junction shaft is proceeding satisfactorily. This station will probably drain the Denn area, as well as upper levels in the Junction. The company will add to the electric equipment of its plant a belt-driven General Electric generator, 2400 amperes at 24 volts and 4800 amperes at 12 volts, with direct-connected exciter.

Through Walter Douglas, the Phelps-Dodge company has bought the Tombstone mines for $500,000 from the receiver in bankruptcy, A. L. Grow. This was the only bid for the property. Heavy flow of water has hampered work at these mines in the past.

Gila County

(Special Correspondence.)—Underground work in the Inspiration mine has been hindered by shortage of air. Another compressor is now at work supplying 3000 cu. ft., making a total of 7500 cu. ft. per minute available. At the new mill the trestle should be finished in a few days. A composition roofing material is being laid on the main mill building. A good deal of riveting remains to be done on the concentrate bins. Work is in progress on the concentrator transformer and distributing station. The latest addition to the test-mill is five Metals Recovery Co.'s pneumatic flotation machines and auxiliary equipment, which are to be given a thorough test to compare their efficiency with Minerals Separation process. Although the two processes depend upon the same basic principle, the means of acquiring the final result are quite different. As soon as the necessary parts are received from the East, a series of experiments are to be started with the Bradley preliminary crushers, to determine the best steel for rolls and dies. These machines, which gave good results on a dry brittle ore, were found to wear excessively in crushing the Inspiration damp ores, but with a change to one, or a combination of modern steel alloys, it is thought that much better results will be obtained. Work is proceeding on the power-plant at the smelter site. Foundations for the turbo-generator have been poured. As the new 25-ton slag-pots, recently received, are not designed for fast haulage around sharp curves, the idea of obtaining slag from Globe for the reverberatory bases has been abandoned. Instead, a blast-furnace obtained from the Old Dominion smelter is being erected on the furnace site, so that the slag can be made as required. The furnace will probably be ready within a week, and the foundations will be poured as soon as possible, as this work is already far behind.

Miami, June 28.

Santa Cruz County

In the lengthy suit of F. J. Heney for a third share in the Three R. mine, the court at Tucson awarded him $200,000 on June 29. Full details of this case have been published in *The Oasis* of Nogales.

Yavapai County

(Special Correspondence.)—Good gold-bearing veins have been opened by prospectors on Curry creek, and Granite creek.——Two feet of galena ore has been cut at 400 ft. in the Swastika mine. It is similar to the ore shipped some time ago, and which contained up to 800 oz. silver per ton.

Mayer, June 25.

CALIFORNIA

Amador County

(Special Correspondence.)—In the suit of the Kennedy Extension Mining Co. v. the Argonaut Mining Co. for $1,000,000 for wrongful extraction of ore and other claims, Judge Fred H. Wood gave his decision on June 29 in favor of the Argonaut company. The latter Company is entitled to retain the gold recovered from ore from the vein in dispute. The principal issue was as to the ownership of the Argonaut vein. The plaintiffs claimed that no vein apexed in the Argonaut from end-line to end-line, and that the orebodies in dispute were not on the Argonaut vein at all, but on a vein apexing in the Muldoon claim, owned by plaintiff. The defendants upheld the continuity of the Argonaut vein, showing that it could be followed from the north end-line, underneath a lava cap, southerly through the claim beyond a point where it would cover the orebodies in dispute. They were also able to show that continuous stoping had taken place from the bottom of the Argonaut mine up to the 280-ft. level, and that from there to the claimed apex underneath the lava-capped lode line the vein could be followed all the way, although not of large or high enough value to justify further stoping.

The plaintiffs attempted to offset this demonstration of the continuity of the Argonaut vein matter by an elaborate theory of faulting, claiming first an overthrust fault, the existence of which was practically conceded by experts for both sides, and in addition to that a normal faulting of several hundred feet which they claimed would destroy the vein continuity of the Argonaut. The opinion of the court is not available for examination at this time. The case was tried for the plaintiff by Messrs. Perry and Dalley, and for the defendant by Messrs. Curtis H. Lindley and William E. Colby, all of San Francisco. A recent cable to London showed that the Plymouth Consolidated equipment was as follows: 20% of shaft guide in place, mill 65% completed, and buildings 70% completed.

Jackson, June 30.

Butte County

The Guggenheim interests, through their manager, O. C. Perry, have acquired a large area of ground on Butte creek, five miles from Chico. This was owned by the Drexler people. One of the Company's dredges at Oroville is to be dismantled and rebuilt on the new site this summer. The dredge operating on the American river near Auburn is returning good results.

Nevada County

The North Star Mines Co. has declared its second quarterly dividend, of $50,000, for the current year.——The Brunswick Consolidated has also declared a dividend of 6c. per share, amounting to $18,000.——The annual meeting of the Zeibright Mining Co. was held in Nevada City on June 23. Development is to be commenced on its property in Bear valley.

Plumas County

The copper deposits on the west slope of the east range of the Sierra Nevada, to the northeast of Indian valley, and

MAP SHOWING SITUATION OF THE ENGELS MINE.

embraced in the claims of the Engels Copper Mining Co., are described in *Economic Geology* for June, by H. W. Turner and A. F. Rogers. The nearest railroad point is Keddie on the Western Pacific line, 30 miles distant by wagon road. The ore in the main Engels mine occurs in a fresh massive diorite rock. The most abundant metallic minerals are magnetite, bornite, and chalcopyrite. Pyrite is conspicuously absent. In the Superior mine three miles away and owned by the Company, the copper minerals are chiefly along joint planes and appear more like veins. The ore is bornite and chalcopyrite in a gangue of a green fibrous hornblende. A 150-ton mill employing the Minerals Separation flotation process is being erected to treat these ores. At present 65 men are employed under the direction of E. E. Paxton.

Sierra County

(Special Correspondence.) A good development was made recently in the Motor gravel mine, in the Port Wine district. The gravel so far averages about $10 per cu. yd. Operations are conducted through a 1100-ft. adit. A. M. Davis is manager.——The Iowa drift mine, in the Scales Diggings district, is to be developed by San Francisco and Oakland people. An adit 2000 ft. long will be driven to cut the lava-capped channel. Wm. C. Pershbaker is consulting engineer.

Port Wine, June 25.

The Kate Hardy mine, on Oregon creek, is developing well. High-grade ore was cut recently in a raise above the main adit.

A very rich shoot of gold ore was opened in the Tightner mine at Alleghany on June 29. For several days the mine was producing about $1000 per day, and the new shoot has yielded $10,000 so far.

Tuolumne County

(Special Correspondence.)—The Omega mine has been bonded to Mrs. M. A. Capell and Mrs. A. D. Ireland, of Salt Lake City, and operations will begin immediately under the direction and supervision of Joseph Loney. The property has been extensively developed by C. W. Ayers, and is equipped with modern mining and milling machinery. It is rated among the most promising mines in the Rawhide ditsrict.——Rich ore is being extracted from a mine near Steven's bar bridge by Fred Klein, owner of the property. Good results are obtained by grinding the ore in an arrastre, but this method may be abandoned and a mill erected if prospects continue good. The vein is about 8 ft. wide.——Development work has been in progress for several months at the Louisiana mine, near Tuolumne, and within a few days the milling of ore will begin. A large compressor has just been installed.——The shaft of the App mine, at Stent, is being repaired, preparatory to active mining operations. The property is in charge of Alex. Chalmers.——The vein at the Wheal Rough, near Soulsbyville, has been cut 300 ft. below the surface, and driving east and west will be commenced at once. The vein assays well where cut.——The adit which is being driven to drain the Springfield Tunnel & Development Co.'s mine, and which will be more than a mile in length, is in 1300 ft. W. M. Hall, of San Francisco, and S. Bogle, of Tacoma, two of the directors of the Company, have just returned to their homes from a visit to the property.——The new 5-stamp mill at the Hope mine, near Sonora, has been in operation for several days, and it is reported that the ore is yielding satisfactory returns.

Sonora, June 27.

The old Sugarman mine, on Bald mountain, is yielding its owners some rich pockets of gold ore.

COLORADO

Gilpin County

After being shut down for about six months, operations are to be resumed at the du Pont-Kelley syndicate mines at Quartz hill, the German, White-Kirke and Belcher, which produce high-grade uranium ore. Forbes Rickard is manager.

Montrose County

Forty tons of carnotite ore averaging 12% uranium oxide,

and worth $43,200, was shipped from Salida to New York on June 23. It came from the Paradox field. The cost of mining and delivering a ton of this ore averages $65 per ton, of which $32 is for mining, and $25 for transport.

TELLER COUNTY (CRIPPLE CREEK)

It is expected that preliminary work on extensions of the Roosevelt drainage tunnel will be finished in a few days.——The Howard shaft of the Mary McKinney company is to be sunk from 600 to 750 ft. Regular ore production is coming from this shaft.——Eighteen inches of ore worth $40 gold per ton, and containing seams of sylvanite, has been cut at 100 ft. in the Gold Bond mine on Gold Hill.——Rich 'float' ore has been found on some fractional claims on the south slope of Beacon hill.——The Golden Cycle company has completed a station on No. 17 level, and is now cross-cutting to the ore-shoots. The shaft is being sunk 125 ft. deeper. The electric pumps at No. 16 level are raising 450 gal. of water per minute. The Company is mining 5000 tons of ore, and 25 sets of lessees are extracting 2000 tons per month. Dividends totaling $270,000 have been paid this year.

IDAHO

IDAHO COUNTY

A good deal of interesting work is under way in the Elk City district. A 5-stamp mill is working at the Black Pine mine. H. B. Supplee is manager.——Development is being done steadily at the Colonel Sellars, and Mrs. M. A. Parr intends to erect a mill.——In the Strong claims is 8 ft. of $8 to $17 ore. A 20-ton mill is operating at the Mascot.——A. Kincaid has given a bond to Theodore L. Lammers of Spokane for the Evergreen Consolidated and Dewey groups, consisting of 14 claims, about eight miles from Grangeville, on the Clearwater river. The bond includes all equipment on the property, also a fine assay office, and water for 250 hp. from this river. About 7000 ft. of development has been done on the property in the last 15 years, and large bodies of gold-copper ore are opened. The equipment will be installed by Spokane manufacturers, and will first operate on the high-grade free-milling ores from the St. Patrick claim.

SHOSHONE COUNTY

The Yankee Boy Mining Co. shipped 271 tons of ore worth $35,461 in 1913, making a profit of $10,915. Profits of all this county's mines last year now totals $4,787,690.

The Bunker Hill & Sullivan company paid dividend No. 202, of $81,750, on July 3, making a total of $15,301,500 to date.

Men are overhauling the Blackhorse concentrator, in the Murray district of Idaho, to be used for milling the ores of the Paragon Consolidated mine, of which L. W. Stedman is manager. New rolls and a Harz jig have been installed, and it was expected that the alterations would be completed last week. The Paragon ores contain lead and zinc, and it is said the Blackhorse mill does good work separating both, saving approximately 75% of the metal content.——Work has been resumed at the St. James mine, adjoining the Sunset mine, on Sunset peak, near Wallace, owned by W. A. Clark.

MINNESOTA

One of the worst storms of recent years was raging on Lake Superior at the end of last week. Many steamers were reported in trouble and there were rumors that three sank on the north shore. All telegraph and telephone wires are down. The large steel steamer *Mataafa* stranded on the breakwater piers while trying to enter Superior harbor on June 27. She was released and towed to the Great Northern ore docks.

MISSOURI

JASPER COUNTY

The Clifford Dry Concentrating Co.'s plant at Duenweg is being dismantled, after experimenting for over a year.——A flotation plant is being operated by Hays & Thomas on the Underwriters' lease, west of Joplin. The process is a 'secret' one.

MONTANA

Montana's mine output of gold, silver, copper, lead, and zinc in 1913, according to Victor C. Heikes, of the U. S. Geological Survey, was valued at $61,900,546, against $64,754,613 in 1912, a decrease of $2,854,067, due mainly to the decreased output of gold and copper. The value of silver, lead, and zinc combined was $3,771,202 greater than in 1912, while the value of the gold and copper was $6,625,269 less than in 1912. The production of gold in 1913 was valued at $3,493,432, as against $3,625,235 in 1912. The production of silver in 1913 was 13,819,201 oz., against 12,731,638 oz. in 1912. Copper decreased from 309,738,873 lb. in 1912 to 287,828,699 lb. in 1913. Lead increased from 7,446,749 lb. in 1912 to 10,935,827 lb., in 1913. Montana's zinc ores in 1913 yielded 88,673,083 lb. of spelter, against 26,918,881 lb. in 1912.

CASCADE COUNTY

Work on the new power-plant of the Montana Power Co. at Great Falls, on the Missouri river, is so far advanced that it is likely that part of it will be in operation by January 1, 1915. At the dam, 50,000 cu. yd. of concrete has been poured, the daily rate being from 1300 to 1400 yd. Power-house foundations above water-level are finished. Six 15,000-hp. units are to be installed. About 500 men are employed in the camp. Six miles upstream, at Rainbow falls, the Company has six 6000-hp. units at work. At Thompson falls, on Clark's fork of the Columbia river, a plant of about 40,000 hp. is being constructed. The St. Paul railroad will probably take 65,000 hp. from the Great Falls plant.

SILVERBOW COUNTY

The Edith May vein has been cut at 2800 ft. in the North Butte mine, where it is 3½ ft. wide, assaying 12.5% copper and 13 oz. silver per ton.——The Anaconda company will add to the electric drive equipment of its plant 19 induction motors ranging from 25 to 50 hp., all of which have been ordered from the General Electric Company.

NEVADA

CHURCHILL COUNTY

The Nevada Hills Mining Co. reports as follows for May: Ore treated, 5300 tons; average value, $7.99 per ton; loss in residue, 80.5c.; net profit $5251; development, 548 ft.; cost, $1.08 per ton; total resources, $220,893. Profits were reduced by shaft sinking and other work.

EUREKA COUNTY

Following the addition of a toothed roll crusher, ball-mill, classifiers, a 14 by 24-ft. Oliver filter, and other apparatus, the Buckhorn mill is now treating 300 tons per day, which is almost full capacity.

ESMERALDA COUNTY

The Goldfield Consolidated Mines Co. acquired 87%, or 592,000 of 680,500 issued shares of Aurora Consolidated, which is capitalized at $1,000,000, the basis being $877,000 valuation of the entire property, including the mill which has a capacity of 500 tons per day and has just commenced operations. This price is $225,000 less than stipulated in the original option. The Knight directorate has resigned and George Wingfield was elected president. A. H. Howe, secretary-treasurer; other directors: Albert Burch, J. H. Miller, Charles E. Knox, Frank Manson, and Henry M. Hoyt. The mill was designed by Kirk and Leavell of Salt Lake City. Mr. Leavell, who remains in charge several months, will be succeeded as manager by L. H. Metzger, who has been with the Goldfield Consolidated six years, latterly as mine superintendent.

The Goldfield Consolidated Mines Co. reports as follows for May: Development totaled 2388 ft. at a cost of $6.91 per foot.

Royalty from lessees amounted to $3491, less cost of milling and transport. There was nothing of importance to report from the Combination, Clermont and Red Top-Laguna mines. The 35 still on the new level in the Sheeta Ish section of the Mohawk mine was extended to the north, and produced 88 tons of $10 ore. On the first level in the Francis-Mohawk section, the 111-KX still was extended and produced 112 tons of $18 ore. On the second level the 248-B still in the Mohawk vein was extended and produced 250 tons of $10 ore. Development on the second level in the Mohawk Jumbo vein produced 188 tons of $14 ore. The 410-C still on the fourth level in the same section produced 132 tons of $10 ore. Development in the Mohawk vein near the old 407 stope, between the third and fourth levels, produced 460 tons of $14 ore.

There was 30,181 tons of ore treated yielding a net profit of $155,049. Total costs were $5.81 per ton, including $3.07 for mining and development, $1.68 for treatment, and 5c. for examining the Aurora mine in Mineral county.

HUMBOLDT COUNTY

Samples from the Seven Troughs Coalition mine at 1150 and 1200 ft. depth vary from $91 to $2787 per ton. On the former level 10 in. of rich ore has been opened for 190 ft. A small car of concentrate recently returned $383 per ton.

NYE COUNTY

It is reported that the large property of the Commercial Mines & Milling Co. is under option to outside capitalists. The claims included are the Crescent, Reilly Fraction, Jumping Jack, Stray Dog, Little Grey, Indian Camp, and Chipmunk, also share interests in the Mustang, April Fool, and others, with control of the War Eagle 20-stamp mill.——A 50-ft. head-frame has been erected at the White Caps. The vertical shaft is to be sunk from 210 to 310 ft.——At the Associated mill, the Consolidated will use 10 stamps, a tube-mill, and cyanide plant.

During the week ended June 27 the mines at Tonopah produced 11,806 tons of ore worth $301,765.——On July 21 the Tonopah Mining Co. will declare a dividend of 25c. per share, amounting to $250,000. Profits for the last three months total $330,915.——At 1020 ft. in the new shaft of the Extension mine, the Murray vein is 23 ft. wide, averaging $20 per ton. Of this, 4 ft. of sulphide ore is worth $100 per ton.——At 980 ft. in the Merger, the ore-shoot is 10 ft. wide for a length of 200 ft.; at 1070 ft., 480 ft. long, of great width in places; and at 1170 ft., 685 ft. long, the first shoot of 400 ft. being worth $20 per ton. Shipments in 1914 to the end of May totaled 3223 tons worth $57,611.

OREGON

BAKER COUNTY

The Independence mine, near Granite, has been unwatered.——Cyaniding tailing at the Red Boy will be continued until November.——Mill machinery is being hauled from the Psyche to the Last Chance mine in Cable Cove.——There will be drilling contests between miners from the Mammoth and Columbia mines on July 4.——Work at the Buck Gulch placers has been stopped for the season.——Work is to be started at the Mayflower claims north of Sumpter.——A new company has been formed at Baker to work a limestone deposit in Pleasant valley.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—At 400 ft. in the San Poil Consolidated mine, a new orebody assaying $15 per ton has been opened. In the south end of this level a drift is being extended to cut ore developed at 300 ft. The mill is treating 95 tons of ore per day, about 30 tons coming from the Knob Hill mine. A new assay office has been built. The Knob Hill is also sending three or four cars of ore per week to smelters. More litigation has been started in this camp, as the Chicago Title & Trust Co. and W. E. Retley of Detroit, Michigan, are suing the North Washington Power & Reduction Co. to foreclose a mortgage for $1,600,000. The case is part heard but it looks as if the presiding judge of the court will hold that labor liens and other creditors would be considered before the mortgagee, and all creditors be compelled to share alike.

Republic, June 20.

CANADA

ALBERTA

(Special Correspondence.)—Dark oil is reported in the Monarch well, section 5, T. 32 N. R. 6 W. on Red Deer river. A little dark green oil was brought up in the bailer and drilling stopped until tankage could be provided. This well started near the base of the Edmonton shale and at 820 ft., where stopped, should be in the Bearpaw shales, near the top of the Montana formation.

Calgary, June 22.

BRITISH COLUMBIA

According to J. M. Wolbert, representing Spokane, Nelson and Kaslo people, a dredge costing from $125,000 to $175,000 will be constructed on the Lardo river at Goldhill this summer. A railway runs near the site, so transport will be easy. At present, a Philadelphia syndicate is working a drag-line dredge in this district, and obtaining 75c. per cubic yard from 12 to 15 ft. depth.

ONTARIO

Official returns of mineral production of the province for the first quarter of 1914 show the following results: Gold ore treated, 112,826 tons yielding $10.65 per ton, of which Porcupine produced 104,880 tons averaging $10.95 per ton; silver ore treated from Cobalt (94.4% of the total), Gowganda, South Lorrain, and Casey, 163,055 tons, which yielded silver worth $490,894 less than the same period of 1913.

M'KINLEY-DARRAGH MINE, COBALT.

Trenching on the Tough-Oakes ground uncovered a new vein near No. 3. The latter averages about $120 per ton over 10 in. width for 500 ft. High-grade ore is being crushed in the mill. Metallurgical tests are being made on the ore.

YUKON

Canadian Klondyke Co.'s dredges produced 3351 oz. gold during the second week of June.

MEXICO

American employees of the Creston-Colorado, in Sonora, and El Rayo and Dolores mines, in Chihuahua, of the Mines Company of America, have returned to their respective properties for the purpose of resuming operations, or carrying on development work. No effort is being made to resume operations at La Dura, as this property is situated in the Yaqui territory, and in a district where it will be impossible for the Constitutionalists to give as good protection as in the case of the other properties.

PERSONAL

H. K. Welch has gone to Alaska.

C. C. Derby was in San Francisco.

S. J. Kidder is back from Honolulu.

A. R. Ledoux has returned from Europe.

D. W. Brunton is visiting friends in the East.

F. C. Alsdorf is in Washington examining mines.

A. G. Charleton left London for Norway on June 27.

C. W. Merrill has gone to Lake Tahoe for the month.

Charles F. Rand has returned to New York from Cuba.

Thomas T. Read is visiting the Lake Superior copper mines.

Theodore J. Hoover has returned to London from Burma.

John C. Ralston has been in New York for the last few weeks.

C. C. Broadwater was in New York last week, returning from Europe.

F. J. Baskow was in San Francisco going from Ray to Salt Lake City.

J. A. Holmes will be at Fort Bayard, New Mexico, for the next few months.

J. E. Spurr examined the Tonopah Mining Co.'s property in Nevada last week.

Marshall Draper, who has been examining mines at Nevada City was in San Francisco.

Walter H. Weed is in Butte, testifying as expert witness in the Anaconda-Pilot Butte lawsuit.

B. J. Padshah and C. P. Perin, who were in San Francisco last week, have sailed for the Orient.

C. A. Brown and J. A. Holmes, Jr. are taking motion pictures of striking mining and metallurgical scenes through the western states for the U. S. Bureau of Mines.

C. M. Means, of Pittsburgh, has been appointed consulting electric engineer with the U. S. Bureau of Mines.

Harry R. Johnson, W. R. Calvert, Ralph Arnold, and Leon J. Pepperberg are among the oil experts at Calgary, Alberta.

Edgar Rickard has been elected president of the Mining and Metallurgical Club of London. H. Livingstone Sulman is vice-president, and Sidney H. Farrar, treasurer.

W. G. Carpenter has resigned from the Goldfield Consolidated mill staff and has accepted a position with the Syndicate Mining Co., Aroroy, Masbate, Philippine Islands.

Albert Burch will have the management of the Aurora Consolidated property as well as the Goldfield Consolidated Mines Co., now that the Goldfield Consolidated has acquired control.

Arthur L. Walker has been visiting metallurgical plants in Michigan and Montana and will sail on July 9 from Vancouver for a holiday visit to Japan and China, returning by way of Suez.

Ludwig Diehl has had the title of 'professor' conferred on him by the Prussian government, in recognition of his sixteen years' work in advancing the metallurgy of gold and silver, through the use of tube-mills and other apparatus.

H. W. Hardinge left New York on June 22 for the Cobalt, Porcupine, and British Columbia districts of Canada, and Alaska. In returning he will visit most of the Western mining states. Mr. Hardinge will be gone until about the second week in August.

Karl Bernson, construction engineer for the General Electric company of Salt Lake City, has gone to Miami, Arizona, to superintend the installation of new equipment in the mills of the Inspiration Consolidated Copper Co. and the Miami Copper Co. He will later go to Superior, Arizona, to superintend the starting of the new mill of the Magma Mining company.

SOCIETY MEETINGS

JULY	
Northern California and Southern Oregon Mining Congress, Ashland, Oregon	9-10
AUGUST	
American Institute of Mining Engineers, Salt Lake City	10-14
British Association, Adelaide, South Australia	8
Canadian Mining Institute, Rocky Mountain branch, Banff.	
Lake Superior Mining Institute, Marquette, Michigan	17
SEPTEMBER	
American Chemical Society, Montreal	15-18
American Institute of Electrical Engineers	not fixed
Colorado Scientific Society, Denver	3
OCTOBER	
American Institute of Electrical Engineers	9
American Iron and Steel Institute	23-24
Colorado Scientific Society, Denver	3
NOVEMBER	
American Institute of Electrical Engineers	13
Colorado Scientific Society, Denver	7
DECEMBER	
American Institute of Electrical Engineers	11
American Museum of Safety	11-20
American Society of Mechanical Engineers	7-8

SCHOOLS AND SOCIETIES

The University of North Dakota *Quarterly Journal* contains a good deal of interesting reading matter in its 70 pages.

Massachusetts Institute of Technology has published a bulletin giving names of graduates of the class of 1914, and titles of theses written by them.

The Colorado School of Mines has issued its *Quarterly*, and also a book of views of this institution at Golden. The publication deals with the college calendar, the faculty, description of the school and plant, and courses given. The summer school lasts from July 20 to August 29, and the first semester of 1914-15 starts on September 8.

Old Freibergers in America met in New York City on June 13 in honor of Dr. Friedrich Kolbeck, rector of the Freiberg Bergakademie, Saxony, Germany. Dr. Kolbeck came to this country to represent the Royal Mining School at the fiftieth anniversary of the School of Mines, of Columbia University. Dr. Kolbeck said that as he had come over to help celebrate this anniversary he hoped to see a number of former students of Freiberg back to celebrate the one hundred and fiftieth anniversary of the Bergakademie in 1916.

The Institution of Mining Engineers held its meeting in London on June 4 and 5. It was the twenty-fifth anniversary of the federation of the seven constituent institutions, namely, Manchester Geological and Mining Society, North of England Institute of Mining and Mechanical Engineers, Midland Institute of Mining, Civil and Mechanical Engineers, South Staffordshire and Warwickshire Institute of Mining Engineers, Midland Counties Institution of Engineers, North Staffordshire Institute of Mining and Mechanical Engineers, and the Mining Institute of Scotland. The total membership is 3338. The president, Sir William Garforth, who received the medal of the Institution, stated that the Duke of Northumberland was the president-elect.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Stocks and Bonds

SAN FRANCISCO STOCKS AND BONDS

(San Francisco Stock and Bond Exchange.)

June 29

BONDS

Listed.	Bid	Ask	Unlisted.	Bid	Ask
Associated Oil 5s	$ 98¼	-	Natomas Consol	8	12
Natomas Con	25	37½	Pac. Port. Cement 6s	100	—
Unlisted.			Santa Cruz Cement 6s	85	--
General Petroleum 6s	38½	40	Union Oil	88½	87½

STOCKS

Listed.	Bid	Ask	Listed.	Bid	Ask
Amalgamated Oil	78	—	West Coast, pfd.	—	112½
Associated Oil	38½	39	Unlisted.		
Du Pont, pfd	80	84	General Petroleum	4	6
Giant	—	81½	Noble Electric Steel	50c	60c
Pac. Ott. Borax, com	—	57½	Pac. Port. Cement	60	94
Sterling O. & D.	—	1½	Riverside Cement	—	63
Union Oil	89	—	Santa Cruz Cement	—	45
			Stand. Port. Cement	—	18½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

June 30.

Atlanta	$ .15	Montana-Tonopah	$ .60
Belcher	.27	Nevada Hills	.32
Belmont	6.75	North Star	.27
Con. Virginia	.14	Ophir	.17
Florence	.40	Pittsburg Silver Peak	.25
Goldfield Con	1.40	Round Mountain	.35
Goldfield Oro	.08	Sierra Nevada	.10
Halifax	.65	Tonopah Extension	2.50
Jim Butler	.97	Tonopah Merger	.42
Jumbo Extension	.21	Tonopah of Nevada	7.00
MacNamara	.01	Union	.15
Mexican	.52	Victor	.38
Midway	.21	West End	.03
Mizpah Extension	.23	Yellow Jacket	.35

CALIFORNIA STOCKS

(Latest Quotations.)

	Bid.	Ask.		Bid.	Ask.
Argonaut	$3.50	..	Kennedy	$8.00	....
Brunswick Con.	1.50	....	Mountain King	...	0.50
Bunker Hill	1.90	....	South Eureka	2.40	....
Central Eureka	0.12	0.13			

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

July 2.

	Bid	Ask		Bid	Ask
Allouez	$ 39½	40	Nevada Con	$ 13¾	14
Ariz. Commercial	4¼	4¾	North Butte	25¼	25⅝
Butte & Superior	36¾	37¼	Old Dominion	48	48½
Calumet & Arizona	64½	64¾	Osceola	76	78
Calumet & Hecla	405	410	Quincy	56½	58
Copper Range	35¾	36	Shannon	5	5¼
East Butte	9¼	10	Superior & Boston	1¼	2
Franklin	4	4¼	Tamarack	34¼	35
Granby	78¼	79¼	United Verde	80	85
Greene Cananea	30	30½	U. S. Smelting, com	33¾	34¼
Isle Royale	19¾	20	Utah Con.	1¼	1¾
Mass Copper	4¼	4¾	Winona	3¼	—
Mohawk	43¾	45	Wolverine	40	41

NEW YORK STOCK EXCHANGE

(By courtesy of J. C. Wilson, Mills Building.)

July 2.

	Bid	Ask		Bid	Ask
Amalgamated	$ 69¼	69¾	Miami	$ 21¼	22
Anaconda	31½	31¾	Nevada Con.	13¾	14
A. S. & R., com.	62¼	62¾	Quicksilver, com.	1	2
Calif. Pet., com.	18¾	19¾	Ray Con.	20¼	21
Chino	40¼	40¾	Tenn. Copper	33	33½
Guggenheim Ex	53	54	U. S. Steel, pfd.	109	109⅜
Inspiration	17¼	17¾	U. S. Steel, com	61¼	61¾
Mexican Pet., com	59¼	61	Utah Copper	58¼	58¾

NEW YORK CURB QUOTATIONS

(By courtesy of E. J. Hutton & Co., Kahl Building.)

July 2

	Bid	Ask.		Bid	Ask
Braden Copper	7½	7¾	McKinley-Dar.	61	65
Bos. Cr. Copper	1⅝	1⅞	Mines Co. Am.	2⅝	3
Con. Cop. Mines	1½	1½	Nipissing	6⅝	6
Davis-Daly	⅜	⅝	Ohio Copper	¼	⅜
First National	1½	2	Stand. Oil of Cal.	120	123
Hollinger	17	19	Tri Bullion	¼	½
Iron Blossom	1¼	1½	Tuolumne	¼	½
Kerr Lake	5	5⅛	United Cop. com.	¼	⅜
La Rose	1⅛	1¼	Yukon Gold	2¾	2¾
Mason Valley	2⅝	3			

LONDON QUOTATIONS

(By cable, through the courtesy of Hollister, Lyon & Walton, New York.)

July 2.

	£	s.	d.		£	s.	d.
Alaska Mexican	1	6	3	Mexican Eagle, com.	1	5	0
Alaska Treadwell	8	5	0	Mexico Mines	4	5	0
Alaska United	3	5	0	Messina	1	6	3
Arizona	1	16	3	Oroville	0	10	0
Camp Bird	0	8	9	Pacific Oilfields	0	1	3
Cobalt Townsite	1	2	6	Rio Tinto	68	7	6
El Oro	0	13	0	Santa Gertrudis	0	11	3
Esperanza	0	13	9	Tanganyika	2	1	3
Granville	0	10	0	Tomboy	1	3	3
Kern River Oilfields	0	7	6				

Metal Prices

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore producer could expect to realize. Ore contracts usually call for settlement on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

LOCAL METAL PRICES

San Francisco, July 2.

Antimony	9 — 9¼c
Electrolytic copper	15 — 15¼c
Pig Lead	4.15— 5.10
Quicksilver (flask)	$38.50
Tin	39 — 40½c
Spelter	6½— 6¾c

Zinc dust, 100 kg. zinc-lined cases, 7½ to 8c. per pound.

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, July 2.—As mentioned in the 'New York Metal Market Review' of this issue, repeated statements as to the depressed condition of the markets become monotonous, yet metals remain practically at the same price. Copper is firmer, with more business doing, giving better tone. June exports totaled 35,182 tons against 27,808 tons in June 1913. Granby's May yield was 1,669,334 lb. Calumet & Hecla has paid a dividend of $5, and Tennessee Copper 75c. per share. In the suit of Sidney Norman, representing minority interests of the Federal Mining & Smelting Co. v. the American Smelting & Refining Co., the New York Supreme Court gave its decision against the plaintiff. Lead and spelter are quiet. In St. Louis these metals are weaker at 3.37½ and 4.45c. respectively. Bar silver in London is steady at 26⅛d. (52.25c.).

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.		Average week ending	
June 25	56.37	May 20	58.31
" 26	56.75	" 27	57.12
" 27	56.50	June 3	56.52
" 28 Sunday		" 10	56.48
" 29	56.62	" 17	56.56
" 30	56.50	" 24	56.[illegible]
July 1	56.75	July 1	56.75

Monthly averages.

	1913	1914.		1913.	1914.
Jan.	63 01	57.58	July	58 70	....
Feb	61.25	57 53	Aug	59.32	....
Mch	57.87	58.01	Sept.	60.53	....
Apr	59.26	58.52	Oct.	60.88	....
May	60.21	58 21	Nov.	58.76	....
June	59 03	56.43	Dec.	57.73	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
June 25	13.35	May 20	14.00
" 26	13.30	" 27	13.98
" 27	13.25	June 3	13.86
" 28	Sunday	" 10	13.75
" 29	13.25	" 17	13.65
" 30	13.20	" 24	13.55
July 1	13.35	July 1	13.28

Monthly averages.

	1913.	1914.		1913.	1914
Jan	16.54	14.21	July	14.21	....
Feb	14.93	14.46	Aug.	15.42	....
Mch	14.72	14.11	Sept.	16.23	....
Apr	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15 08	....
June	14.71	13.60	Dec.	14.25	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds New York delivery.

Date		Average week ending	
June 25	3.90	May 20	3.90
" 26	3.90	" 27	3.90
" 27	3.90	June 3	3.90
" 28	Sunday	" 10	3.90
" 29	3.90	" 17	3.90
" 30	3.90	" 24	3.90
July 1	3.90	July 1	3.90

Monthly averages.

	1913.	1914.		1913	1914.
Jan.	4.28	4.11	July	4.35	....
Feb.	4.33	4 02	Aug.	4.60	....
Mch	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec	4.02	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
June 4	39.00	June 18	38.50
" 11	38.50	" 25	38.50
		July 2	38.50

Monthly averages.

	1913.	1914.		1913.	1914
Jan.	39.37	39.25	July	41.00	....
Feb.	41.00	39.00	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40 25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date		Average week ending	
June 25	4.75	May 20	4.95
" 26	4.75	" 27	4.93
" 27	4.75	June 3	4.90
" 28	Sunday	" 10	4.88
" 29	4.75	" 17	4.85
" 30	4.75	" 24	4.85
July 1	4.75	July 1	4.75

Monthly averages.

	1913.	1914.		1913.	1914
Jan.	6.88	5.14	July	5.11	....
Feb	6.13	5.22	Aug.	5.51	....
Mch	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4 91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	....
Feb	48.07	39.76	Aug.	41.75	....
Mch.	46.85	38.10	Sept.	42.45	....
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

New York Metal Review

Continued reports of the depressed state of the metal trade become monotonous, but the truth permits no deviation to the side of more cheerful reports at present. One deduction that augurs well for the future, however, is the unquestionable fact that stocks of all sorts are in a depleted state, and any revival of business, especially in the metal-working trades, must be felt without delay by the producers and sellers of raw materials. The freight rate decision, now expected daily, will help in this direction; but of greater force yet is the fact that this great country is constantly wearing out enormous quantities of finished products, and these must be replaced. There is a limit to the patching which can be done. Prices may have to be kept lower than is desirable, in order to ward off too great an influx of foreign-made goods, but the United States is going to keep on making the bulk of what it uses, the production of which must support its people. June brought lower prices in copper, tin, spelter, and the products in which these materials enter. It has been a quiet month all around. Lead has been dull but steady. Tin is exceptionally low, and buying is only 'from hand to mouth.' Of antimony there is an oversufficiency in stock. Aluminum is unchanged.

COPPER

If evidence were needed as to the present dullness and low prices of the metals it might be supplied by an announcement made on June 15 by the Ansonia Brass and Copper Branch of the American Brass Co., wherein it was stated: "In view of the decline in the prices of raw materials, we beg to withdraw all prices on brass and bronze sheet, wire, rods, brazed tubing, angles, and channels, and to submit herewith a new schedule taking effect on all orders received June 15, 1914, and after." The new schedule indicated that sheet copper was reduced ¼c. to 19c. per lb. base, and that there were reductions of ⅜c. per lb. on sheet brass to 15⅛c.; brass wire to 14¾c., and brass rods to 14¾c. per lb. base. Copper wire in carload lots, mill shipments, was at the same time reduced to 15¼c. per lb. base. Between June 1 and 25, the copper market declined about ½c. per lb., and the dullness was without relief. The quotation for electrolytic on June 1 was 14.12½c. cash New York, while on June 25 it was 13.62½c. cash New York, with a tendency toward still lower prices. Of course, there was some business during this period, but it was mostly in small lots for prompt shipment to meet current requirements. Consumption is estimated as being between 60 and 70% of normal. In the first day or two of the month the offerings at substantial concessions outnumbered the takers, with second hands, rather than the producers, pressing for business. European buying slackened up considerably, although exports against old transactions kept up well, those for May having totaled 30,777 tons. The June exports, up to the 27th, amounted to 29,388 tons. The May report of the Copper Producers' Association, out June 8, showing that stocks had increased 14,005,640 lb., was construed as unfavorable, and the electrolytic market at once dropped ⅛c. In this instance, and again later in the month, the producers did not publicly announce a reduction, but the price came down, nevertheless. Toward the end of the month the market could only be described as stagnant, buyers showing no interest, and there being no pressure to sell on the part of either producers or second-hands. Prime Lake shared the decline, though it did not come down in proportion to electrolytic. On June 1 it was quoted at 14.37½c., while 24 days later it could have been had at 14.12½c. cash New York. Inferior grades of Lake were to be had at 14c. and lower. Early in the month, prime Lake was sold at 14.25c., and other grades not regarded as prime, at a shade under 14c.

The apparent consumption of copper in the United Kingdom, as per the Board of Trade returns, in the first five months of this year, was 53,319 tons, as compared with 45,637 tons in 1913.

LEAD

Dull but steady, sums up the lead market in June. Prices were unchanged at 3.90c New York and 3.80c St. Louis. Toward the end of the month the patience of sellers was becoming exhausted, and they complained of the lack of orders. Just at the end of May a good sale was reported, a New England ammunition maker taking 1000 tons on a basis of 3.95c delivered. Early in June there were reports that inquiries from Europe had resulted in sales, but the business could not be traced. Despite the quiet, there was little or no disposition to shade prices, and the market was in all respects a waiting one.

SPELTER

While the request for spelter was quiet, there was promise of a better demand from the sheet mills, which toward the end of the month began to feel a disposition on the part of their customers to buy sheets for the third quarter. This was offset, however, by the prospect of trouble between the sheet mills and their employees over the wage scale for next year. A conference which was held at Atlantic City did not bring any agreement between them, and the situation was left with the possibility of a shut-down of about 22% of the sheet mill capacity of the country unless further conference was successful. Until near the last of the month, quotations were unchanged at 5.10c. New York and 4.95c. St. Louis, then five points were lost, making the price 5.05c. New York and 4.90c. St. Louis. Of course, the metal was adversely affected by the slack business of the brass mills.

TIN

The market ranged between 30 and 31c. from June 1 to June 27, with buying light at all times. Nearly all of such activity as prevailed was in comparatively small lots for prompt or very early delivery, an evidence of the depleted state of consumers' stocks. Deliveries continued good, principally because of the large consumption of the tin-plate mills. In May, deliveries totaled 3800 tons. On June 2, the London price dropped £5, causing a break here of over ½c., and about 150 tons changed hands as a result. The London market at this time was in a more or less demoralized state, because of a lack of support which left it at the mercy of the bears. In New York, conditions were not pleasing either, as some of the metal taken June 1 by consumers under contract, had cost them 40c., while the quotation on that day was 31.25c., and the next day it dropped to 30.45c. It was noted that dealers lost no time in making deliveries on such contracts. Abroad, the unsatisfactory condition was attributed to the world supply statistics, the shipments from the Straits having been 788 tons larger in May than those of the same month last year. In five months of this year the Straits shipments were 1774 tons greater than those of the same months in 1913. The middle of June brought no betterment, either in the number or character of sales, and a serious development at this time was a failure to take certain deliveries against an old contract. On June 15 there was a sale, under the rule, on the floor of the New York Metal Exchange of 25 tons, ex-steamer *Atholl*, which brought 29.50c., the lowest price in years. Spot supplies were closely concentrated. As the month drew near its close, consumers seemed to have but little faith in the market, were showing no interest in futures, and all sides seemed to be awaiting developments. The arrivals in June, up to the 27th, totaled 3200 tons, and there was afloat 2308 tons. In five months of this year deliveries decreased 450 tons as compared with the same time last year. The total visible world supply June 1, was 17,862 tons, as compared with 13,710 tons June 1, 1913. On June 25 London declined between £4 and £5 and the New York price dropped to 29.87½ cents.

ANTIMONY

The demand has been poor and the supply over sufficient. Stocks in bond, June 1, were reported at 1,361,554 lb., as against 1,445,599 lb on the same date a year ago. These amounts cannot be compared, however, for the reason that a year ago a change in tariff was impending and all the metal was carried in bond, whereas now a great deal is stored in private warehouses. With but slight changes the following prices ruled through the month: Hallett's, 6.87½ to 7c., Cookson's, 7.12½ to 7.20c., and other grades 5½ to 6c. per pound.

Current Prices for Oils and Candles

(Corrected monthly by Standard Oil Co., California.)

All prices are f.o.b. San Francisco except where otherwise specified, and are subject to change without notice.

Granite Mining Candles.	Per set, cents.	Granite Mining Candles.	Per set, cents.
6s-12 oz.-10s	8¾	6s-14 oz-20s	9½
6s-12 oz.-20s	9	6s-16 oz.-40s	10
6s-14 oz.-40s	9¼	6s-16 oz.-20s	10¼

Extra hard 1c. per set higher than the above.

The following prices are for oils (Calol) in wood barrels, cases (2-5 gal.) 3c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Compressor oil	40	Light gas engine oil	28
Amber gas engine oil	40	Red compressor oil	26
Castor machine oil	20	Red engine oil	17
Dynamo and motor oil	24	Turbine oil	35
Engine oil	24	Turbine oil, heavy	35
Gas engine oil	26	Diesel engine oil	40
Heavy gas engine oil	45	Cylinder oil	37
Heavy red engine oil	19	High-pressure cylinder oil	50
Heavy red journal oil	21	Low-pressure cylinder oil	37
Ice machine oil	28	Valve oil	50

The following prices are for oils in iron barrels, cases (2-5 gal.) 7c. per gallon higher, except on Eocene, which is 8c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Pearl oil	9	Red Crown gasoline	14½
Headlight oil	10	Engine distillate	7
Eocene oil	11	Aroturps	23

	Per bbl.
Star fuel oil, f.o.b. Richmond Refinery	$1.00
	Per ton.
Petrolastic cement X	$12.00
Petrolastic cement XX	11.00
Asphaltum	$5.50 to 12.50

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, per ton	*$18.00	$20.00
Arsenic, white, refined, per lb	0.03	0.04
Arsenic, red, refined, per lb	0.08	0.08½
Asbestos, chrysotile	100.00	350.00
Asbestos, amphibole	5.00	10.00
Asphaltum, refined, per ton	11.50	20.00
Barium chloride, commercial, per ton	40.00	42.50
Barium sulphate (barytes), prepared, per ton	20.00	30.00
Bismuth ore, 15%, per ton	*250.00	upward
China clay, English, levigated, per ton	15.00	20.00
Chrome ore, according to quality, per ton	10.00	12.50
Cobalt metal, refined, f. o. b. London, per lb	2.50	....
Coke, foundry, per 2240 lb	12.00	15.00
Diamonds (according to size and quality):		
Borts, per carat	2.00	15.00
Carbons, per carat	55.00	80.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Silica, per M	50.00	55.00

Snowball, per M	40.00	45.00
Flint pebbles for tube-mills, Danish, per 2240 lb.	21.50	22.50
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	40.00
Graphite:		
Amorphous, per lb.	0.01½	0.02½
Crystalline, per lb.	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Iridium	55.00	....
Magnesite, crude, per ton	5.00	7.50
Magnesite, dead calcined, per ton	20.00	25.00
Manganese ore, oxide, crude, per ton	10.00	15.00
Manganese, prepared, according to quality, per ton	30.00	70.00
Mica, according to size and quality, per lb.	0.05	1.00
Molybdenite, 95% MoS_2, per ton	750.00	1000.00
Monazite sand (5% thoria), per ton	150.00	200.00
Nickel metal, refined, per lb.	0.45	0.60
Ochre, extra strength, levigated, per 100 lb.	1.60	2.00
Osmiridium, per oz.	25.00	....
Platinum, native, crude, per oz.	30.00	45.00
Silex lining for tube-mills, per 2240 lb.	35.00	45.00
Sulphur, crude, per ton	15.00	25.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	425.00	450.00
Tungsten ore, 65%	400.00	425.00
Uranium ore, 10% min.	25.00 per unit	
Vanadium ore, 15% V_2O_5, per ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are f.o.b. San Francisco and subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l 66°, drums, per 100 lb.	$ 0.80	$ 1.10
Acid, sulphuric, com'l, 66°, carboy, per 100 lb.	1.25	1.75
Acid, sulphuric, C. P., 9-lb. bottle, bbl., per lb.	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, per lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, per 100 lb.	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., per lb.	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, per lb.	0.10½	0.15
Acid, nitric, com'l, carboy, per 100 lb.	5.50	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., per lb.	0.16	0.22
Acid, nitric, C. P., bulk, carboy, per lb*	0.12½	0.15
Argols, ground, bbl., per lb.	0.10	0.20
Borax, cryst. and conc., bags, per 100 lb.	3.38	4.50
Borax, cryst. and conc., bags, per 100 lb.	3.00	4.35
Borax, powdered, bbl., per 100 lb.	3.38	4.50
Borax glass, gd. 30 mesh, cases, tin lined, per 100 lb.	10.50	13.50
Bone ash, 60 to 80 mesh, bbl., per 100 lb.	0.50	6.50
Bromine, 1-lb. bottle, per lb.	0.55	0.65
Clay, domestic fire, sack, per 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, per lb.	0.18	0.22
Cyanide, 98 to 100%, 200-lb. case, per lb.	0.18	0.22
Cyanide, 129%, 100-lb. case, per lb.	0.22	0.25½
Cyanide, 129%, 200-lb. case, per lb.	0.22	0.25
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white broken, casks, per 100 lb.	10.50	10.75
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white, crystals, per 100 lb.	12.50	13.25
Lead, C. P., test., gran., per 100 lb.	13.00	15.00
Lead, C. P., sheet, per 100 lb.	15.00	18.00
Litharge, C. P., silver free, per 100 lb.	11.50	13.50
Litharge, com'l, per 100 lb.	8.00	9.50
Manganese ox., blk., dom. in bags, per ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, per ton (85% MnO_2—¾% Fe)	35.00	50.00
Nitre, double ref'd, small cryst., bbl., per 100 lb.	7.00	8.00
Nitre, double ref'd, granular, bbl., per 100 lb.	6.50	7.50
Nitre, double ref'd, powdered, bbl., per 100 lb.	7.25	8.00
Potassium bicarbonate, cryst., per 100 lb.	12.00	15.00
Potassium carbonate, calcined, per 100 lb.	7.50	9.00
Potassium permanganate, drum, per lb.	0.10¾	0.13
Silica, powdered, bags, per lb.	0.03	0.05
Soda, carbonate (ash), bbl., per 100 lb.	1.45	1.75
Soda, bicarbonate, bbl., per 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., per 100 lb.	2.75	3.25
Soda, caustic, solid, 98%, drums, per 100 lb.	2.50	2.75
Zinc shavings, 850 fine, bbl., per 100 lb.	12.00	12.00
Zinc sheet, No. 9—18 by 84, drum, per 100 lb.	10.20	11.00

*Extra charge for packing nitric acid for shipment to conform to regulations.

Petroleum Production of the United States

After making a complete investigation of this industry, the U. S. Geological Survey has compiled the following table. The totals are only 2.5% different from preliminary estimates published by the Survey eight days after the close of the year 1913. The Survey is the only statistical agency which prepares a statement of the value of the crude oil at the wells. The principal feature was the gain in value over 1912, namely, $72,908,141, although the output was only 25,511,186 bbl. greater. Every state except Colorado showed an increase in the value of the oil.

	1912.		1913.	
State or region.	Quantity, barrels.	Av.price per bbl.	Quantity, barrels.	Av.price per bbl.
Alaska	.....	.....	(12)	.....
California	87,272,593	$0.454	[3]97,764,525	$0.467
Colorado	206,052	0.793	188,799	0.947
Illinois	28,601,308	0.851	23,893,899	1.296
Indiana	970,009	0.918	956,095	1.337
Kansas	1,592,796	0.688	2,375,029	0.947
Kentucky	484,368	0.877	524,568	1.288
Louisiana	9,263,439	0.758	12,498,828	0.981
Michigan	([4])	.....	([5])	.....
Missouri	.....	.....	([5])	.....
New Mexico	.....	.....	([5])	.....
New York	874,128	1.604	902,211	2.404
Ohio:				
Southeastern	5,013,110	1.631	4,964,425	2.463
Lima	[3]3,955,897	0.988	3,817,043	1.391
Total Ohio	8,969,007	$1.347	8,781,468	$1.997
Oklahoma	51,427,071	0.674	63,579,384	0.937
Pennsylvania	7,837,948	1.644	7,963,282	2.487
Texas:				
Northern	5,275,529	0.779	9,184,252	0.994
Coastal	6,459,528	0.934	5,825,226	0.953
Total Texas	11,735,057	$0.754	15,009,478	$0.978
West Virginia	12,128,962	1.643	11,567,299	2.492
Wyoming	1,572,306	0.507	2,406,522	0.493
Other	.....	.....	[6]34,843	1.930
Total U. S.	222,935,044	$0.737	248,446,230	$0.954
SUMMARY.				
Appalachian	26,338,516	$1.626	25,921,785	$2.458
Lima and Indiana	4,925,906	0.932	4,773,138	1.380
Illinois	28,601,308	0.851	23,893,899	1.296
Mid-Continent	65,473,345	0.692	84,920,225	0.951
Gulf	8,545,018	0.742	8,542,494	0.936
California	87,272,593	0.454	97,764,525	0.467
Colo. and Wyo.	1,778,358	0.561	2,595,321	0.525
Other	.....	.....	[6]34,843	1.930
Total	222,935,044	$0.737	248,446,230	$0.954

[1]Included in 'Other.'
[2]Estimated.
[3]California production in 1913 subject to revision.
[4]Included in Lima, Ohio.
[5]Includes Michigan.
[6]Includes Alaska, Michigan, Missouri, and New Mexico.

The total values of the respective years was $164,213,247 and $237,121,388.

COMPANY REPORTS

COLOMBIAN MINING & EXPLORATION COMPANY, LTD.

The report of this Company, operating at Marmato, Colombia, deals with the year ended March 31, 1914. In the Colombiano mill of 40 stamps, Cien Pesos of 22 stamps, and Inferno of 10 stamps (now 20), owing to a shortage of water, only 25,494 tons of ore was treated, yielding $7 per ton in gold. A plant is being erected to treat the sand, which averages $8 per ton. The value of gold recovered was $240,000, an increase of $48,000 over 1912. Ore reserves in the different mines are estimated at 136,344 tons averaging $10.50 per ton. Good progress has been made with the new mill at La Palma. It consists of rock-crushers, 40 stamps, two Dorr classifiers, three tube-mills, two Dorr thickeners, six Paterson agitators, and 10 Dehne filter-presses. Labor and transport arrangements continued satisfactory.

ROBINSON GOLD MINING COMPANY, LTD.

During January of the current year, it was proposed to amalgamate this great Rand company with the Crown Mines, Ltd., but shareholders objected to this being done. The report for the year ended December 31, 1913, contains the following information: Owing to the gradual reduction in the number of stope faces capable of supplying large quantities of the higher-grade ore, the increased tonnage was made up from development ore from surface dumps, and Main 'reef'. This resulted in a fall in yield of $1.90 per ton milled, and a decrease in working costs of 38c., with a reduction in working profit of $390,000. A small amount of development was done on the lowest levels, disclosing good ore in each reef. The development of the mine is now practically completed. Ore reserves are as follows: Leader, 349,000 tons of $10.20 ore over a stoping width of 82 in.; South reef, 189,200 tons of $11.1 ore over 65 in.; and recoverable from old workings, etc., 469,100 tons. There is also estimated to be in the Main reef, 772,900 tons of $4.30 ore. Sand-filling of stopes was done for about nine months.

Results were as follows:

	1913.	1912.
Ore mined, tons	700,149	673,058
Ore from surface dumps, tons	26,734	.....
Sorting done, per cent	8.1	13.8
Ore milled, tons	668,900	577,300
Yield per ton	$ 8.58	$ 10.48
Total yield	5,750,000	5,900,000
Working profit	3,500,000	3,940,000
Working cost per ton	3.38	3.76
Dividends paid	2,010,000	2,970,000
Transvaal Government tax on profits	312,000	.....
Balance unappropriated	$2,490,000	.....

BROKEN HILL PROPRIETARY BLOCK 10 COMPANY, LTD.

The report of this New South Wales Company covers the half-year ended March 31, 1914. Development totaled 1112 ft. At the beginning of the term the management adopted the policy of confining all development work to the upper levels, from the 615 ft. level upward. No work was done in the lower levels, except making necessary repairs, and providing an emergency escape from the 1215-ft. level into the neighboring Proprietary mine. The main drift at 615 ft. followed the ore for about 200 ft. southwest, and it looked as if it would connect with the western orebody discovered in the Central mine. But it turned almost due east, with the result that at 311 ft. the ore passed over the boundary of the Central mine at a point within a few feet of the Block 10 old main-lode workings. Ore reserves are about 228,900 tons.

The new mill did good work in treating 48,739 tons of ore, yielding 6752 tons of lead concentrate. Metal recoveries were: Lead 74.8%, and silver 47.8%. A total of 73,809 tons of concentrate, current by-products, dump tailing, slime and middling was sold, the total revenue being $410,000, and net profit $31,000. A dividend of $144,000 was paid, and the surplus reduced from $485,000 to $440,000. Costs were as follows: Mine development, 34c.; ore extraction $3.84; milling, treatment, and transport, $1.44; and general, 24c., a total of $5.86 per ton.

ST. JOHN DEL REY MINING COMPANY, LTD.

The eighty-third annual report of this Company, operating in Brazil, covers the year ended February 28, 1914. The superintendent, George Chalmers, commented as follows on the work done: The average number of native men and women employed was 2408, and of officers and English employees there were 170. Early in 1912, labor troubles started, and the climax was reached in September and October, 1913. Efforts at recruiting labor in Brazil and other countries were not successful. While the government was prosperous, and paid good wages for work being done, men kept away from the mines; but when rubber and coffee prospects were poor, it retrenched, and men returned to the mines. A rise in wages was necessary and increased the costs considerably. Among the attempts to help the labor difficulty was the importation of 107 Japanese. They arrived on August 30, 1913. They were a sturdy lot and well disciplined, and great consideration was shown them. But only 40% of them would go underground, in spite of patience of the mine staff. In October, they started to desert, and at the end of the Company's year the 107 Japanese had gone. The experiment was therefore a failure. The mine is a fairly hot one, and this is a reason for men not liking to work underground. There were five fatal accidents in the mine, mostly due to the mens' own carelessness. The general health of Morro Velho was good. The medical officer treated a total of 24,755 patients, most of whom consulted on trivial cases. Tuberculosis is on the increase here and throughout Brazil.

The Morro Velho and Raposos tramway started operation on April 5, and handled 14,937 tons of stores, ores, and 32,725 passengers. It is showing a small profit, but is generally a great convenience. Cost of transport from Honorio Bicalho used to be $3.84, but is now reduced to $1.76 per ton.

At the mine, a total of 2588 ft. of work was done. Ore reserves are estimated as 887,400 tons, compared with 813,788 tons in the previous term, and are estimated to 122 ft. vertical below last year. No. 18 level is 5226 ft. below the surface, 4902 ft. below the adit, and 2458 ft. below sea-level on the incline. Electric locomotives in the adit worked well, and it is proposed to substitute these for mules in the lower levels. The Sirocco fan is now driven by a 300-hp. motor, increasing the volume of air delivered 22%. Another fan will be installed at the top of 'G' shaft. Stope-filling for the year amounted to 135,573 tons.

The stamp-mill crushed 174,000 tons of ore yielding 97,208 oz. gold, worth £411,508. The recovery by all processes was 93.13 per cent.

Costs were as follows: State and Federal government duties and transport, 60c.; development, 41c.; working charges in Brazil, $7.30; and London expenses, 10c., a total of $8.41 per ton. The profit was £115,349. Dividends amounting to 24c. per share, or 10%, were paid. The balance carried forward is £7196. Investments are worth £96,472.

Owing to the shortage of labor, development and sampling of the extensive iron-ore deposits was suspended. Foreign capital has secured all of the other first-class iron land for a radius of many miles from the mine, and the general tendency of these owners is 'watchful waiting.'

Brazilian exchange for the Company's drafts averaged 16,088d. (32.176c.) per milreis. Mine temperatures will be discussed in another issue of this journal.

MINERAL STATISTICS

THE FOLLOWING DATA, COVERING THE YEAR 1913, IS FROM THE UNITED STATES GEOLOGICAL SURVEY:

COAL MINING IN MISSOURI

Coal production in Missouri in 1913 was 4,318,125 short tons, valued at $7,468,308, a decrease compared with 1912 of 20,731 tons in quantity and of $165,556 in value. With the exception of 1912, however, the output in 1913 was the largest in the history of the state. The number of fatal accidents was reduced to just one-half of the fatalities of the preceding year, or from 20 to 10, according to reports to the Bureau of Mines.

COAL MINING IN INDIANA

Coal production in Indiana in 1913 was 17,165,671 short tons, valued at $19,001,881, according to Edward W. Parker. Although this was an increase of 1,879,953 short tons, or 12.3% over 1912, it fell short of the record output of 1910 by more than 1,200,000 tons and was withal far from satisfactory to the producers. Floods and a drought interfered with regular work. The average value per ton showed a decline from $1.14 in 1912 to $1.11 in 1913. The total value of the coal mined increased from $17,480,546 to $19,001,881, a gain of $1,521,335, or 8.7%, compared with the increase of 12.3% in quantity.

In spite of the adverse conditions which prevailed in 1913, labor was in better supply and the number of working days made by the employees was greater than in 1912. The total number of employees in the coal mines of Indiana increased from 21,651 in 1912 to 22,235 in 1913, and the average working time from 182 to 190 days. The average annual production per man increased from 706 to 772 tons, and the average daily production by each man from 3.88 to 4.06 tons. The increased efficiency was due in part to the larger proportion of the product being mined by the use of machines, the increase in that item contributing 66% of the total increase, or 1,270,387 tons. The production of machine-mined coal in 1913 amounted to 9,634,146 short tons, or 56% of the total, compared with 54.7% in 1912. The number of fatal accidents reported to the Bureau of Mines for 1913 was 66, compared with 40 in 1912.

METAL PRODUCTION OF THE EASTERN STATES

The following table, compiled by H. D. McCaskey, shows the output from 90 mines, of which 48 were gold-placer, 9 zinc, and 7 copper properties. Of the gold mines, 27 are in Georgia, 17 in North Carolina, and 4 in South Carolina. Nearly all the copper came from the Ducktown district of eastern Tennessee. The zinc mines at Franklin Furnace, New Jersey, produced the bulk of that metal:

State.	Ores mined. *Short tons.*	Gold. *Value.*	Silver. *Fine ounces.*	Copper. *Pounds.*	Lead. *Pounds.*	Zinc. *Pounds.*	Total value.
Alabama	4,068	$ 11,094	117	.....	.....	.....	$ 11,165
Georgia	2,614	15,108	75	.....	.....	.....	15,153
New Hampshire	400	.....	.....	.....	.....	30,000	1,680
New Jersey	490,434	.....	.....	.....	.....	168,244,000	9,421,664
North Carolina	11,274	126,448	1,812	.....	.....	20,400	128,685
Pennsylvania and Vermont	239,178	3	105	517,692	.....	.....	80,309
South Carolina	1,010	4,881	40	.....	.....	.....	4,905
Tennessee	823,645	7,595	108,105	19,390,750	1,632,000	11,166,000	3,703,752
Virginia	30,916	604	960	56,287	.....	5,438,000	386,244
Total, 1913	1,603,539	$165,733	111,214	19,964,729	1,632,000	184,898,400	$13,753,557
Total, 1912	1,361,734	$222,496	96,523	19,265,945	561,026	144,699,863	$13,470,276

PUMICE

Pumice produced in the United States in 1913 amounted to 24,563 short tons, valued at $55,408, a decrease of 2583 tons in quantity and of $31,279 in value compared with 1912. The material came from six states, namely, California, Kansas, Nebraska, Idaho, South Dakota, and Utah.

OILSTONE

The production of oilstones, including hones and whetstones, and scythe-stones in the United States in 1913 amounted to $207,352, a decrease of $24,866 compared with 1912, according to Frank J. Katz of the U. S. Geological Survey. Oilstones were produced in Arkansas, Indiana, Ohio, and Kentucky, especially in Arkansas, which has led in the production for many years. New Hampshire led in the production of scythestones, but Vermont, Ohio, and Michigan also contributed important quotas.

PORTLAND CEMENT PRODUCTION

During 1913, according to final figures collected by Ernest F. Burchard, the output was 92,097,131 bbl., an increase of 11.72% compared with 1912. Shipments by states were as follows:

State.	Shipping plants.	Quantity, barrels.	Value.	Average price per barrel.
Pennsylvania	23	28,060,495	$24,268,800	$0.865
Indiana	5	10,219,492	10,218,867	1.000
California	7	6,018,262	8,896,734	1.478
New York	8	5,136,334	4,801,607	0.935
Illinois	5	4,734,540	4,784,696	1.011
Missouri	5	4,485,820	4,556,822	1.016
New Jersey	3	4,255,015	3,638,755	0.855
Michigan	11	4,081,281	4,228,879	1.036
Iowa	3	3,455,800	3,972,876	1.150
Kansas	10	3,291,818	3,286,861	0.998
Texas	4	2,108,737	2,663,063	1.263
Washington	5	2,023,172	2,853,260	1.410
Ohio	5	1,631,055	1,721,423	1.055
Utah	3	950,469	1,233,421	1.298
Other states*	16	8,237,087	7,980,911	0.969
Total	113	88,689,377	$89,106,975	$1.005

*Alabama, Arizona, Colorado, Georgia, Kentucky, Maryland, Montana, Oklahoma, Tennessee, Virginia, and West Virginia.

In 1912 there were 117 shipping plants, moving 85,012,556 bbl. valued at $69,109,800, an average of 81.3c. per barrel. In 13 states, in the above table, there was an increase in the price of the product.

Total recovery of useful fuel from waste heaps and culm banks, at coal mines in the United States, has amounted to 49,329,376 tons since 1890.

BOOK REVIEWS

METALLURGY OF COPPER. By H. O. Hofman. McGraw-Hill Book Company, New York. P. 556. Index. For sale by the *Mining and Scientific Press*, San Francisco. Price $5.

The aim in the preparation of this book as stated by the author has been to meet the demands of the copper metallurgist of today and toward this end Mr. Hofman has succeeded in compiling a vast amount of information on the subject. The work presents the leading physical and chemical facts about copper, its alloys, and compounds which are of metallurgical importance; details of the older smelter practice which are of value together with the modern methods and recent developments in copper metallurgy with examples taken from the modern American plants are presented in detail. The work opens with a discussion of the properties of copper, its grades, impurities and their effects. The industrial alloys are discussed with eutectic curves, and the compounds and ores of copper are briefly treated. The author devotes 340 pages to the smelting of copper in which space the numerous phases of the subject are dealt with, special attention being given to the dynamics of copper smelting. The pages are replete with detailed drawings of smelter equipment.

The leaching of low-grade and finely desseminated copper ores, which has of recent years come to be such an important branch of copper metallurgy, forms an important part of the work. A general discussion of the chemistry of the subject is followed by descriptions of the various leaching processes with apparatus for use in this branch of metallurgy. The electrolysis of ore, matte, speise, and metallic copper in general is discussed. The current, cells, and equipment for the electrolytic refining of copper form the subject of this department of the book. The bibliography presented is an important asset as the numerous references which are given as foot-notes cover the literature on the subject and are valuable as reference for one caring to go into further refinements of the subject. The work is a valuable addition to the literature on copper metallurgy and is of particular interest as a text or reference work.

CHEMICAL GERMAN. By Francis C. Phillips. The Chemical Publishing Co., Easton, Pennsylvania. P. 241. Notes, vocabulary. For sale by the *Mining and Scientific Press*, San Francisco, California. Price $2.

Practically every engineer who, by necessity or inclination, has occasion to make a careful survey of the literature on any subject finds it necessary to read papers appearing in German and French, since one or the other of those two languages is used not only by their respective nations, but also by scientific workers in almost every other European country. In the case of French, this involves little difficulty, since technical French is lucid and anyone who can read, even with some difficulty, an ordinary French novel, finds less labor required to comprehend a scientific paper. German, on the other hand, presents the reverse characteristics, and an engineer who successfully passed the examination in German for entrance to his technical school and for whom the American *rathskeller* or travel in Germany has no terrors, not infrequently gives up in despair when confronted with the necessity of reading an article written in technical German. Many of the words used in such an article are not to be found in any ordinary dictionary, or if they appear their technical meanings do not. The German method of naming compounds is also puzzling: thus *Zweifachschwefeleisen* (FeS_2) and *Zyanwasserstoffsaüre* (hydrocyanic acid) are not at once recognizable. Superimposed on these difficulties is the controversy raging in Germany between the advocates of simplified spelling and those who adhere to the old style, so that between the *teknik* and the *technik* and the *nitrogen* and *stickstoff* the student is apt to become hopelessly entangled. Mr. Phillips, who is professor of chemistry in the University of Pittsburgh, has come to the aid of the chemical student and by giving him the rules which govern chemical German an excellent vocabulary of chemical terms as well as ordinary words used in chemical sense, and a series of graded extracts from chemical literature, enables him to find his way through chemical literature and to equip himself to proceed unaided. A similar guide to geological and metallurgical German is greatly to be desired, but pending its appearance American students will be greatly aided by this volume, for which Mr. Phillips deserves and will doubtless receive the thanks of every plodding research student.

MINING DECISIONS

OIL LEASE—RIGHT OF ACTION

Where an oil lease by its terms leased the land therein described and not merely the right to extract oil therefrom, the lessee could maintain an action thereon prior to the discovery of oil.

Kline *v.* Guaranty Oil Co. (California), 140 Pacific, 1. March 25, 1914.

CORPORATION LIABLE FOR VIOLATION OF STATUTE

Those in charge of a mine for a corporation must see that the statute against mining within five feet of a division line is observed, otherwise the corporation is itself liable for the penalty. The neglect, mistake, or disobedience of its servants in this particular will not excuse it.

Gawthrop *v.* Fairmont Coal Co. (West Virginia), 81 Southeastern, 560. April 7, 1914.

COAL LEASE—IMPLIED COVENANTS

A lease of "all coal and mineral rights and privileges whatsoever, contained on, in and beneath the surface", of certain described land, for a period of ninety-nine years upon a consideration of royalties, but with no covenants for diligent working by the lessee, was held to be a lease upon an implied covenant for reasonable diligence on the part of the lessee, vesting no estate in the coal until actually mined. A lapse of twenty-five years before commencing operations was held to warrant a forfeiture.

Chandler *v.* French (West Virginia), 81 Southeastern, 825. May 21, 1914.

ASSIGNMENT OF OIL LEASE—HELD VALID

An oil lease was granted upon condition that a well should be commenced within a year, or in lieu thereof $160 paid to the lessor. A year elapsed without compliance by the lessee with either of these conditions. A new lease was then made by the lessor to third parties, who assigned it to the defendant for a consideration. Before all the consideration was paid, the original lessee paid $160 to the lessor. The assignee thereupon refused to pay the balance of the consideration for the assignment of the new lease, alleging that the old lease had been continued in force by the acceptance of the delayed payment and that there was a breach of implied warranty. Held, that the assignor of the new lease was entitled to recover the balance of his consideration, as the $160 had not been paid within the year and could not validate the old lease after the new one became effective.

Eastern Oil Co. *v.* Holcomb (Oklahoma), 212 Federal, 126. February 23, 1914.

New Machines and Devices

The Use of Link-Belts

The detachable link-belt was invented by William D. Ewart in 1873, and since that time the original link-belt has been manufactured at the Ewart and Belmont works of the Link-Belt Company at Indianapolis. Link-belts are adapted to such a wide variety of uses and their construction is so well understood that the engineer and millman, who has occasion to use them, thinks little as to their technology and correct application. The two qualities most desired in chain drives are, of course, immunity from break-downs and durability, both of which can be secured by using the proper belt for the working load. The magnitude of this load depends upon the speed of the chain and the character of the work which the chain is to perform.

In transmitting power the engagement of each chain link with the tooth of the sprocket wheel is attended by a certain degree of shock, and as this is multipled and intensified as the speed is increased, the working load of the chain should be reduced in a compensating ratio.

As the result of numerous and carefully conducted series of tests, the Link-Belt Co. recommends that the working load of the chain be determined as follows:

For a speed of 200 ft. per minute and under, divide average ultimate strength by 6.

For a speed of 300 ft. per minute and under, divide average ultimate strength by 8.

For a speed of 400 ft. per minute and under, divide average ultimate strength by 10.

For a speed of 500 ft. per minute and under, divide average ultimate strength by 12.

For a speed of 600 ft. per minute and under, divide average ultimate strength by 16.

For a speed of 700 ft. per minute and under, divide average ultimate strength by 20.

If the load to be transmitted is irregular or subject to shock, or if the chain is used in an elevator or conveyor handling gritty or coarse material, a still further reduction of the working load must be made. The ultimate strength of the chains is obtained from the manufacturers' catalogs. The horse-power transmitted may be ascertained by multiplying the number of feet the chain travels per minute by the working load and dividing the result by 33,000.

Manganese steel has been adapted for link-belts where special toughness and hardness is required. By special processes, mixtures, and heat treatments, it has become possible to manufacture smooth and uniform chain links of the various types used for severe work. The characteristics of the manganese steel used for link belts are its extreme toughness, it not being brittle, but so ductile and malleable that when overstrained it will stretch and twist out of shape instead of giving way suddenly.

In the operation of link-belts it is essential that the sprocket wheels are carefully fitted to the chain. It is true that chains will frequently 'run' on sprocket wheels which do not fit them, but to insure durability and maximum service of both chain and wheel, they must fit. A sprocket wheel with hardened face that does not fit the chain may have a long life, but at the expense of the chain. It is necessary, therefore, that when sprocket wheels are purchased it be insisted upon that they fit a chain of standard pitch. Smooth hard bearing surfaces for contact with the links and a careful fit insure the chain against undue wear.

A recent publication of the Link-Belt Co., represented on the Pacific Coast by the Ely Machinery Co. of San Francisco, entitled 'Advance Section A' of general catalog No. 110, describes in detail the numerous chain belts and sprocket wheels manufactured by this Company.

New Deister Products

The Deister Machine Co., of Fort Wayne, Indiana, during the past year has placed a number of new machines on the market, for which there is claimed marked advantages over the older products. Among these it is claimed that the simplex double-deck slime concentrator will handle twice, and the simplex double-deck sand concentrator four times, the tonnage handled by the respective older type single deck tables. The capacity of the six-deck tilting slimer is said to be four times that of the old type single-deck slimers. The Company states that the multiple-deck machines are no longer an experiment, but on the contrary have proved a great success. They have been in continual operation in one of the most up-to-date mills in the country for over a year, and are so rigidly tied together and mounted that they have given no trouble mechanically. In connection with these machines, a blueprint is furnished for a stationary pulp distributor which provides for an even distribution of feed to the decks. The Deister Machine Co.'s 'Ideal' headmotion is interchangeable and is used on all the latest sand and slime tables manufactured by this Company. Every millman knows that the headmotion is the important factor in the operation of a concentrator. Simplicity, durability, and efficiency of the 'Ideal' headmotion, it is claimed, has been demonstrated in nearly a year's constant operation. During this time, it required no attention other than the regular oiling. The principal wearing parts are made of case-hardened steel and run submerged in oil. It can be adjusted, while in operation, by an adjustable eccentric pin in the rear of the motion. This adjustment is independent of the means for adjusting the stroke. The Company also equips decks of other types of concentrating tables with the patented plateau and riffling system, and thereby proposes to increase the capacity of these tables without decreasing their efficiency.

Commercial Paragraphs

The June number of 'Leschen's Hercules,' the monthly publication of A. Leschen & Sons Rope Co., contains an interesting description of the application of flattened strand rope to coal mining operations in Utah.

The Western Electric Co., of New York City, has for distribution a most interesting publication entitled 'The Making of the Voice Highways.' The publication presents a pictorial review of the history of communication and modern wire and cable making. The subject-matter is attractively presented and of an educational nature.

An enormous conveyor belt was recently made in Australia by the Dunlop Rubber Co. for the Broken Hill Proprietary company. It is 4875 ft. long in seven sections, 36 in. wide, ¾ in. thick, 6 ply in the centre, 9 ply at the edges, weighs 30.5 tons, and is to run at 250 ft. per minute. It will be used in loading ironstone from the Company's deposits in South Australia into vessels for conveyance to Newcastle, New South Wales, where a large iron and steel plant is being erected.

In November 1909, the House of Lords, England, delivered a unanimous judgment in favor of the Minerals Separation, Ltd., in an action brought by the Elmore Process. A similar judgment was given July 24, 1911, by the New South Wales Court in an action brought by the same plaintiff. The Elmores appealed from the decision of the Australian court in this action and in March 1914 the Privy Council of the House of Lords decided this appeal overwhelmingly in favor of Mineral Separation patents.

In July 1913, in the United States District Court for Montana, The Minerals Separation original process patent was completely upheld.

The recent decision of the Court of Appeal for the Ninth Circuit, reversing the decision of the Montana Court, we regard as a temporary setback only, as it will not be accepted by us as final.

Minerals Separation, Limited, own nearly thirty patents for the United States, alone, covering flotation processes and apparatus, all of which are controlled by the Syndicate. There are also a considerable number of applications pending. These patents and applications cover practically everything of value in the art, and include those of fundamental importance.

The Minerals Separation Flotation Process

Is a General Method of Separating Sulphide Minerals from Gangue

The application of this method is being extended constantly to cover separations hitherto considered impracticable. The newer modifications being developed and used have greatly reduced the costs of operation and at the same time have increased recoveries and grade of concentrate.

No Mine Owner or Mine Manager Can Afford to Ignore the Developments Which Have Been Made in This Method of Ore Treatment

At the very least they should state their problems to the Minerals Separation Company and get advice as to whether or not the flotation process offers any possibilities in the treatment of their ore.

The Flotation Process

As Invented, Perfected and Owned by

MINERALS SEPARATION, LTD.

has been successful practically everywhere installed, and millions of tons of ore are now being annually treated thereby.

This is the Only Concentration Process Which has No Slime Limit

Mine owners, metallurgists and others interested in preventing mineral losses and reducing the cost of treatment are invited to send their inquiries

—— TO ——

Minerals Separation American Syndicate (1913), Ltd.

Sole Agents: Messrs. Beer, Sondheimer & Co., 61 Broadway, New York.
Chief Engineer: E. H. Nutter, Merchants Exchange Bldg., San Francisco.

NOTICE is hereby given that no one except our Chief Engineer and the agents named above is authorized to act for or represent Minerals Separation, Ltd., or to introduce their process or apparatus into the United States, Canada and Mexico. A testing laboratory is maintained in San Francisco for the purpose of testing ores by flotation, and samples sent to our Chief Engineer there will be tested at minimum expense to prospective licensees. No tests made by unauthorized persons can be depended upon in determining the amenability of an ore to Minerals Separation Process.

PROFESSIONAL DIRECTORY

ENGINEERS, METALLURGISTS AND GEOLOGISTS

Arranged geographically. For addresses see cards on following pages.

RATES: One-half inch, $25 per year (48 cents per week). Combination rate with THE MINING MAGAZINE of London, one-half inch in each, $40 per year (77 cents per week). Subscription included.

ENGINEERS IN THE UNITED STATES

ALABAMA.
Dodge, W. R

ARIZONA.
Blauvelt, Harrington.
Burch, H. Kenyon.
Collins, Edgar A.
DeKalb, Courtenay.
Eye, Clyde M.
Smith & Ziesmer.
Ten Oever, Uneko.

CALIFORNIA.
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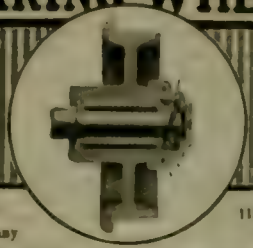

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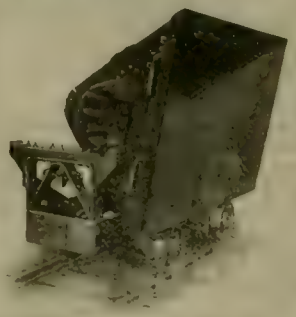

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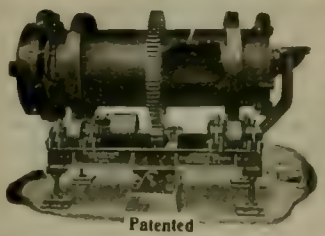

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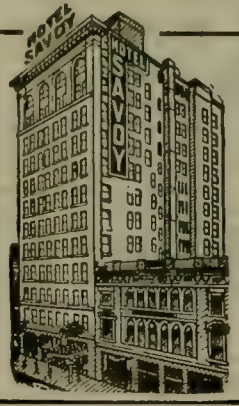

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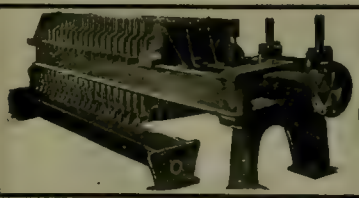

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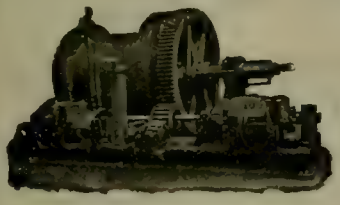

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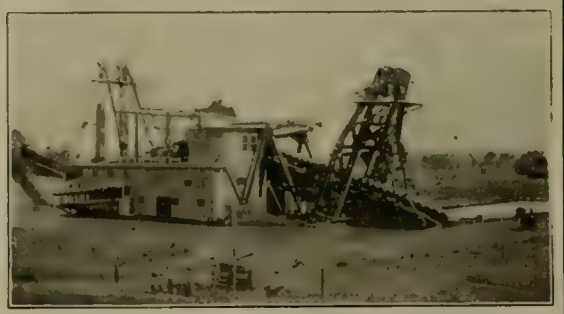

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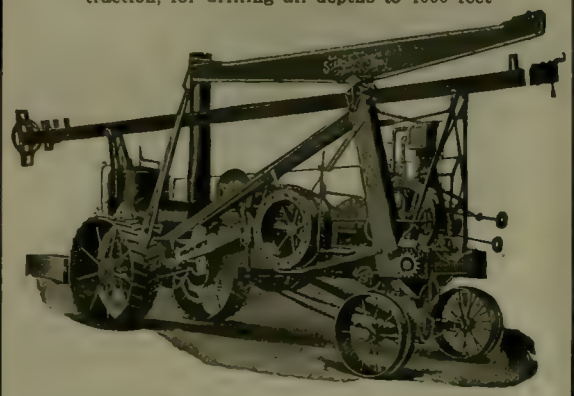

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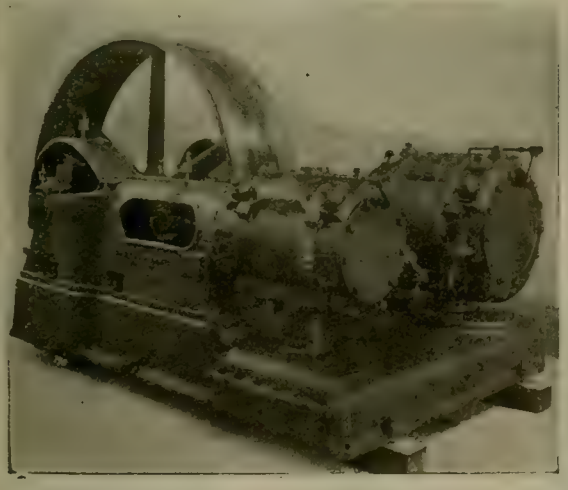

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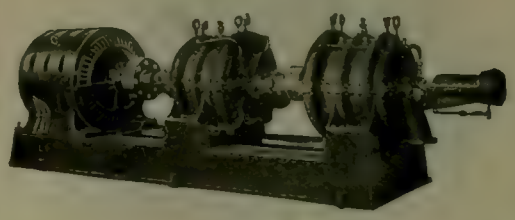

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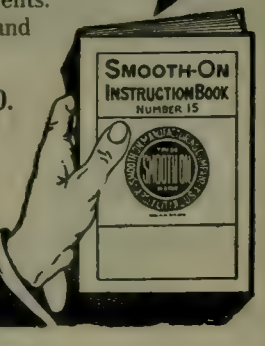

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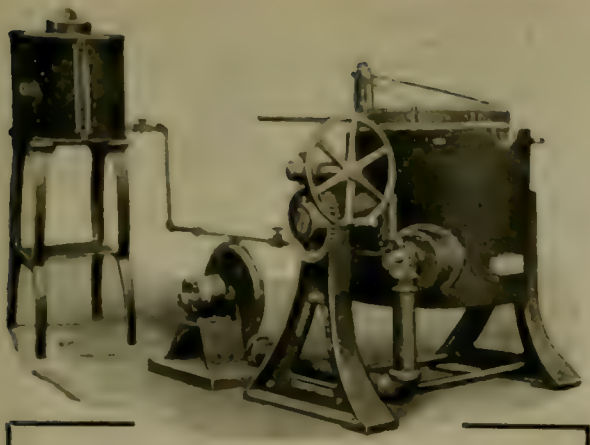

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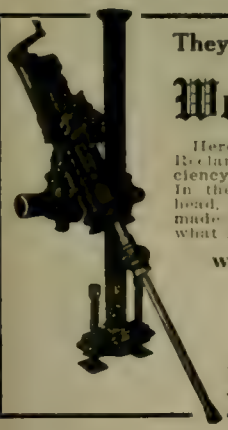

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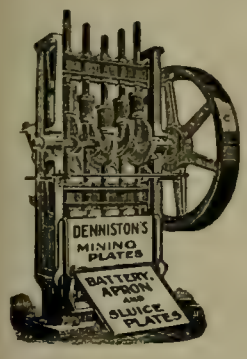

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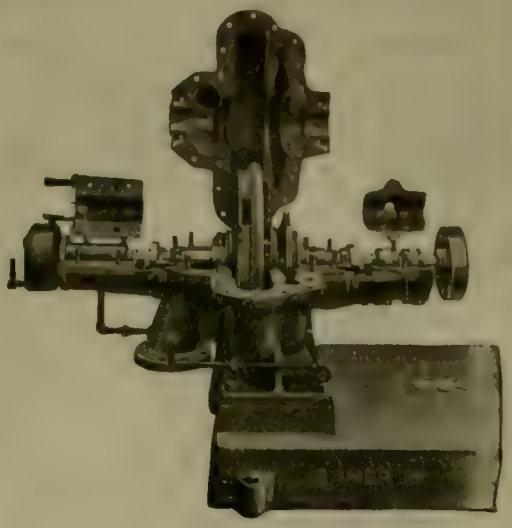

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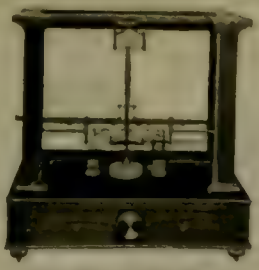

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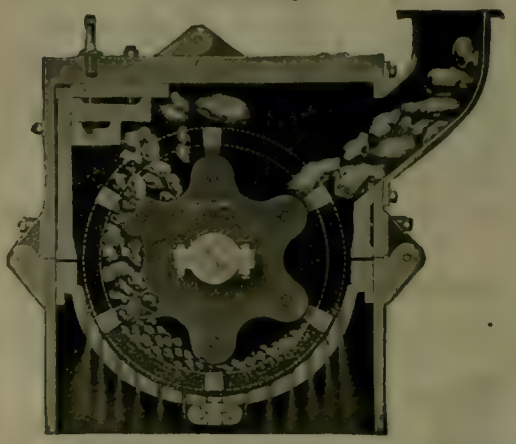

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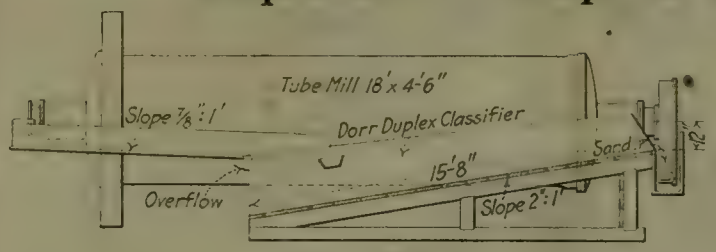

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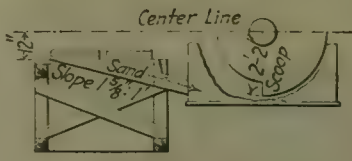

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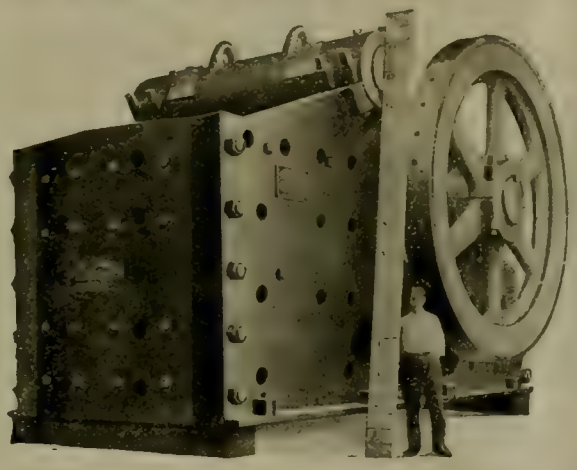

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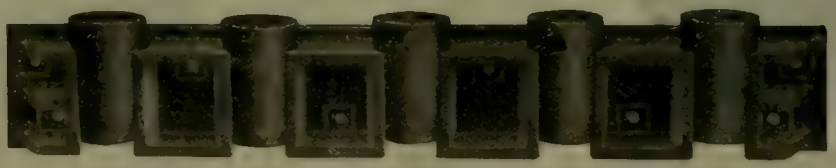

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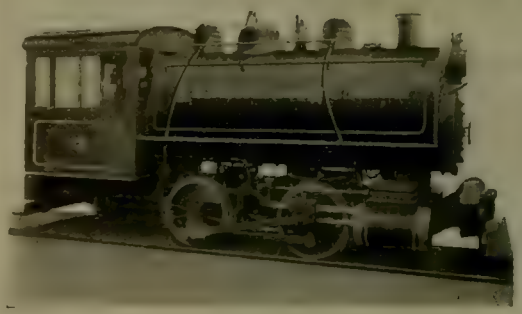

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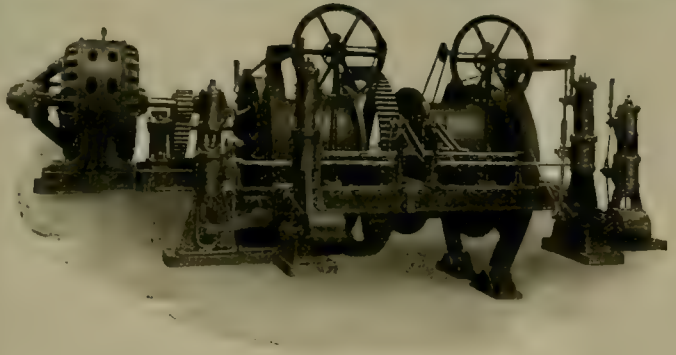

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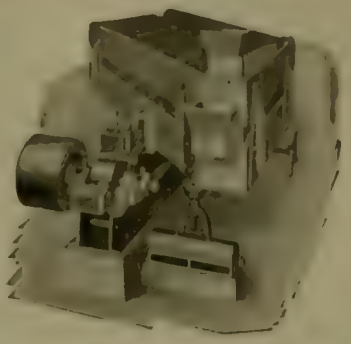

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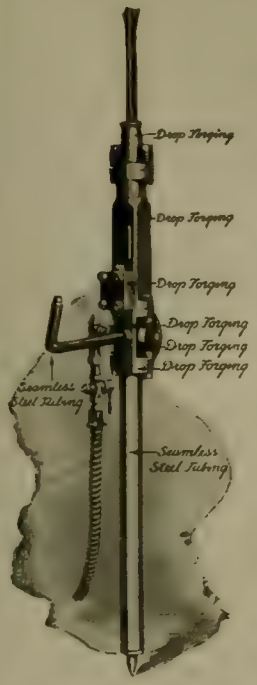

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AN IMPORTANT SERIES

We have the pleasure of announcing a most important series of articles upon present-day practice in zinc smelting, prepared by Mr. E. H. Leslie, assistant editor of the *Mining and Scientific Press*. The first of the articles is printed this week. The whole series will include:

ZINC SMELTING AT BARTLESVILLE, OKLAHOMA.

NATIONAL ZINC COMPANY, BARTLESVILLE.

COLLINSVILLE SMELTER OF THE BARTLESVILLE COMPANY.

ZINC SMELTING AT HILLSBORO, ILLINOIS.

ROSE LAKE SMELTER OF THE GRANBY COMPANY.

MINERAL POINT SMELTER AT DEPUE, ILLINOIS.

These articles are based upon first-hand information collected in the course of personal visits to the plants described and have been prepared with the active coöperation of the companies mentioned. They show how experience in the gas-fields has led to redesigning of furnaces in the coalfields; how introduction of flotation has modified furnace work; and how in a multitude of other particulars metallurgists have been improving zinc smelting till it no longer deserves the reputation for being a backward art.

Zinc ranks fourth in value among the metals produced in the United States, being exceeded by iron, copper, and gold, and in turn exceeding lead, silver, and the minor metals. The spelter production for 1913, according to the U. S. Geological Survey, amounted to 337,252 tons. There are now 31 zinc smelters operating, and two building. The plants visited by Mr. Leslie are among the largest and most interesting in the Middle West. Several of them are here described for the first time, and at each plant there are many things to interest anyone connected with the zinc industry or with metallurgy in general.

Readers may wish to refer to a previous paper by Mr. Leslie on 'Mining and Milling at the American Zinc Property, Joplin,' May 23, and the one on 'Industrial Hygiene as Practised at Palmerton, Pennsylvania,' by Dr. John W. Luther, chief medical officer of the New Jersey Zinc Co., May 16. Monthly summaries of Joplin and Wisconsin development are also printed with weekly tabulations of metal prices.

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EDITORIAL

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THE Circuit Court of Appeals at San Francisco reaffirmed its decision in the case of Minerals Separation, Ltd., *versus* James M. Hyde, on July 6. Minerals Separation now has sixty days within which to move in the matter of getting the case before the United States Supreme Court.

REVIVAL of old mining properties by modern methods is a subject which is engaging increased attention by mine operators. The Secretary of State reports the revival of 43 companies in California during the first six months of the year, with a total capitalization of $22,978,500. In the current issue we record the recent revival of mining at Aurora, Nevada, and detail the milling practice. Old mines, like old tailing dumps, are often worthy of investigation and many of the mines of the future will doubtless be mines of the past.

JOHNSON once said that a man ought to read as inclination leads him, for what he reads as a task will do him little good. Granting the wisdom of the remark, the inclination can yet be guided so that at the end of each year a man shall feel himself possessed of wider knowledge of every subject than he had at its beginning. There is no easier way to acquire true culture than by thoughtful reading of the best books on a wide range of topics. Engineers often rank high as golf players, stamp collectors, or the like; they might even better rank as distinguished amateurs in political economy, public finance, sanitation, public hygiene, or some other useful subject, just as Dr. James Douglas is a well known authority on the early history of New England, and Mr. H. C. Hoover the leading authority on the early history of mining.

RADIUM INVESTIGATIONS by the United States Bureau of Mines at Denver, noted in an editorial of May 30, have recently resulted in the application for patent, by Mr. Richard B. Moore, for a process for the extraction of refined radium salts. The process is reported to be in successful operation at the South Denver plant of the Bureau and will be given to the public for free use. It is stated that this government plant will be able to supply American hospitals with radium salts in the near future. While out of 972 cases treated by the Radium Institute of London in 1913 only 56 were apparently cured and 183 improved, physicians are still hopeful, and a more thorough study of the element, it is hoped, will redound to the good of humanity.

FOURTH OF JULY at Ely was celebrated by mine-rescue and first-aid contests, which were held under the auspices of the University of Nevada. The interest and enthusiasm aroused by these contests is reported as having equalled that formerly displayed in drilling contests and foot races. The 'safety first' movement, which was inaugurated in Nevada sometime ago and resulted in the organization of a state association for its advancement, is producing results and it is gratifying to note the hearty support which the mine operators are giving this movement.

WORKMEN'S COMPENSATION INSURANCE IN CALIFORNIA

As we noted last week the 'Mine Owners' Casualty Indemnity Exchange' has been formed to afford to mine operators a means of insuring themselves against terms of the 'California Workmen's Insurance and Safety Act.' We have frequently discussed this Act and the unequal manner in which it bears down upon mine operators. While there is little disposition among the latter, even in the face of what they justly feel to be unfair burdens, to question the soundness of the general principle that each industry should carry its own burdens, there is a widespread feeling that in mining, no way has been yet provided to distribute those burdens equitably.

We have had frequent conferences with the Industrial Accident Commission and can assure the mine operators that the Commission shows every disposition to afford them such relief as lies in its power. As we pointed out January 17, the funds placed at the disposal of the Commission by the legislature are inadequate to permit it to carry unlimited liability on mines, and any other insurance is unsatisfactory. It was at first hoped that it would be possible, with the friendly services of the Commission, to establish a separate fund for mine insurance on a mutual basis; the Commission doing the work involved at cost. Legal advice was, however, to the effect that any such fund, if under control of the Commission, could not be maintained in the face of any shortage in the general fund due to a catastrophe in another industry. In the end, the state must make pro-

vision permitting the Commission to offer insurance to the small operators, or the development of new mines will be greatly restricted or cease altogether. The larger operators can, and should, combine in a mutual company and carry their own risk at the same time that they establish their own inspection service, so as to permit a risk-rating system to be evolved. In the absence of any such general association, and the fact that the law itself cannot be amended until the legislature meets, indemnity exchanges seem to offer the only possible means for reducing the premiums. That the cost at present is too high is evident from a number of circumstances.

The cost now varies with the nature of the work. We have collected figures covering $5,112,870, estimated pay-rolls for 1914. The average rate paid is a trifle over 6 per cent. The greater number of mining companies are carrying their own risk. Of 71 mines reporting, 29 are insured, 27 not insured, and 15 failed to state. Of mills and smelters the figures are: reporting, 35; insured, 20; not insured, 14; not stating, 1. At the mines the total pay-roll insured amounted to $782,276; and the non-insured or not stated, $2,111,505. The average pay-roll at 58 mines amounts to $49,893. At the mills the insured pay-roll amounts to $272,034; the non-insured or not stated, $747,520. The average mill pay-roll is $29,987. By branches of mining the figures are:

	Pay-roll.	Rate.	Insurance.
Mining in general	$2,596,118	$7.86	$204,055
Hydraulic and dredging	1,382,626	5.25	73,588
Mills and smelters	1,134,126	3.15	35,725
	$5,112,870	$6.17	$313,368

It is impossible to say exactly what the real cost of the insurance is. While we have returns from a large number of companies based upon their accident rate in the past, it must be admitted that these records have not always been well kept and that past conditions no longer obtain. One notably liberal and well managed company operating two mines and with a total pay-roll of about a half million dollars, found the total cost of compensation, medical, and hospital service at one of its mines to be $2\frac{3}{4}$ per cent in 1912, 2.65 per cent in 1913, and at the other mine 1 per cent. Its officers estimate that under the new law the cost will be approximately the same. Another mine with a pay-roll of $158,179 found the cost under the Roseberry act in 1913 to be $6190, and estimates that under the new law the cost will be $2\frac{1}{4}$ times as much. Other figures might be quoted, but their variation causes hesitation in accepting them as a guide, though it is to be noted that none of them even approximate the rates asked by the insurance companies. Perhaps a better basis for figuring is an estimate made by an experienced insurance man, based upon operations in California and covering $17,000,000 in pay-rolls. Applying to the accident record covered by this pay-roll the terms of the present law, the cost of compensation was estimated at $285,000. We have had no opportunity to check these figures, but so far as data are available to us they tally. It will be noted that less than one-third of this pay-roll would produce more than the total sum in premiums, at the rates actually being charged.

Another reason for believing that California mine operators are being overcharged, is the experience that many of them are having as mine owners in Nevada. We gave the figures for the first 10 months operation of the Nevada law, in our issue of June 27. It is unnecessary to repeat, but with a base rate of 2.2 and a maximum of 3 per cent, the insurance fund is meeting all claims and building a surplus; and in Nevada the bulk of the business is with the mines. It is true that the terms of the law are not identical with that in California, and it is possible, as urged by insurance men, that adequate provision is not being made for the catastrophe risk. Time will tell as to this, but in California, so far as the workmen are concerned there is some question whether the cost of a catastrophe would be met by some of the insurance carriers. California laws give to the Insurance Commissioner limited powers, and the Industrial Accident Commission has taken the ground that as one branch of the government of the state it should not question the action of a coördinate branch in permitting an insurance company to do business within the state. Whether the insurance be good or bad, the operator is protected; though possibility of an attack upon the constitutionality of the law lies in the power under these conditions to do away with the workmen's fundamental right to compensation for injury, without his consent. That again is a problem for the future. It is only important at the moment in connection with the fact that the new form of insurance, represented by the indemnity exchange, is now available to California operators.

Under the plan of the exchange the insurance is carried mutually by the companies or individuals forming it. The rates paid in are the same as those of the regular companies and in addition notes, securities, or cash equal to an extra premium or a defined part of such a premium, are deposited with the exchange, to meet a contingent risk. From the sums so accumulated a percentage, in the case of the concern mentioned amounting to 20, is taken to cover the cost of conducting the business. Next the losses are paid, and the necessary reserve set aside to cover future payments on these losses. The remaining funds are periodically distributed in the form of dividends. The total liability of any person or company in such an exchange is limited to the amount of two annual premiums. The final cost of the insurance is his due portion of the actual loss met by all members of the exchange, and the sum mentioned as paid for general expense. If he insures with a regular company he pays one premium and gets no refund. If he joins the exchange he risks two premiums and gets insurance at cost plus 20 per cent. Since regular companies pay that rate, at times more, to agents who solicit the business, the member of an exchange gets his insurance for cost and makes the solicitor do the work.

As is true of all institutions there are drawbacks. In the first place there has been no specific decision in California to the effect that such exchanges constitute insurance carriers so as to relieve their members of all further liability. In a few states it has been held that there is still a contingent liability, but, as always, it is needful to be careful in drawing conclusions, since the various state laws differ, as well as do the courts. In California there is an especially strong presumption in favor of the exchanges since their organization is specifically provided for by law. There is the further fact, already noted, that the Industrial Accident Commission is not disposed to go behind the fact that a company or an exchange has been authorized to do business by the insurance department of the state. As a matter of fact such exchanges are now in operation in a number of industries.

The second danger is that members of an exchange must work through a person or persons who are constituted 'attorneys in fact,' under terms of the insurance contract. These men handle the funds and conduct the business. In the case of the 'Mine Owners' Casualty Indemnity Exchange,' they are young but experienced insurance men who are in the business, properly enough, for profit. Provision is made for an advisory board of three members of the exchange which has large supervisory powers. Presumably they will be mine operators, and if the results of the exchange prove unsatisfactory they will be to blame, since the three will have a clear majority on the board. A further safeguard is the right of cancellation which is reserved to each exchange member.

Mine operators having shown no disposition to organize a mutual company to care for themselves, experienced insurance men offer to form such a company, operate it on a limited ratio of cost, and permit its members to have a majority upon what will constitute for most purposes a board of directors. This warrants investigation.

BUSINESS AND POLITICS

In a sane and conservative exposition of the relation of business to politics, Mr. F. A. Vanderlip, president of the National City Bank of New York City, in a recent address before the New York Bankers' Association, presented a statement of facts and conditions bearing on the present so-called psychological depression which sums up the present condition of business in the United States in an admirable manner. His appeal to the bankers and business men to get in closer touch with the economic and political tendencies of the day and to direct their energies more to guiding and informing rather than obstructing is most laudable.

There was a time when the outlook for business was gauged by production statistics, distribution of products and manufactures, by the state of the money market, by records of the accumulated stocks, and by the condition of credits. With such statistical data of business in hand and correlated, it was not impossible to make a fairly accurate prediction of what the future had in store for a twelvemonth. The statistics of business were a measure of the business outlook. It is almost startling to note how far from true that is today, and how important has become the adventitious factor of legislation and legislative tendencies. It is no longer possible to measure the outlook in the terms with which business men are made familiar through their daily routine. The *Congressional Record* is crowding out of its place of importance *The Financial Chronicle*, and the public is watching and waiting for executive and congressional action rather than the comptroller's abstract to measure the status of industry. Mr. Vanderlip cites as an example of this feeling on the part of the public, the fact that the attitude of mind of the Interstate Commerce Commission has become more important than the statistics of railroad traffic; the amount of our foreign trade is studied to learn the effect of changed tariff law rather than of trade tendencies. Reports of the attitude of mind of the Attorney General vie in interest with the crop predictions of the Secretary of Agriculture; investigations by bureaus, commissions, or Congress form a more important feature in gauging a market outlook than do the plans for development or expansion formulated by the executive committees of corporations.

The factors which appear uppermost in the minds of the business interests of the nation are what is going to be the effect of new legislation, what new laws are to be enacted; not what is the prospect of crops but of congressional action. It, therefore, seems reasonable that so long as the public looks with fear and trembling to the action of commissions and governing bodies, rather than to natural conditions, the present inertia will continue. Mr. Vanderlip states a belief that if business men will get themselves into a state of mind where they view conditions broadly, with a historical and social sense rather than only from their individual point of view, they will apprehend better the direction in which the whole current of political thought is flowing and will feel less impatience with the legislative movement and vastly less pessimism concerning its results.

As a result of Mr. Vanderlip's plea, a publicity committee has been appointed whose purpose will be to enlighten and direct public sentiment rather than contend with it. No good can be attained by quietly sitting by and railing at Washington. With a 900,000,000-bushel wheat crop and a statistical position of industry which should warrant a prediction for prosperity and immediate expansion, there appears to be a psychological phase to the present depression. While this condition may be intangible, it is nevertheless real; a restoration of confidence in what the future has in store and a realization that industry is not being plotted against by the executive and legislative heads of our government, while it may not be a solution of the difficulty, would undoubtedly strengthen the business position and remove some of the obstacles from the channels of progress.

GENERAL VIEW OF THE BARTLESVILLE SMELTERS, SHOWING THE NATIONAL

Zinc Smelting at Bartlesville, Oklahoma

By E. H. LESLIE

The Oklahoma gasfields mark the apparent last stand of the natural-gas zinc smelter, and while the days of such plants are by no means numbered, unless unexpected discoveries are made in this or other localities, the time is not indefinitely far off when the zinc smelting interests must abandon the present natural-gas belt and seek sites convenient to permanent fuel supplies and reasonable freight rates. At the present time the coal districts of Illinois are most favored, as they have been since the beginning of the industry in this country, but the latest zinc smelters are being erected farther east, in Ohio and western Pennsylvania.

Fuel is, of course, the keystone upon which depends the life of the smelter. At present there is no shortage of gas at Bartlesville and there are three smelters in operation; the Bartlesville Zinc Co. and the Lanyon-Starr Smelting Co., both subsidiaries of the American Metals Co., and the National Zinc Co., which is controlled by Beer, Sondheimer & Co. and E. O. Jacobsen. The future gas supply is uncertain and as a result the plants have not that stamp of permanency which characterizes the new producer smelters of the Illinois coal districts. Improvements and upkeep expenditures are kept low, since no one knows upon what day there will be no more gas and Bartlesville will follow in the footsteps of Iola. In an effort to prolong the life of the smelters, the Smelter Gas Co., a subsidiary of the American Metals Co., has been organized and, having leased large tracts of land in the vicinity of Bartlesville, is exploring this ground vigorously for new gas deposits, with some success. The gas consumption of the three smelters when in full operation amounts to 23,000,000 cu. ft. per day. The Bartlesville Zinc Co. uses 9,000,000 cu. ft., the Lanyon-Starr Smelting Co. 6,500,000 cu. ft., and the National Zinc Co. 7,500,000 cu. ft. per day. While it is impossible to say how long this consumption can be met, there is reason to believe that the end is not yet in sight and a long period of activity is anticipated.

The Bartlesville smelters are situated about one and a half miles southwest of Bartlesville. The smelter sites lie on the north side of the right-of-way of the Missouri, Kansas & Texas railway lines, from which private sidings have been laid for the unloading of ore-cars and supplies and shipment of spelter. The town of Bartlesville is 75 miles from Joplin, the centre of the zinc mining industry of the Middle West and from which the smelters in the past have received the bulk of the concentrates treated. The topography of the smelter sites is generally level, with some depressions which have been filled with retort residue and others which at the present time are being used for dumping ground and will afford dumping space for years to come.

Bartlesville No. 2 Plant

The ground plan of the Bartlesville Zinc Co.'s smelter, which is shown in the accompanying drawing, shows the arrangement of the buildings. The compactness of the plant and favorable spacing of buildings and furnaces for short hauls, with little or no available space wasted, is apparent. The general view of the plant, opposite, shows the character of the buildings and furnishes an idea as to the magnitude of the works. In addition to the standard-gage railway turn-outs, the plant has adequate narrow-gage industrial track for the handling of charges, pottery, residue, spelter, and smelter supplies.

In the past the smelter was operated largely on Joplin concentrates, but at the present time the bulk of supply is a flotation product from Butte, with some Joplin, Colorado, Needles, and Mexican ore. The concentrates are received at the plant in ordinary freight cars and unloaded by hand into the receiving bins in the ore-house at the northwest corner of the property. The ore-house is divided into compartments for the storage of various grades and kinds of concentrates. The bins are flat-bottomed with wooden partitions and are underlaid with steam coils which are used for reducing the moisture in

ZINC COMPANY, LANYON STARR, AND BARTLESVILLE No. 2 PLANTS.

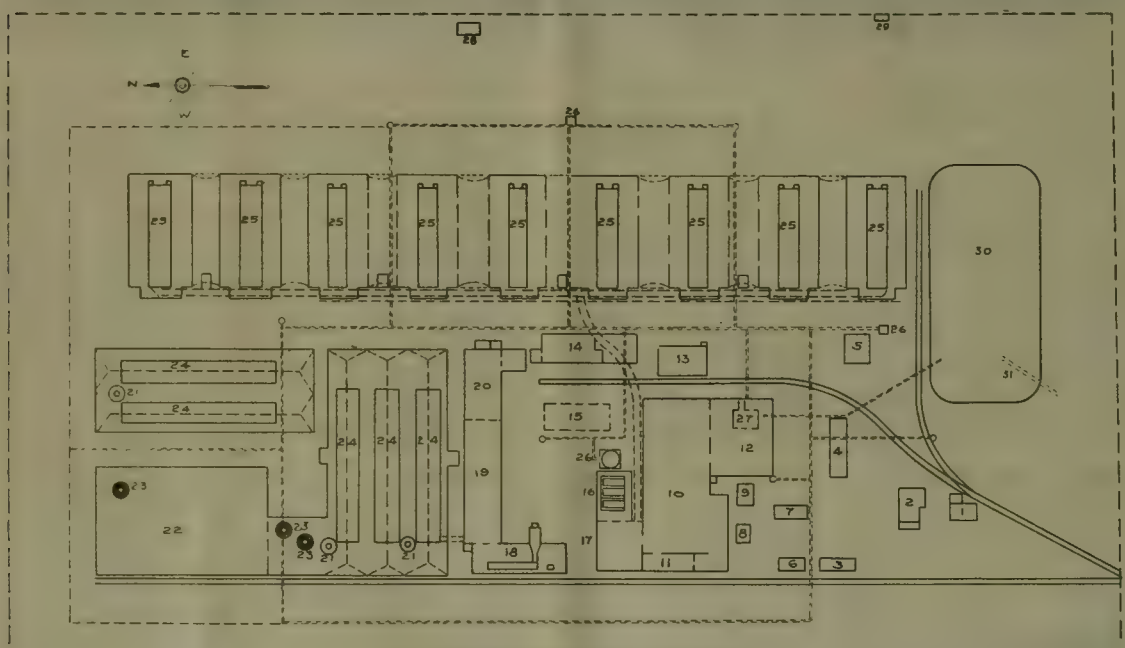
the concentrates as received. The bins are on the ground level, and in removing concentrate it is necessary to shovel it into barrows, in which it is taken to the crushing and drying department.

Two circular dryers are situated in a wing of the old roaster house containing the three original furnaces, while another dryer of the same type has been installed in the new roaster house, which contains two additional furnaces. The concentrate, which is usually a mixture of Colorado and Butte ores, is fed at the centre of the dryer and moved by revolving rabbles to the periphyry where it is discharged through chutes into the boot of a bucket-elevator. The bucket-elevator discharges into a 4-mesh trommel screen, the oversize from which is returned to a pair of 24-in. rolls, while the undersize is taken by a belt-conveyor to the superimposed steel feed bins of the Zellweger roasting furnaces. The drying capacity of the smelter is not sufficient for handling the entire roaster feed, with the result that during the day shift undried concentrate is shoveled directly upon the feed end of the roasting furnaces and both drying and roasting is done by the Zellweger roasting furnaces during the day shift. The dryers and crushers are operated by a 50-hp. General Electric motor operating on a 110-volt circuit.

For roasting sulphides, five of these furnaces are

THE BARTLESVILLE No. 2 SMELTER.

used. This type of roasting furnaces has found considerable favor through the Oklahoma gas smelting district. The furnaces are of the mechanical reverberatory type with hearths 150 ft. long and 15 ft. wide. The rabbling or raking mechanism is the special feature of this type of furnace and consists of a number of V-shaped steel cups which are mounted radially on a heavy shaft with cog-wheel supports connected by wire cable with the driving machinery. The wheels rotate on tracks in wheel pits at the sides of the hearth and are sometimes protected by an apron which is suspended from the arch and thus protects the wheels and driving



PLAN OF BARTLESVILLE No. 2 SMELTER.

1. Laboratory.
2. Office building.
3. Lime house.
4. Wash house.
5. Wash house.
6. Carpenter-shop.
7. Condenser store-room.
8, 9. Retort ovens.
10. Pottery.
11. Clay storage-bins.
12. Drying-rooms.
13. Blacksmith-shop.
14. Mixing house.
15. Coal storage.
16. Boiler-house.
17. Engine-room.
18. Dryer and sampling house.
19. Ore-bins.
20. Steel bins for roasted ore.
21. Tile and steel stacks.
22. Ore-bins.
23. Rotary dryers.
24. Zellweger roasting furnaces.
25. Retort furnace blocks.
26. Hose-house and 10,000-gal storage tank.
27. Fireproof room for fire pump.
28. Ash elevator.
29. Barn.
30. Earth-bank reservoir.
31. Pipe-line from Sand creek (1½ miles away).

mechanism from the intense heat of the furnace. A flash-light photograph of the interior of a Zellweger furnace at the Neodesha plant of the Granby Mining & Smelting Co. is shown opposite. This furnace is a typical Zellweger roasting furnace and the rabbling mechanism and the class of construction is seen from the illustration. The rabbling cups are fitted to collars which are mounted loosely on the shaft and a locking device holds them rigid or allows them to turn on the shaft according as to whether the passage of the rabble wheel is from the feed to the discharge or from the discharge to the feed end of the furnace.

By this means the charge is uniformly picked up by the cups, raised, turned, and moved forward as the rabbles pass through the furnace toward the discharge end, while on the return to the feed end the charge is moved but little and only a plowing effect is obtained by the rabbles moving over the hearth. The racks, which serve as track for the support of the rabbles and cause the mechanism to move uniformly through the furnace, are air-cooled by an air-chamber below them and the rabbling mechanism is air-cooled as it passes out of either end of the furnace, where it remains for a minute and a half before the return trip through the furnace. The ends of the furnace are closed with hanging walls and sheet-iron suspended doors as shown in the halftone. The furnaces, as operated at the Bartlesville plant, will treat 30 tons of concentrate per day reducing the sulphur content in the roasted product to about one per cent. The temperature of the furnaces is kept at about 1000°C. The roasted concentrate is discharged from the end of the hearth by the rabbles, which move the charge every six minutes. It falls into steel cars and is removed to steel storage bins. The furnaces are equipped with 10 gas burners on each side. The four burners nearest the feed end are ⅝ in.; these are followed by three ½-in. and three ⅜-in. burners, making 20 burners to each furnace. The rabbling mechanism is driven by a 12½-hp. General Electric motor operating on a 110-volt circuit, each furnace having an individual motor. The motors are equipped with automatic starting, stopping, and reversing device for regulating the travel of

the rabbles through the furnace, a simple hydraulic device being used for this purpose. Combination tile and steel stacks discharge the furnace gases into the atmosphere. When the furnaces are being fed with dried concentrate from the superimposed bins, the feed is automatic, the gate being tripped upon each passage of the rabbles through the furnace and the feed falling directly upon the hearth.

Retort Fuel.

The coal used in the mixing room is brought from the Pittsburg, Kansas, field together with some Arkansas semi-anthracite. It is delivered from the railway cars at the coal bins, which are conveniently situated with relation to the mixing house and centrally placed with reference to the furnace buildings, as shown in the plan of the plant. Here the roasted sulphide, carbonate, and fuel are mixed in a concrete mixing machine, and the mixed charge elevated to bins from which it is drawn into the charge cars and moved over the industrial tracks to the furnaces.

The original smelter plant comprised six blocks of retort furnaces, to which three additional blocks have been added. The furnaces are a modified Hegeler type 100 ft. long and adapted to natural-gas fuel. The furnaces consist of 18 sections on each side of the block, with 16 retorts to the section in four rows, making 288 retorts to the side, and 576 retorts to the block. The plant, therefore, comprises 5184 retorts in the 9 blocks of furnaces. Air and gas is admitted at the front of the furnaces at each section, a practice which in some of the more modern natural-gas furnaces has been replaced by using a 'blow-box' at each half-section. The furnaces are of the cellar type. The retorts used are 50 by 8¾ inches inside dimension and are made, together with the condensers, at a pottery on the grounds. As has come to be standard practice in the United States, no prolongs are employed. The average life of the retorts at this plant is about 30 days. Air for the furnaces is supplied by a blower in the engine room and conducted to the furnace blocks through a galvanized iron pipe-line and distribution system. Under present operating conditions there is charged from 14,500 to 16,000 lb. of roasted ore to the side per day or about 150 tons of raw concentrate for the entire plant. The extraction of the zinc is about 85% of the charge assay.

The furnaces are about seven years old and in a good state of preservation. Blue powder is added to the charge in the last two sections of each block and a temperature of about 1400° C. is maintained. About three hours are occupied in charging the retorts, from 4 to 7 a.m. The first draw is made at 3 p.m., the second at 11:30 p.m., and the last about 4 a.m. The result of a day's run is about 115 slabs of spelter to the side, the first draw producing about 35 slabs, the second 65, and the last 15. The first metal drawn, being distilled at the lowest temperature, is the purest, and is cast as 'extra select' in 56 lb. molds. The regular run of the furnaces is cast in 60 lb. molds. The retorts are drawn into a 360 lb. ladle suspended from a crane in a movable carriage, which ladle is swung under the condensers and operated by a hand winch. The oxide or 'blue powder' is skimmed off and shoveled aside for re-treatment.

INTERIOR OF A ZELLWEGER ROASTING FURNACE.

During drawing operations the drawman is protected by a shield on the draw carriage from the heat of the furnace. After the last draw, the residue is removed from the retorts and falling through a chute in front of the retorts is collected in industrial cars or pans below the furnace. Steam is used for cleaning the retorts, the water being immediately converted into steam upon entering the retort. The water-line and hose connections are in front of each side. Any slag adhering to the retorts is removed by scrapers. In cleaning the retorts the man operating the hose is protected by a shield which is suspended from a rail on rollers and is easily moved along the furnace. Twenty men are employed per day on each block.

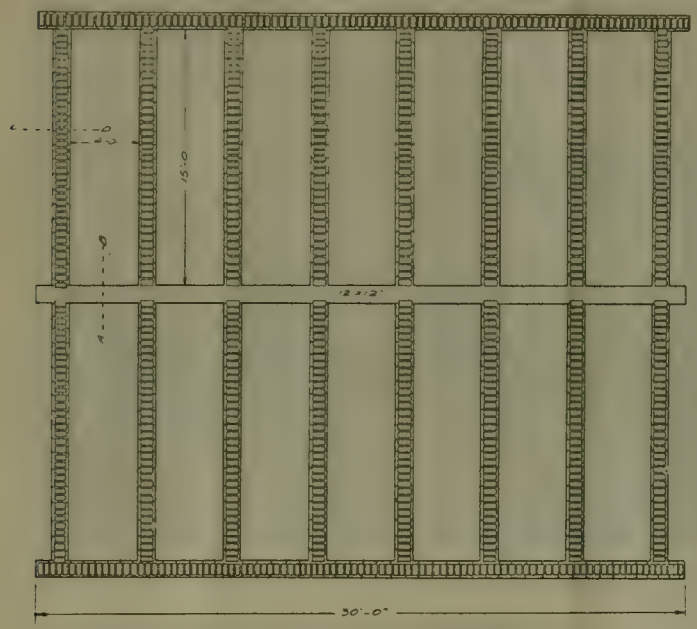
Treatment of Retort Residue

The treatment of retort residue presents some interesting features which have been developed at this smelter as a result of the treatment of the Butte flotation concentrate. In that the residue contains silver in commercial quantities, a large amount of experimental work was necessary to develop the best method of recovering the silver and it has resulted in the 'clinkering

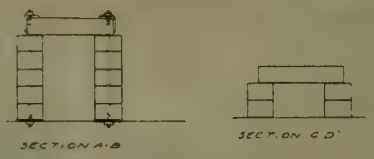
process' by which a blast-furnace material is made at the plant and shipped to Colorado smelters. The process consists in reducing the carbon content, which is upward of 30%, and the formation of clinker.

Construction of Heaps

The residue is removed from the furnaces in steel industrial cars and run out over an elevated structure as shown in the halftone to a site to the north of the smelter, where it is dumped and shaped into roasting heaps. In the building of these heaps a bed of residue 2 ft. thick is spread out into a square of from 20 to 30 ft. on a side, and upon this bed, brick-work air channels are constructed. A plan and sections are shown in the



PLAN OF BRICK-WORK FOR CLINKERING-HEAPS.



accompanying figures. One main air channel is laid through the centre of the bed and this channel is banked with dirt to prevent clinker from adhering to brick-work. From the main channel, branch channels are constructed at right angles extending to the edges of the heap. Eight of these branch channels are laid to allow the air to escape and be evenly distributed, thereby producing a uniform blowing effect throughout the heap. The ends of these branch channels are connected in the large heaps as shown in the plan. The main channel is connected by pipe with the main air-distribution pipe and this is connected with a blower which supplies air for all of the heaps. When the brick-work has been completed it is covered with residue, the air is admitted, and the heap is fired. The heap is then added to until a height of about six feet is reached and it contains about 400 tons of residue. The roasting or burning process is kept up for approximately 40 days, when the pile will be reduced to less than one-half its original size, the carbon reduced to almost nothing and a mass of clinker bearing silver results. This clinker is then cooled, broken, the brick channels removed, and the product shipped to Colorado furnaces.

The pottery plant at which the retorts and condensers for the Company's use are manufactured is equipped with a Mehler retort press, and pug-mill, an augur condenser machine, and two small Ft. Scott pug-mills for pugging condenser materials. The crushing machinery consists of one 12-in. Blake crusher, one set of 24-in. and one set of 16-in. rolls, and screens. The retort material is ground to 5 mesh. St. Louis clay is used for retorts while the condensers are manufactured from a 1 to 1 mixture of clay and old retorts. The clay is unloaded from freight cars into the clay-bins, where it is weathered from three to six months. After the first pugging it is cut into short cylinders as it comes from the pug-mill and again stacked for about a week, when it is given the final pugging and put into the retort press. The retorts are inspected as they come from the press and sent to the drying rooms, which are steam heated. They are then removed from the drying rooms as the furnaces demand, placed upon industrial cars, and taken to the furnaces where they are finished in the annealing ovens, there being one annealing oven to each two blocks of furnaces.

The power-plant, which adjoins the pottery building, is equipped with a 250-hp. Corliss engine with belted generators, a 150-hp. Chase compound, and a 120-ft. Garden City blower to supply air for the retort furnaces. Natural gas is used for fuel under the boilers. There is also a fire pump with pipe connections to all departments of the plant. The water supply is brought through a pipe-line from Sand creek, which is a mile and a half southwest. An earth-bank reservoir 250 by 100 by 10 ft. deep serves as a reserve water storage at the smelter. There is also a 10,000-gal. steel tank for the smelter supply, the water being pumped to this tank from the earth reservoir.

The plant equipment includes about two and a half miles of narrow-gage industrial track for the handling of smelter products and a mile of standard-gage railway sidings for the receiving of smelter materials and shipment of spelter. A laboratory building is fitted with all of the equipment necessary for making industrial analyses and determinations in connection with zinc smelting. There are also machine and blacksmith shops, carpenter shops, lime house, wash rooms, and offices on the smelter site.

Due largely to the efforts of the present manager, Archibald Jones, the smelter, after a somewhat dis-

A HEAP IN COURSE OF CONSTRUCTION.
A ROW OF HEAPS BEING CLINKERED.

couraging beginning, is at present being successfully operated, and the development of the treatment of Butte flotation residues has constituted one improvement in the smelting of zinc concentrate.

Dust Prevention on the Rand

A simple but seemingly effective process for preventing dust-blowing from dumps has been placed in active operation at the Ferreira Deep. The originator of the process is F. L. Bosqui, who describes the process as follows: It consists of spraying the surface of the dumps with the slime residue in the condition in which it is ordinarily pumped to the slime dam and mixed with about 100 lb. of salt per ton of two parts water to one of slime pulp. The hygroscopic properties of the salt prevent the crust from drying and cracking. It is estimated that it might be necessary to renew this coating three or four times a year at insignificant cost. The spraying plant consists of a 40-ton cone-bottom agitator to which the residue slime stream is diverted as required. From this tank the pulp is forced by means of a triplex Gould pump into a 4-in. distributing main provided with hose taps at suitable points. The pulp is sprayed on the dump by means of a 4-in. hose and nozzle, the stream issuing from the nozzle at about 40 lb pressure. So far the system has proved extremely simple and inexpensive as well as effective. It is too early to obtain definite figures as regards cost, salt consumption, etc., as the proportion of salt, the thickness of slime pulp, and other details will necessarily be modified in accordance with experience.

The effect of the spraying is to give the dump a thin crust. The peculiarity of the crust is that it is not so brittle as might be expected. There is a degree of plasticity about it which is renewed by the moisture in the air. The hygroscopic or moisture-absorbing property of the salt in the spraying mixture prevents the crust from drying and cracking. It only remains to test the capability of the crust to resist the disintegrating influence of the high winter winds. Should they prove powerless to rob the process of its efficacy, a great boon will have been conferred upon the mine dwellers of the Rand. An estimate of the cost of spraying the dump places it at the modest figure of a penny per 100 sq. ft., or even less.

The hose is easily manipulated by one or two natives who can spray at a rate of considerably over an acre per hour, consequently the time taken to spray a whole dump, once the equipment is erected, would be in most cases under a day, and in no case would it exceed two days.

The idea of adding brine to the slime was suggested by F. J. Trump, manager of the Ferreira Deep, who pointed out that salt is used in some of the colliery districts in England for laying dust on roads. The installation at the Ferreira Deep cost under £1000. The credit for being the first to apply the spray treatment for the prevention of dump dust is due to the East Rand Proprietary Mines, which has already covered the Driefontein dump with a coating of *vlei* mud, which has proved very effective, but such mud is not everywhere available, and, in any event, the use of current slime which Mr. Bosqui has installed is cheaper, simpler, and more likely to be universally adopted.—*Capetown Times.*

THE WORKS of the Hydro-Electric Power & Metallurgical Co. have been acquired by the Tasmanian Government. Financial troubles led to this end. Good progress has been made with the pipe-lines and power-plant, and within a year there will be 85,000 hp. available for mines and manufacturing plants.

MINERAL PRODUCTION of New South Wales for the first quarter of 1914 was worth £2,754,999, an increase of £467,162 over the same period of last year. Coal and silver-lead exports showed a large increase.

Siderite and Sulphides in Leadville Ore Deposits

By PHILIP ARGALL

Siderite, though once of considerable economic importance, is now the least valuable of the iron ores. Even manganiferous siderite, at one time in great demand for the manufacture of spiegeleisen, has now no economic value in the West. Genetically considered, siderite is perhaps the more important of the sedimentary iron ores, most of which have been precipitated as carbonates and, through chemical and other processes, rearranged or redeposited chiefly as hematite. Much of the Lake Superior iron ore is now considered to have had such origin. The hematite ore of Breese Hill iron mine, Leadville, is in all probability derived from siderite, which is plentiful at depth even now in that locality and recently has been reported in great abundance in the Hopemore mine.

Siderite—carbonate of iron—has long been known as an important mineral of Leadville replacement deposits in the blue limestone horizon, particularly in association with the primary sulphides, and in fissures and solution cavities. Over 25 years ago I collected specimens from the walls of watercourses in the La Plata mine, partly filled with manganese oxide, and reached the conclusion that this oxide was in great part, if not wholly, derived from the oxidation of siderite. Last May I picked up specimens from the dump of the adjoining Stevens mine showing a crust of manganiferous iron oxide attached to partly oxidized siderite. A casual examination of several mine dumps a few days later showed siderite in every one, resulting in a nice collection of specimens, some perfect, but mostly typical siderites comparatively free from oxidation. The dumps yielding siderite are the Stevens, Colonel Sellers, A. Y. & Minnie, Colorado No. 2, Louisville group, R. A. M., Mikado group, the Penrose, down-town mines, the Wolftone, the El Paso, the Jamie Lee, and the Fitzhugh. I had previously collected specimens from the workings of the Resurrection, Moyer, Tucson, Silver Cord, and Maid of Erin mines.

Distribution of Siderite

The list, covering two miles in one direction and almost five in another, from the Resurrection to the Penrose, is ample to show the wide distribution of siderite at Leadville. While I examined no other dumps, excepting those of the principal downtown mines, there is little reason to doubt the occurrence of siderite in all the mines that have penetrated the oxidized zone, while in the white limestone horizon, the siderite replacement deposits with their associated lead and zinc ores, are second only in importance and extent to the sulphide replacements in the blue limestone horizon; judging by the last few years' development in the Tucson mine of the Iron Silver Mining Co. and of the Maid of Erin mines.

I believe that *sedimentary siderite*, with its carbonaceous and organic impurities should be differentiated from the siderite deposited in fissure veins and in replacements therefrom, herein called *vein siderite*. Both varieties contain manganese chiefly as carbonate; particularly vein siderite, which invariably contains a much higher proportion of manganese than does sedimentary siderite. It may be permissible in discussing the difference between sedimentary siderite and vein siderite, briefly to review some of the important siderite veins, including that peculiar class of silver-lead-zinc veins in which siderite forms the principal gangue; then to compare chemical analyses of vein siderite with those of sedimentary origin.

European Siderite Veins

The great Perran Iron lode, Cornwall, England, occurs in Devonian clay slate intruded by granite porphyry dikes. The vein averages about 50 ft. in width and is in places filled with massive siderite carrying 10 to 15% manganese. The outcrop has been extensively worked for limonite, and much siderite was mined in the 'seventies' from the deeper workings. Because of the decline in the price of iron and increase in silica in the ore, it could not be profitably sold as 'spiegel' ore in 1880, when I had charge of the principal mine on the lode. The vein bore evidence of reopening, and between the shoots of massive siderite a breccia of zinc-blende occurred. In the Duchy Peru mine, the angular pieces varying from a few pounds weight to several tons, were imbedded in decomposed clay slate, and cemented and seamed with siderite. The blende breccia was profitably worked for several years with a production varying from 500 to 900 tons per month of 38 to 42% zinc content. Rich veinlets of argentiferous galena occurred in places, but apart from stray crystals of galena and sphalerite the siderite was free from zinc, lead, and silver. Near a granite porphyry dike ('elvan') a large deposit of fine grained sphalerite occurred in a siderite gangue. The difficulty in separating these minerals by water concentration led to my first experiments with magnetic separation in 1881.

The vein in the siderite shoots was full of watercourses and oval solution cavities. One of them extended two levels in height and was used for a ladderway. The vein was extremely wet, the flow at the Duchy Peru mine varying from 600 to 1000 gal. per minute, depending on the season. It all came from the bottom of the mine. The iron ore sequence is approximately as follows: limonite to 60 ft.; siderite, 60 to 360 ft.;

[1] Ross, Heinrich. 'Economic Geology,' 1910, p. 370.

siliceous siderite 300 to 150 ft., and at 180 ft. the deepest point reached the vein was filled with quartz and siderite, the latter constituting only about 20% of the whole.

In Brendon Hills, Somerset, England, a series of irregular siderite veins occur in slaty rocks of middle Devonian age. The veins extend over a distance of five miles with a maximum aggregate of 27 ft. in thickness. The siderite carries 13 to 14% manganese peroxide. The brown iron of the outcrops has been mined from a very early date, while siderite has in recent times been extensively mined for 'spiegel' ore. Quartz is associated with the siderite usually as separate lenses in the veins.[2] Lead or zinc does not occur in any appreciable quantity in the veins.

Siderite in England and Germany

In numerous lead mines in the North of England in Carboniferous limestones, such as those of Allenheads for example, siderite occurs as a gangue accompanying the galena not only in the vein fissures but also in 'flats' or replacement deposits in favorable limestone beds. Siderite is of common occurrence on the European continent both in massive veins and as the principal gangue, accompanying zinc-lead ores. Suffice it to mention the Stahlberg Müsen, where a nearly vertical vein enclosed in lower Devonian clay slate has been worked since 1313. This mass of siderite is about 75 ft. thick, nearly 500 ft. long, and proved to a depth of about 800 ft.[3] The Luise mine, near Horhausen, in which sphalerite, galena, and copper minerals occur in the vein alongside siderite, is noteworthy in that in it a basaltic intrusion changed the siderite into magnetite. The siderite lode of the Friedrich and Esingarten mines of the Hamm district, which also contain galena, sphalerite, chalcopyrite, and bornite, as well as antimony and bismuth minerals,[4] may also be cited.

J. Arthur Philips[5] calls attention to the import of manganiferous iron ore into England from limestone districts producing lead ore, where it probably represents the superficial alteration of manganiferous spathose ore. He mentions Almeris and Porman, near Cartagenia, where there is a large export, Laurium in Greece, and other localities. The ore, he states, varies between 25 and 35% of iron and of manganese.

American Siderite Veins

Siderite silver-lead veins in North America are well represented by the Slocan series in British Columbia and the Wardner deposits in the Coeur d'Alene, Idaho. The Slocan rocks are clay slates and limestone beds of possibly pre-Cambrian age; this formation is intruded by granite, quartz porphyry, and lampropyric dikes. The fissure veins usually carry rich silver lead ore associated with siderite and quartz, the latter predominating in depth. Siderite was deposited throughout the whole vein forming period, being often the first mineral deposited on the vein walls. It also occurs as alternating seams with galena and sphalerite in the vein filling, as the cementing material in brecciated zones, and lastly, as crystals deposited on galena crystals, marking the last mineral deposition in the fissures.

Selected specimens of siderite from the Slocan silver-lead veins gave the following approximate composition:[6]

	Per cent	Per cent	Per cent.
Fe CO$_3$	58.88	62.31	36.53
Mn CO$_3$	27.48	26.12	55.52
Mg CO$_3$	11.59	11.57*	7.95*
Ca CO$_3$	2.05		

*By difference.

The siderite is free from zinc, though deposited in veins with sphalerite. It is also free from silver, copper, and lead as molecular constituents. However, grains of galena and sphalerite occur in all but the purest specimens. Tetrahedrite or Freibergite is the chief silver-bearing mineral. It is invariably associated with galena and often contains 2000 oz. silver per ton. The Slocan siderite, usually forming the bulk of the vein material, being free from precious metals and from zinc, becomes a true gangue in these silver-lead veins. Quartz forms the remaining gangue and is scarce in the upper reaches of the veins, but predominates in depth.

Coeur d'Alene Veins

The silver, lead, and siderite veins of the Coeur d'Alene district, Idaho, are of great economic importance, furnishing as they do nearly one-third of the lead produced in the United States. The country rock is sericitic quartzite of pre-Cambrian age, and the ores were formed chiefly by replacement along tight shear planes. It is believed the siderite developed first, replacing both the quartz grain and the sericitic cement. According to F. L. Ransome,[7] siderite is the most abundant and characteristic gangue mineral of the district. He writes: "Its presence as a replacement of quartzite constitutes a striking mineralogical feature of the ore. In fact, the deposits in this respect are unique among the known orebodies of the world." He gives no chemical analysis of this important vein mineral. The deposits are unusual because siderite forms so large a proportion of the gangue and because siderite replaces quartzite. Both phenomena are common at Leadville, but perhaps on a smaller scale so far as quartzite replacement is concerned. Mr. Ransome, describing the typical Coeur d'Alene deposit, states: "the siderite is massive, the ordinary gangue of the Bunker Hill &

[2]Morgans, Morgan, *Proc.* South Wales Inst. of Eng., Vol. VI., p. 78.

[3]Philips, J. A., 'Ore Deposits' (1884), p. 272.

[4]Beck, F., 'The Nature of Ore Deposits' (1905), p. 196 (W. H. Weed).

[5]'Elements of Metallurgy' (1887), p. 152.

[6]Argall, Philip, 'Report of the Zinc Commission' (Ottawa, 1906), p. 236.

[7]F. L. Ransome and F. C. Calkins, 'The Geology and Ore Deposits of the Coeur d'Alene District, Idaho,' U. S. Geol. Surv., Prof. paper No. 62 (1908), p. 95.

Sullivan mines, for example, being a pale brown, fine grained aggregate of siderite not always distinguishable at a casual glance from the quartzite, which it has in part replaced. In the vicinity of the orebodies all gradations can be observed between nearly pure massive siderite and a usually somewhat sericitic quartzite." Coarsely crystalline siderite, he states, is comparatively rare, confined to the filling of open spaces or diaclases. Mr. Calkins observes (page 97): "That although siderite has a much wider distribution than the ores, yet it is most abundant where the rocks have been folded and fissured." A sample of comparatively clean siderite from the Bunker Hill & Sullivan mines,

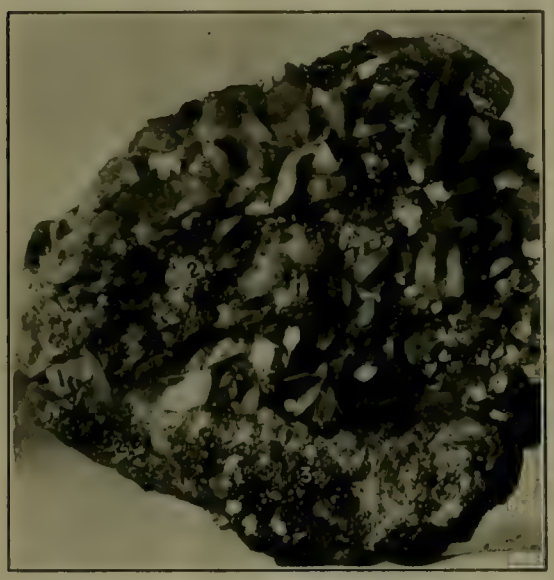


FIG. 1. SIDERITE CRYSTALS ON SULPHIDES FROM IRON MASK MINE, RED CLIFF, COLORADO. 1, GALENA; 2, PYRITE; 3, CRYSTALLINE ZINCBLENDE AND GALENA.

obtained through the courtesy of Stanly A. Easton, assayed 38.8% iron, 4.5% manganese, and 0.5 oz. in silver, with only 4.8% insoluble. It contained no lead, but showed some fine specks of disseminated sulphide.

In Colorado there is a great belt of intrusive porphyry, of late Cretaceous age, which extends almost 100 miles in a general southwesterly direction from the gold-telluride district of Boulder county through the gold district of Gilpin county, the gold, silver, lead, and zinc district of Clear Creek county, the mining districts of Montezuma, Kokomo, Breckenridge, Alma, Leadville, Red Cliff, and Aspen. These intrusions, while not continuous, may be said to reach their greatest development in the mining districts noted, principally at Leadville and probably least at Montezuma. This belt of porphyry intrusion closely circumscribes the largest and richest silver, lead, zinc, and iron sulphide deposits so far developed in Colorado. Over the greater part of this mineral belt, varying from 10 to 15 miles in width, siderite is a characteristic vein mineral. This is particularly true of those veins and deposits carrying silver, lead, and zinc sulphides and extending from Silver Plume to Aspen. They reach their largest development so far known, with the maximum porphyry intrusion, namely at Leadville. Here the lower sedimentaries are seamed with fissures and extensive replacement deposits of vein siderite, associated as gangue with mixed sulphide ores—galena, zincblende, and pyrite.

Siderite has been described in the U. S. Geological Survey reports as occurring in the mining districts noted. Spurr and Garrey make frequent mention of vein siderite in their description of the Georgetown quadrangle.[8] Their figures 86 and 95 are instructive, showing siderite as the first incrustation on the fissure walls. Siderite is also described as one of the last minerals "coating all other crystals." The Colorado Geological Survey chronicles the occurrence of siderite in the Montezuma veins.[9] Siderite is a common mineral in the replacement deposits at Red Cliff, and its occurrence has been noted at Aspen by Mr. Spurr. Fig. 1 shows siderite crystals on sulphides of iron, lead, and zinc taken from wall of a watercourse in the blue limestone replacement deposit, Iron Mask mine, Red Cliff, Colorado, by courtesy of Mr. Hanington, general manager. The siderite crystals covering the galena, pyrite, and blende are the finest I have seen. Siderite, in smaller crystals, occurs all through the specimen and on the back, which is mostly pyrite.

SIDERITE IN LEADVILLE DISTRICT

All the massive Leadville siderite I have tested is of the vein variety. That is to say, it is manganiferous. It also contains 10 to 30% silica. Part of the manganese or iron is possibly present as silicate. A few analyses of vein siderite are quoted below for comparison with sedimentary siderite, taking iron, manganese, lime, and insoluble as a basis:

ANALYSES OF VEIN SIDERITE

	Iron.	Manganese.	CaO.	Insoluble.
	%	%	%	%
No. 1	34.67	9.78	0.28	0.08
No. 2	36.75	8.21	0.50	....
No. 3	31.00	10.80	1.40	15.00
No. 4	28.40	13.14	6.78*	....
No. 5	30.15	12.97	....	....
No. 6	17.62	26.55	....	....
No. 7	38.80	4.50	1.00	4.80
No. 8	23.00	20.70	0.47	19.60
No. 9	21.80	21.10	0.40	21.20
No. 10	19.40	21.00	0.70	19.20
No. 11	25.60	12.60	....	4.40
No. 12	28.10	9.90	trace	2.00
No. 13	42.50	2.40	....	2.80
No. 14	29.70	5.40	....	18.10
No. 15	17.20	11.70	....	28.40
Average	27.30	13.44	0.82	9.48

*Including 5.52% magnesia.

[8] U. S. Geol. Surv., Prof. paper No. 63 (1908), pp. 240-257-259, and 263.

[9] First Report Colorado Geol. Surv., 1908, p. 139.

No. 1—Brendon Hills, Somersetshire, England. Vein siderite. J. A. Philips, 'Elements of Metallurgy' (1887), p. 148.
No. 2—Stahlberg Mines. Vein siderite. J. A. Philips, op. cit., p. 148.
No. 3—Perran Iron Lode, Cornwall, England. Record of shipments. Philip Argall.
No. 4—[illegible] and 6. Slocan silver-lead veins, British Columbia. Philip Argall, 'Report of the Commission on Zinc Resources of British Columbia' (Ottawa, 1906), p. 2[illegible].
No. 7—Bunker Hill & Sullivan, Idaho. Siderite replacing [illegible].
No. 8—Leadville, Tucson mine. Siderite replacing white limestone.
No. 9—Leadville, Tucson mine. Siderite replacing white limestone.
No. 10—Leadville, Tucson mine. Siderite replacing white limestone.
No. 11—Leadville, R. A. M. mine. Siderite collected from dump.
No. 12—Leadville, Maid of Erin mine. Siderite replacing white limestone.
No. 13—Leadville, El Paso mine. Siderite collected from dump.
No. 14—Leadville, Fitzhugh mine. Siderite collected from dump.
No. 15—Leadville, Penrose mine. Siderite collected from dump.

No. 13, collected on the El Paso dump, is a coarse crystalline siderite intimately mixed with pyrite and not over one-third siderite. No. 14 is a very fine grain silicious siderite.

As an illustration of sedimentary deposits or 'spathic' iron ores (siderite), including blackband ores, the following is presented:

ANALYSES OF SEDIMENTARY SIDERITE

	Iron.	Manganese.	CaO.	Insoluble.
	%	%	%	%
No. 1	28.76	0.73	2.78	28.00
No. 2	31.82	0.74	2.26	19.35
No. 3	40.84	0.71	0.53	11.14
No. 4	28.83	0.18	6.61	9.80*
No. 5	33.12	0.20	5.24	8.87*
No. 6	29.78	0.75	0.74	28.86†
No. 7	31.25	3.92	0.81	16.62
No. 8	8.40	0.22	22.50	23.90
No. 9	38.20	2.28	1.90	....
No. 10	37.87	....	16.93	4.36
No. 11	35.70	....	9.54	14.76
No. 12	36.05	0.94	6.47†	13.53
Average	31.72	0.89	6.36	14.92

*Carbonaceous matter. †Al_2O_3.

No. 1—White Bed mine, Brierly, Yorkshire, England.
No. 2—Thorncliffe, White mine, Park gate, Yorkshire.
No. 3—Gabbin and Balls mine, Bunkers Hill colliery, Staffordshire, England.
No. 4 and 5—'Coal brasses,' Aberdane, South Wales. J. Arthur Philips, 'Elements of Metallurgy,' p. 149, 150.
No. 6—Sunday Lake, Michigan. 'The Data of Geochemistry,' U. S. Geol. Surv., 1908, p. 492.
No. 7—Penokee district, Michigan. 'Data of Geochemistry.'
No. 8—Gunflint Lake, Canada. 'Data of Geochemistry.'
No. 9—Styrian Erzberg. *Trans.* Am. Inst. Min. Eng., Vol. 23, p. 24.
No. 10, 11—Helen mine, Siderite, Canada. (In No. 10, CaO includes 12.8% magnesia carbonate. In No. 11, CaO includes 8.75% magnesia carbonate.) Bureau of Mines, Ontario, 1901, p. 193.
No. 12—J. J. Singewald, 'Report on the Iron Ores of Maryland,' Maryland Geol. & Econ. Surv., Vol. 9, Part 3 (1911).

Excluding No. 13, which is only one-third siderite, the remaining 14 samples of vein siderite average 13.44% manganese, against an average of less than 1% manganese in the 12 samples of sedimentary siderite. The computed averages are:

	Iron	Manganese	CaO	Insoluble
	%	%	%	%
Vein siderite	27.40	13.44	0.82	9.48
Sedimentary	31.70	0.89	6.36	14.92

The vein siderites not only carry a higher combined metal content, 40.7 against 32.6%, but also contain 5.5% less alkaline carbonate and 4.5% less insoluble residue, yet the manganese is the most conspicuous difference. In comparing the iron and manganese content of vein and sedimentary siderites, note that the ultimate source of both metals is the igneous rocks of the earth's crust in which iron and manganese occur in the proportion of approximately 60 parts of iron to 1 of manganese. The proportion of these metals in the above analyses is in the ratio of 36 iron to 1 of manganese in the sedimentary siderites, against 2.03 parts iron to 1 of manganese in the vein siderites. The metals, however, have not only a different solubility ratio, but also act differently in their precipitation from solution through what I shall call surface agencies, to differentiate between the deposition of siderite in lakes, bogs, and amid carbonaceous sediment, marine or otherwise, and the deposition of siderite in mineral veins.

SOLUBILITY OF MANGANESE

According to E. C. Sullivan, manganese in rocks is dissolved more easily than iron, by either carbonated water or dilute sulphuric acid.[10] F. P. Dunnington[11] showed that an acid solution of ferrous sulphate dissolves manganese from the carbonate as sulphate, with the separation of ferric sulphate and limonite. Calcium carbonate precipitates the iron, but the manganese requires access of air. The metals, therefore, may be dissolved from rocks simultaneously by the same reagent, but for reasons stated are not usually redeposited together. C. R. Fresenius,[12] from his studies of the warm springs of Wiesbaden, showed that the manganese in these waters remains in solution as carbonate much longer than the iron and is finally laid down as a carbonate, hence the manganese salt is more stable in solution and is carried farther. Through some of the foregoing reactions, manganese is partly separated from iron and is perhaps redeposited as beds of carbonate, or as a local precipitate enriching in manganese certain localities in the sedimentaries.

Thomas and MacAlester,[13] while hesitating to put forward any trustworthy example of precipitated beds of manganese carbonate, cite Barmouth in Merionethshire as having two distinct horizons containing well marked beds. They also state that manganese carbonate exists as an original deposit in the Devonian beds of the Pyrenees, in the Oligocene of Mähren, and in other localities.

[10]Sullivan, E. C., *Trans.* Am. Inst. Min. Eng., Vol. 42 (1911), p. 39.
[11]Dunnington, F. P., *Am. Jour. Science*, 3rd ser., Vol. 36 (1888), p. 177.
[12]Quoted 'Data of Geochemistry,' cited p. 173.
[13]'The Geology of Ore Deposits' (London, 1909), p. 317.

Vein Siderite

The condition of solution and deposition is here entirely different. The circulating solutions are presumably strongly alkaline, sulphuretted under high pressure, and doubtless charged with CO_2. They are powerful solvents of iron and manganese minerals. That they readily dissolve silica is clearly shown in the extensive replacement of quartzite in the Coeur d'Alene and to a less extent in Leadville, where the quartzite adjoining the fissures and solution cavities between the ninth and tenth levels in the Tucson mine has been reported as reduced to a soft sandstone by removal of the silicious matrix between the quartz grains, and fine galena and blende crystals had been deposited in the interstitial spaces in the altered quartzite of the lower Cambrian horizon.[14] Further up in the quartzite the same solution that dissolved the matrix from between the quartz grains also partly filled the interstitial spaces with siderite and mixed sulphides, while the ore crust lining the solution cavities often shows siderite as the first mineral deposited in the sericitized quartz matrix, and also the last mineral formed, coating the penultimate crystals, usually of galena, with a growth of crystalline siderite.

Moreover, these irregular fissures and meandering solution cavities in the Cambrian quartzite, with their very rich gold and silver ores, are not confined to Leadville. They are common in Red Cliff and elsewhere along the 'great mineral belt' of Colorado, and are evidently produced by the same agency—hot alkaline solutions under pressure, charged with CO_2, sulphides, and ferrous iron, perhaps poor in silica content and dissolving silica in the quartzites with avidity, forming silicious carbonate and sulphide of iron replacement deposits in the Silurian limestones above, and to some extent in the Carboniferous limestone.

[14]Argall, George O., *Eng. & Min. Jour.*, Jan. 29, 1910, p. 264.

Selective Mining of Orebodies

By DOUGLAS WATERMAN

The question of what grade of ore will give the maximum profit when mined and treated is of paramount importance at every mine, and is an ever present problem; beginning with the inception of the enterprise and continuing throughout the whole life of the mine. The owner or shareholder usually decides whether the profits shall be won from a large tonnage of ore yielding a narrow margin of profit over a long term of years, or from a smaller tonnage of selected ore requiring a smaller capital outlay and giving quicker returns, but leaving ore in the mine. It is the business of the engineer to set before his clients the possibilities of the property for producing the greatest net profit for any capital outlay, and to define the limits within which the mine is capable of producing a constant tonnage.

Factors Influencing Output

This requires a careful study of the ore deposits to determine the width and mode of occurrence of the various grades of ore; the rate at which it is possible to carry on development; the available labor supply and its producing capacity; and the future prospects; all of which have a direct bearing on the output. The mill should be of a capacity to treat the output of ore of the grade decided upon without crowding the mine, which must run at a steady pace and according to a definite plan, or innumerable difficulties will arise. The effect of increased or diminished tonnage on the costs is of vital importance. An analysis of their relation presents some interesting facts which I shall endeavor to bring out in this paper.

For the purpose of illustration I have been fortunate not only in securing actual costs of operation over a full year, but also on a variation in tonnage ranging from 6400 to 11,000 tons. These costs are grouped under three headings: fixed charges, mining, and treatment, including tailing loss. The total cost represents the value the ore must have in order to meet all operating expenses. The cost of the various operations of mining and treatment necessarily varies from month to month even with the same tonnage, owing to renewals and repairs which must be charged to current expenses. In order to arrive at a representative cost for any tonnage, the monthly costs were plotted as shown in Fig. 1. If a straight line is drawn through the average cost for the year and adjusted so that there is a balance between high and low costs on either side of the line, it should represent the true average for any given tonnage. This method was pursued with each separate item of cost, the results being as in the table opposite.

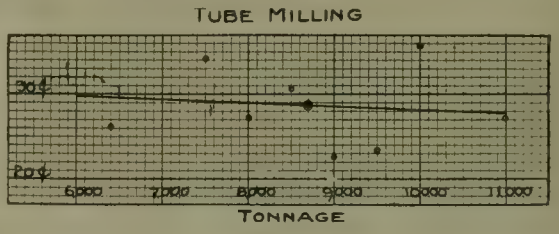


Fig. 1.

These tabulated costs were then plotted in the form of curves shown in Fig. 2. While the figures are based on results obtained from treating tonnages ranging between 6400 and 11,000, the curves may be readily extended, as has been done in this case. The curve representing fixed charges may be obtained by dividing the total cost for the year by the total tonnage, that is

Tons treated	3,000	4,000	5,000	6,000	7,000	8,000	2 months of 11,000 tons 2 " 9,000 3 " 7,500 Based on total for year of
FIXED CHARGES							
Development (including repair to shafts	0.252	0.264	0.272	0.284	0.300	0.320	0.340	0.399	$70,688.88
Pumping	0.167	0.189	0.195	0.204	0.217	0.230	0.246	0.287	12,052.65
Office	0.042	0.048	0.050	0.052	0.055	0.058	0.062	0.073	5,610.88
Sundry expense	0.152	0.172	0.178	0.186	0.197	0.210	0.223	0.261	20,113.27
Auxiliary construction	0.067	0.075	0.078	0.081	0.086	0.092	0.098	0.114	8,794.59
Total	0.661	0.749	0.773	0.807	0.855	0.909	0.969	1.136	$87,260.24
MINING.									
Stoping	0.678	0.760	0.790	0.800	0.840	0.870	0.910	0.980	
Timber and rails	0.050	0.059	0.061	0.063	0.067	0.069	0.072	0.078	
Hauling and hoisting	0.176	0.181	0.182	0.184	0.187	0.189	0.191	0.195	
Filling	0.060	0.070	0.072	0.075	0.079	0.082	0.086	0.093	
Tramming to mill	0.040	0.046	0.047	0.048	0.050	0.052	0.053	0.058	
Total	1.004	1.116	1.152	1.170	1.223	1.262	1.312	1.404	
TREATMENT.									
Crusher station	0.068	0.082	0.086	0.091	0.097	0.102	0.110	0.120	
Battery	0.231	0.239	0.240	0.242	0.245	0.248	0.250	0.255	
Tube-mills	0.272	0.280	0.282	0.284	0.286	0.289	0.291	0.296	
Treatment	1.040	1.110	1.130	1.150	1.180	1.210	1.240	1.300	
Filter	0.076	0.082	0.084	0.085	0.088	0.090	0.092	0.095	
Precipitation	0.106	0.112	0.113	0.114	0.116	0.119	0.122	0.126	
Refining	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	
Bullion	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	
Tailing loss	0.500	0.500	0.500	0.500	0.500	0.500	0.520	0.550	
Total	2.503	2.615	2.645	2.676	2.722	2.768	2.835	2.952	
Grand total	4.170	4.480	4.570	4.650	4.800	4.940	5.120	5.490	

to say, 12 times the rated tonnage, whether it be 4000 or 16,000 tons. The curves representing mining and treatment charges, being nearly straight lines, may be extended without danger of serious error. This graphic representation gives a comprehensive idea of the effect of tonnage on the costs, and may be employed in solving many problems in mining. In the following illustrations in the use of the curves, let it be assumed for the sake of convenience that neither profit nor loss is to result from the operations, and that the normal capacity of the mill is 10,000 tons. Then the following conclusions may be drawn.

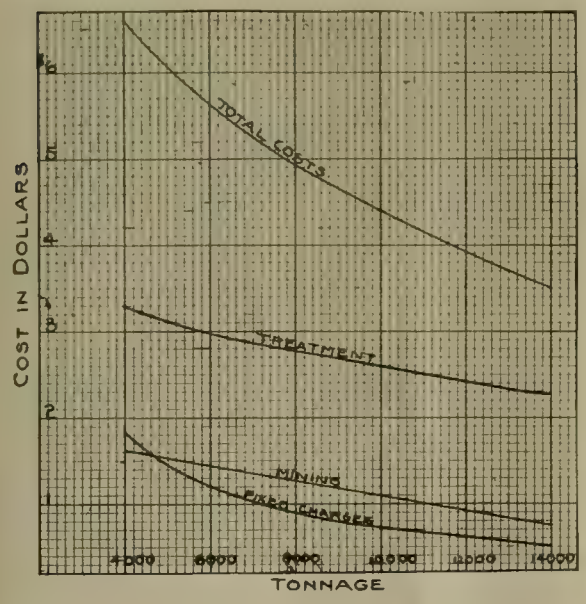


FIG. 2.

EXAMPLES

For example, if there is 4000 tons of available ore monthly which if treated alone will just pay expenses, what grade of ore may be added to bring the mill up to full capacity without changing results?

Treating 4000 tons alone the cost—from the diagram—would be $6.70 per ton, or a total of $26,000; but if 6000 is added, the cost is $4.40, or a total of $44,000. The difference between these two amounts is $17,160; that is to say, allowing $6.70 for treating the first 4000 tons, it would cost only $17,160 to treat an additional 6000 tons, or $2.86 per ton. In other words, of this 6000 tons, all ore of a grade of over $2.86 would give a profit.

The following are various combinations illustrating the example:

4,000 tons at	$6.70	$26,800
6,000 tons at	2.86	17,160
10,000 tons at	4.40	$44,000

5,000 tons at $6.10	$30,500
5,000 tons at 2.70	13,500
10,000 tons at 4.40	$44,000
6,000 tons at $5.65	$33,900
4,000 tons at 2.53	10,120
10,000 tons at 4.40	$44,000

These results may be applied to actual mining operations in the following manner: There are perhaps stopes on the lower levels that will produce 4000 tons of ore per month and no more, while there is a large reserve in the levels above that will average $3. If treated alone, the low-grade ore will show a loss of $1.40 per ton on a 10,000-ton basis. The high-grade ore, if treated alone, will give a profit of $0.30 per ton, or $1200 per month. Combining the two in the proportion of 4000 and 6000 tons, results in a profit of $2000 per month.

This brings out the point already mentioned, that the mine must be run according to a definite plan, otherwise the stoping of the high-grade ore is bound at some time to get ahead of development, leaving the mine with nothing but the low-grade ore, which, if treated alone, will result in a loss.

As another example, suppose there is 5000 tons of ore obtainable monthly from the mine that will just pay expenses if treated alone, what grade of dump-rock costing 10 cents for hauling, may be added to bring the mill up to full capacity and still pay expenses?

Referring to the diagram, on a 10,000-ton basis the mining cost is $1.10, so that $1 per ton is saved on the mining charge for the 5000 tons of dump-rock treated, or 50 cents on the whole tonnage.

5,000 tons of ore at $6.10	$30,500
5,000 tons dump-rock at $1.70	8,500
10,000 tons at $3.39	$39,000

Various other problems may be solved in a similar manner; as, for instance, the treatment of tailing in combination with the run-of-mine ore. In such cases, allowance must be made not only in the item of mining, but in the crushing and stamping as well, although in all probability there will be an added consumption of lime to neutralize the acid in the tailing, and perhaps a greater cyanide consumption; but these are matters to be decided by experiment.

It will be noted that the value the low-grade ore must have to pay expenses varies with the tonnage, and also that in this illustration the critical point is in the neighborhood of $2.70. It will result in an actual loss to treat any ore much below this figure.

As it is difficult to secure from month to month the exact quantity and grade of ore desired, especially where the deposit is irregular, it would be well to set a limit on the permissible grade of ore somewhat higher than the theoretical—in this case say at $3. This could be adjusted to suit conditions as indicated by observations over a period of time.

It is a mistake to think that the bullion output of a mine is any indication of whether it is being worked at its best advantage. The manager may call for 4000 tons of $7 ore. The stopes in this particular month can produce 3000 tons of $9 ore, so the miner stopes a little wider and adds 1000 tons of $1, still keeping the average at $7, but at an actual loss to the mine of from $1300 to $1700. This emphasizes the necessity for careful sampling and direction underground.

In these examples a maximum tonnage of 10,000 tons has been considered. Cases may arise in which it will be more profitable to run the mill at less than its full capacity. Where the tonnage is reduced to three-quarters or one-half its full capacity it may be advantageous, instead of running a part of the stamps the full 24 hours, to run the full number for 12 or 18 hours, and thus effect a saving in power and the labor of one shift. And if the mine is incapable of supplying the demands of the mill, why not build a smaller mill in the first place? This is where there is the greatest need for the judgment of an engineer.

Mining in Spain

Mining companies in Spain totaled 22,463 at the last census. The mineral riches of the country furnish one of its chief hopes of future prosperity. The surface areas of the workings already open cover nearly 1,000,000 hectares, or about 2,500,000 acres, an increase in area of over 25% during the last decade. In the same time the output of coal, iron, and copper have increased, while that of lead has remained about stationary. The chief provinces where mining as an industry is in the front rank are Huelva, Oviedo, Murcia, Viscaya, Jaen, Ciudad Real, Cordoba, Santander, Badajoz, Almeria, and Leon. These provinces account for 90% of the output of minerals of the peninsula. Copper predominates in the Huelva district, quicksilver in Ciudad Real, and anthracite in Cordoba. Viscaya furnishes 30% of the entire iron production, Murcia 5%, and Almeria 2%. Coal leads in Oviedo, Cordoba, and Leon, salt in Alicante and Cadiz, lead in Ciudad Real and Cordoba, zinc in Santander and Murcia, lignite in Teruil, silver in Guadalajara, manganese in Oviedo, asphalt in Alava, and antimony in Leon. As a corollary to the Spanish mining industry, what is technically known as the 'transformation branch' has made even a more remarkable advance of late than the extraction of ore. During the past 10 years the production of coke has been doubled, and iron and steel likewise; silver smelted has increased 50%, cement 150%, mercury 30%, asphalt 200%, pig iron 300%, and patent fuel 35 per cent.—*Daily Consular Report.*

MINERAL PRODUCTION of Queensland, Australia, in the first quarter of 1914 was valued at £441,180, which is £94,457 less than for the same period of 1913. Copper showed a reduction of £84,508, but molybdenite had an increase from £668 to £6628.

MILL OF THE AURORA CONSOLIDATED MINES COMPANY.

The New Aurora Mill

By An OCCASIONAL CONTRIBUTOR

The sale of the control of the Aurora Consolidated Mines Co. of Aurora, Nev., to the Goldfield Consolidated Mines Co., for almost $1,000,000, brings to light some interesting facts. It demonstrates that there is a demand for good mining properties with no lack of purchasers; that there is a chance for old camps to revive; that new methods in milling are making millions of tons of low-grade ore profitable, and that the distance from a railroad does not deter the building of an excellent mill and equipping the property throughout with the most efficient and up-to-date machinery.

Just before the sale of the control of the property by Jesse Knight to George Wingfield and Albert Burch, representing the Goldfield Consolidated, there were in Salt Lake City four other interests actively bidding. It required $388,000 in cash to close the bargain, with notes from the Goldfield Consolidated endorsed by Mr. Wingfield for the remainder. Among those who made verbal or written offers for the property were Morton Webber; a Toronto engineer, representing Ellis P. Earle, president of the Nipissing; John W. Finch, representing the Amalgamated Copper interests; representatives from the United States Smelting, Refining & Mining Co., and O. J. Salisbury, of Salt Lake City, who is believed to have represented certain porphyry copper interests.

Early History

In the sixties, Aurora was one of the big mining camps of the West, as witnessed by the ruins of the buildings. It was in this camp that Mark Twain made his home, and so down at the heel was he at the time, it is said that he collected champagne bottles and scattered them about his back door to give his little cabin an air of prosperity. During the life of this camp it is reported to have had a production of $30,000,000 and no less than 13 mills were built at the various mines. When work was first started on the Aurora Consolidated in September, 1912, there was by actual count 14 people in the once flourishing town. Today Aurora has about 300 inhabitants, and there are nine places where liquid refreshments are poured.

The nearest railroad point to the camp is Thorn, Nev., on the Southern Pacific, from which there are two stages running to Aurora each day, covering the 32 miles in about two hours time. On account of the grade all the freighting into the camp is by way of Hudson, Nev., on the Nevada Copper Belt Line, which is a distance of 62 miles from Aurora.

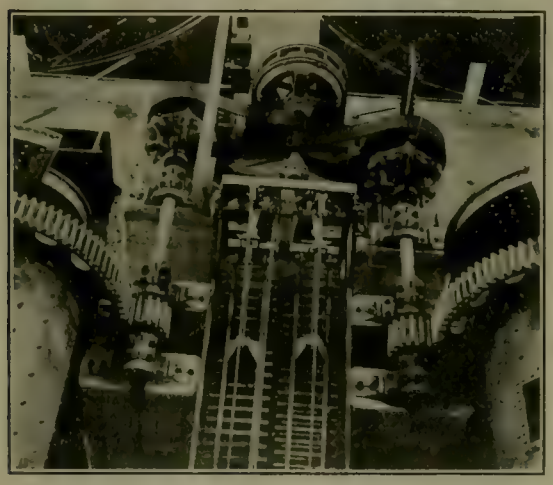
It was in 1912 that Charles E. Knox and John H. Miller secured an option on the Cain Consolidated Mining company property, which owned the principal mining claims in the camp of Aurora. They succeeded in interesting Jesse Knight and the Aurora Consolidated was organized. In September of that year work was started in a small way and continued until June 1913, when it was decided to build a 500-ton mill. W. Lester Mangum was made general manager. Morris P. Kirk and John H. Leavell of the firm of Kirk & Leavell, were given instructions to design the mill, and Mr. Leavell, with the title of manager, was placed in charge of the development of the property and the construction of the mill. Mr. Kirk became the consulting engineer. Ground was broken for the mill on June 20, 1913 and on June 15, 1914, the crushing of ore was started. Since then the amount handled has been gradually increased.

Although the number of mining claims brought into the Company by the Cain Consolidated was quite large, many more have been added. The management of the Aurora has during the past year purchased a number of others, until today there are some 52 claims held under patent or in the process of patenting. Embraced in this territory are some of the most famous claims of the camp, having between 30,000 and 40,000 ft. of underground workings.

The Aurora mine is opened by a long adit which is now being extended from the Humboldt shaft workings toward the Del Monte or Last Chance hill country, with branches to the Durand shaft and the Juniata mine; opening these workings at a depth of about 500 ft. The Last Chance hill was famous in the early sixties and eighties as a producer of high-grade ore. From local sources its production is estimated at over $20,000,000, the entire output having been won between the surface and the 200-ft. level, at which point the veins were lost. In some of the old pillars today in this part of the property are to be found pieces of gold ore that will carry from $4000 to $5000 per ton in gold.

Del Monte Shaft

At the Del Monte shaft there is an old Cornish pump, which at the time of installation, was the largest in the United States, and cost, laid down at Aurora, about $150,000. It was hauled by team from Stockton, California. The corner-stone of the building that housed this installation has carved upon it in large letters, 'Wild West Mining Company, 1862.' This block of stone weighing several tons is now used as a mantle-piece for the fire-place in the manager's cottage.



MOTOR DRIVING TWO TUBE-MILLS.

The ore is chiefly gold, with a small amount of silver, averaging close to $5 per ton and disseminated quite evenly through a hard quartz. The quartz veins vary from 30 to 80 ft. in thickness and run through an andesite formation. On account of the hardness of the rock scarcely any timber is necessary. The mine has been developed for mining by the shrinkage stope system, to which the property seems particularly adapted. It is estimated that the cost of mining will be $1 per ton or less. The mine is electric lighted and equipped with an electric haulage system.

The ore is drawn from the chutes into 20 car trains, drawn by a 4½-ton electric locomotive. The cars are double truck, side dump, and were especially designed for the work. From the mine the train travels over a short tram to the mill. The cars are automatically weighed, no stop being necessary. They then pass over the steel ore-bins where they are dumped for the coarse crushing plant. The trains then make a complete circle and come back to the main tracks.

From the coarse-ore bins, which are of steel, the ore passes through a 7½ Gates crusher. Thence it passes over a Gates screen, where everything over an inch and a half is sent on to two No. 5 Gates crushers, where it is reduced to 1½ in. Joining the undersize from the screen, it passes to the conveyor belt and is carried to the head of the mill, where it is further elevated by a Gates elevator, carrying it to the sampling plant. A 500-lb. sample is taken each day from the 500 tons going through the plant.

From the sampling plant the ore passes to another conveyor by which it is carried to four steel ore-bins having an aggregate capacity of 1600 tons. From this point the ore passes through feeders to the stamps, where it is crushed to pass a quarter inch. From the stamps the ore passes to Callow tanks and then to Dorr classifiers. Thence it goes to 6 by 16-ft. tube-mills and a second Dorr classifier, where the — 200-mesh material is taken out. The + 200 goes to a second tube-mill where it is reground until all material passes 200 mesh.

From this point the ore goes to three Dorr thickeners where it is reduced to a consistency of one to one. From the thickeners it passes through a series of 5 Dorr agitators and from the agitators to 4 Trent replacement machines, where most of the gold in the cyanide solution is replaced with water. From the replacement machines the pulp goes to three Trent filters where a large portion of the remaining cyanide solution is taken out, the tailing going to waste.

From the Trent replacement machines and the Trent filters the gold cyanide solution flows by gravity to the lower end of the mill where it is pumped through Merrill clarifying presses, which are set on the thickener floor. From this point the gold solution flows by gravity through two Merrill precipitating presses, where the precipitate is separated from the solution and sent to the refinery, and the barren cyanide solution is pumped to the stock tanks at the head of the mill. There they are enriched before being started through the mill again.

Heavy Stamps

Several unique features have been incorporated in the design of this mill. One of these is the heavy stamps that are used. These weigh 1660 lb. each, being among the heaviest in use in the United States today. Heavier stamps have been used with much success in gold mining practice in the Rand. The stamps are in batteries of five. Each battery is driven by an individual back geared motor of sufficient power to lift the stamps from rest and start them going without the necessity of hanging them up.

The 6 tube-mills, as previously stated, are 6 by 16 ft., which is a radical departure from the type of mills heretofore used in this class of work in that they are larger

in diameter and shorter in length. They are even capable of handling about 100 tons per day of stamp feed, crushing to 200 mesh. The tube mills are arranged in units of two mills. Each unit is driven by a 150 hp. motor with outboard bearings and Morse silent chain drives.

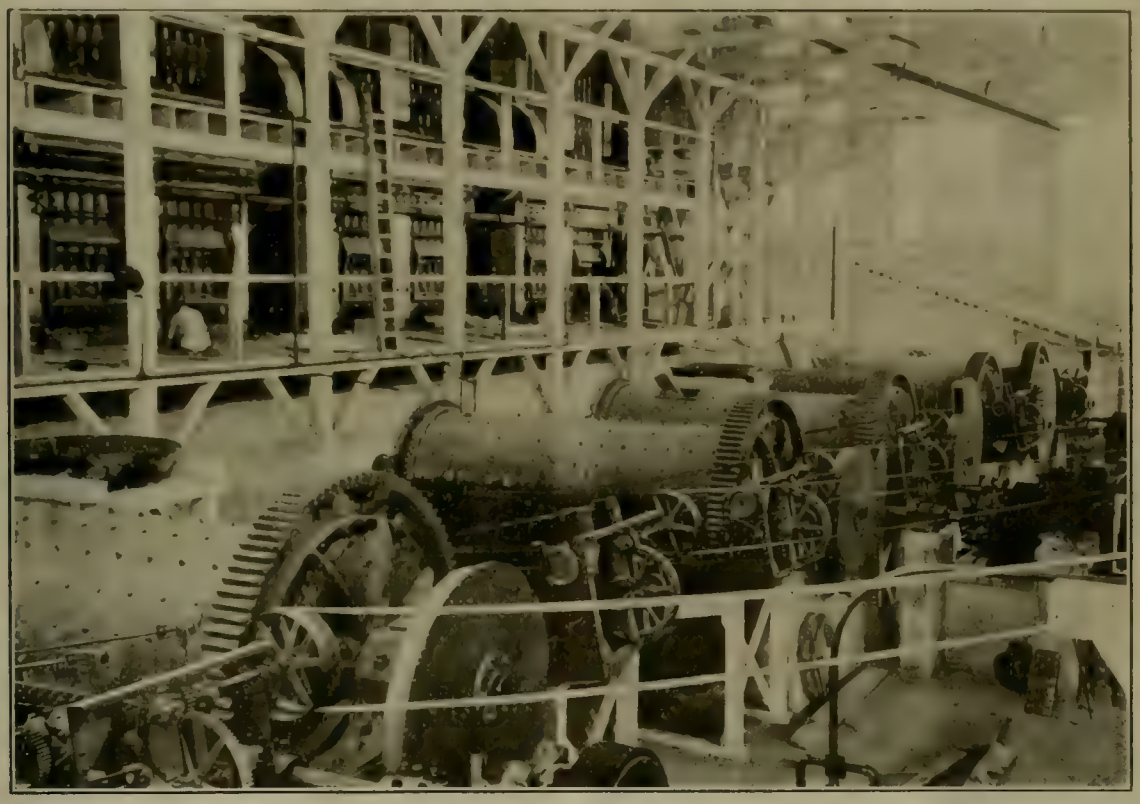
The 6 Dorr classifiers which feed these tube mills are unique in the fact that they are the largest thus far constructed. The classifiers are driven by a 5-hp. motor driving a line shaft, which is the only one in the mill. The thickeners, agitators, and replacement machines are all individually motor driven. On the lower floor of the mill all the pumps are assembled in one room and are driven by individual motors.

Another feature of the plant is the automatic incline electric elevator. On the opposite side of the mill from the conveyor is the elevator which runs up and down from the top of the mill to the bottom to facilitate the men traveling from one end of the mill to the other and also for the delivering of supplies to the different floors. The Trent replacement process which is in use at the mill has been tried out for over a year in Arizona in various plants and has met with considerable success.

Electric power is used throughout at the mine and the mill. This is furnished by the Pacific Power company, a subsidiary corporation of the Nevada California Power company. The power line is also connected with the main Nevada California power line so as to insure a constant flow of electricity. The current is delivered at the property at 60,000 volts and is transformed down to 440 volts for mill purposes.

The property is probably one of the best equipped in the country with machine shop, blacksmith shop, carpenter shop, assay office, warehouse, club house, main office, boarding houses and bunk houses for 150 men, superintendent's residence and cottages for various officials. The machine shop is equipped with a full outfit for repairing machinery of all kinds. It is said that there is hardly anything at the mill but what could be repaired in the shop. It has a 20-ft. lathe, planers, an oxy-acetylene welding outfit, and all kinds and grades of tools. The carpenter shop is equally as well equipped.

The mill has been well arranged for convenience and economy. It is declared that when running at full capacity only 18 men will be necessary to handle the full tonnage every 24 hours. This provides for a mill crew of four men working each eight hour shift, a repair crew of four men, a superintendent, and a metallurgist.



INTERIOR OF THE AURORA MILL.

LEAD, SILVER, ZINC AND ORE SHIPMENTS from Broken Hill, New South Wales, in April were valued at $1,830,000.

MEN EMPLOYED at the Mt. Lyell properties, Tasmania, total 2100.

Simple Mine Accounts

Mine accounts are often more elaborate than a medium-sized mine warrants. Little mines often stagger under a ponderous system of red-tape which the chief clerk or cashier adopted from a big operator's system. In general, mines are not propitious places to quibble over bookkeeping technicalities. If the master mechanic wants a man-hole gasket and 'wants it quick,' he does not like to have to make out a lengthy requisition for it and charge it to the proper subdivision of the proper department; and if he is too much bothered by forms and clerical details, he will likely lose the company more money taking time to grumble over its inconsistencies than the extra red-tape will save.

In the Lake Superior iron ore district many of the medium-sized mines keep a fairly well-stocked warehouse and hire a supply clerk to tend it; frequently, he is also timekeeper, and he makes out the monthly payrolls, charges and delivers supplies promptly, perhaps keeps track of cars of ore shipped, and is a valuable unit in the force and picks up many details whereby he can save the company money.

Forms 2 and 3, the 'Oil Sheet' and 'Explosive Sheet,' are simple yet convenient methods for the supply clerk to keep track of supplies used in the different departments. At the end of the month he can total up quickly the amount of cylinder oil used in the engine house, the boiler house, pumps, etc., the amount of black oil used for underground cars, etc. Then, of course, the engine-house items are apportioned to shaft-sinking, driving, hoisting accounts, etc., according to how much of each relatively was done during the month. The oils and explosives are, by no means, the only classes of supplies which can be kept track of on a tabulated form. Whatever items are used in large amounts at any particular mine, such as perhaps timber or pipe-fittings, can be conveniently recorded on a sheet ruled by the clerk to suit his ideas of the matter. This is a more efficient method of keeping track of supplies than the complicated 'countersigned' order blanks sometimes afflicted upon a mine by its Eastern secretary or auditor. If the mine clerk is overwhelmed with red-tape so that he has little time for anything else, he cannot go out for an occasional walk around the plant and observe that a car of rails is being unloaded in the wrong place, or that the mine boss left the powder magazine door open and a cow has wandered in there.

The superintendent usually does considerable figuring, comparing, and planning over the monthly cost sheets. It is his guide and prompter; and it should be in his hands as soon as possible after the end of the month. At Lake Superior, the different accounts to which labor and supplies are apportioned and charged, include some twenty or thirty divisions of the mine work with items of exploration, development in rock, development in ore, pumping, stoping, hoisting, underground haulage, steam, air, and water lines, etc. It is also customary to tabulate on the cost sheet, a classi-

MONTH OF JULY 1912 SUPPLIES USED IN DIFFERENT ACCOUNTS	EX PLOSIVE	MINING TIMBER	[illegible]	NAILS [illegible] SPIKES	TOOLS	[illegible] DRILL PARTS	[illegible]	ETC.	ETC.	[illegible]			
SHAFT SINKING FORTY BOXES POWDER.	240.												
2 DRILLS $300 4 BOXES CANDLES, $16. ETC						300.	16.						
ETC. ETC (SHAFT SINKING TOTALS)	[illegible]	18.60	2.70			300.00	16.00						
STOPING 1500' MINING TIMBER.		75.											
40" 60 D NAILS, ETC. ETC . ETC				1.20									
(STOPING TOTALS)	1042.00	75.00	10 41	[illegible]									
[illegible]													

FORM 1.

OIL SHEET

	ENGINE HOUSE	BOILER HOUSE	PUMPS	U G CARS	MISCELLANEOUS
CYLINDER OIL	5 5 5 5 Total 22 gals	3 3 . Total 7 gals	5 1 5 Total 11 gals		
ENGINE OIL	5 5 5	3 3	.		
BLACK OIL				5 5 5 5 5 5 Total 30 gals	
KEROSENE					
WASTE (WEEK)	10" 10" Total 20 "				

FORM 2.

EXPLOSIVES

	SHAFT SINKING	DRIFTING	STOPING	ETC	
DYNAMITE 40%.	[illegible] Total 40 Boxes				
FUSE	[illegible] Total 20 Rings				
CAPS, ETC					

FORM 3.

fication of the supplies used, so that the superintendent can see just how much timber, oils, and waste, explosives, candles, tools, rock drill parts, pipe and pipe fittings, rails and track supplies, etc., were consumed during the month. For conveniently arriving at the total cost of each classification of supplies used in each account of activity around the mine, a sheet having the general scheme of 'Form 1' is often used. This is a large sheet, ruled at the printer's, and perhaps several will be required at the end of each month, as all the records of supplies used during the month are transferred to it, including the contents of the 'Oil Sheet' and 'Explosive Sheet,' which can then be destroyed. This 'Form 1' is made out either by the supply clerk or the bookkeeper, and is then used in making up the cost sheet, as it furnishes a complete record of all supplies used and their costs.

For convenience in adding up the number of shifts which each man has worked, when payment is made monthly, time-books can be bought which have an extra column at the end of every week, in which the number of shifts for the preceding week can be marked, six (or five, perhaps) per man. Then at the end of the month, it is comparatively easy to add up the four weeks totals, rather than to have to count up twenty-five or so shifts one by one.

Kennedy Extension-Argonaut Decision

The following opinion was delivered by Judge Fred M. Wood, in the Superior Court of the State of California, in and for the county of Amador, in the case of the Kennedy Extension Gold Mining Co., plaintiff, *v.* Argonaut Mining Co., defendant, June 29:

The plaintiff in this case is the owner of the Muldoon quartz mine and millsite, a portion of the Jackson quartz mine, and a portion of the Jackson placer mine, embracing an area of 54 acres, contiguous territory. The defendant is the owner of the Pioneer quartz mine, adjoining plaintiff's property on the west, of the pioneer millsite and the Volunteer quartz mine, adjoining plaintiff's property on the north, and of the portion of the Jackson placer mine lying east of the Jackson quartz mine.

The plaintiff became the owner of its mining property in May 1909 and commenced operation of the property in the month of October following. Upon the Muldoon quartz mine there have been sunk two shafts, one of them to the depth of 1000 ft. with levels and crosscuts. Upon the Jackson quartz mine there has been sunk a shaft. No ore has ever been mined or milled by plaintiff, or its predecessors in interest, from any of its property mentioned. All the work that plaintiff has ever done, since its acquisition of the property, has been to clean out the old workings, and perform such other work as it deemed important to establish its claim in this action, and all of the property was idle for many years prior to plaintiff's ownership.

The defendant purchased its property in the year 1893, from the Pioneer Gold & Silver M. Co. Previous to the time of the acquisition of the property by defendant, a shaft had been sunk to a depth of some 70 ft. through the lava-cap lying over the apex of the Pioneer vein, and thence a drift extended northward a distance of 70 ft. along the vein. A tunnel was started in the Volunteer quartz mine, and driven 520 ft. to the Argonaut vein, and drifts driven north and south along the vein. Various other work of minor importance had also been done when, in 1893, the defendant started a shaft on the Pioneer millsite about 430 ft. down the slope and east of the apex of the Argonaut vein, and sunk it to the 1460-ft. level. This shaft was started on the millsite for the purpose of getting dump room, and to obtain sufficient pressure from the reservoir on the hill. Subsequently stations were cut, and levels opened, and stoping done from the 1200-ft. level upward to the 290-ft. level, where the shaft intersects the vein. In the regular and customary course of mining, the defendant extended its shaft, opening and developing various levels, and mining and milling the ore and minerals until, at the time of the trial, the shaft had been sunk to the 3900-ft. level on the incline. In developing the mine below the 1240-ft. level, and following what it claimed to be its vein or lode, the defendant company extended its levels, drifts, and openings, and extracted therefrom, and removed, ore and minerals of the value of many thousands of dollars, much of it underneath the placer lands owned by the plaintiff and its predecessors in interest. The damages caused by the removal of these ores and minerals are the subject of this litigation.

Claim of the Plaintiff

On the part of the plaintiff, it is claimed that the lode or vein from which these ores and minerals were taken formed no part of the so-called Argonaut vein or lode, and that it, plaintiff, is entitled to recover the value of all the ore and mineral mentioned, upon either one of two grounds: (1) its common-law right to the ownership of all minerals lying underneath the surface of its property, when not extracted from a vein having its apex within the exterior boundaries of land belonging to other persons; (2) that the ores were extracted from veins having their apices within the Muldoon quartz and Jackson quartz mines, extended downward within vertical planes of the end lines of such claims.

The defendant asserts, in its defense, that the orebodies mentioned were all obtained from, and formed a part of, the so-called Argonaut vein, having its apex within the surface boundaries of the Pioneer quartz mining claim.

As to the plaintiff's claim under the common-law right to ownership of the ores, the same may be elimin-

ated from discussion, for it can be sustained only by disregarding practically all the oral testimony of the witnesses, and the opinion of the experts. The real controversy in the action is waged over the location of the apex of the vein from which the minerals were extracted, that is: whether the ores were taken from veins having their apex within the surface of plaintiff's or of defendant's land, and the respective claims of plaintiff and defendant are based upon Section 2322 of the Revised Statutes of the United States.

Plaintiff's claim, under such apex right, to the ownership of the ores and minerals mentioned, is based upon what it terms the Jackson vein, by virtue of a union with the Muldoon gouge vein below the 950-ft. level of its mine. No continuous development of the vein has been made. It is not the discovery vein upon which the patent to the claim was issued, but developed exposures have been made upon which plaintiff has founded theory upon geological movements causing the formation of the great Mother Lode; that the Mother Lode fissure is a normal fault with a displacement of some 700 ft., and not an overthrust fault, as described by F. L. Ransome in the Mother Lode folio of the United States Geological Atlas; that instead of there being one vein with branches as claimed by defendant, and heretofore generally supposed to exist, there are a number of veins, formed at different periods of time, which by their faulting must have prevented any connection between the pioneer vein and the vein from which the ores and minerals in controversy were extracted.

It can serve no useful purpose to enter into a discussion of the testimony of many hundred pages given by experts in support and refutation of this theory. Upon the trial, the impression was strong in the mind of the Court that there was great probability of the correctness of this theory, and after a subsequent examination and consideration of the record, there is no attempt on its part to reconcile it with the positive and preponderating testimony of practical men engaged in mining, and familiar with the conditions in this mining district. Before this Court, however, will say that these men are all mistaken, and make a finding that will take the property in the possession of the Argonaut company, and award it to plaintiff, upon a speculative theory as to the convulsions and workings of nature countless ages before the time of man, it will require something more than a strong opinion as to the plausibility of a theory. As was said by the Supreme Court of Utah, in Grand Central Mining Co. *v.* Mammoth Mining Co., 83 Pac. Rep., at page 674:

> Science has not yet unfolded all of Nature's intricacies, and in all probability never will, to such an extent that the fallible human mind can fully grasp them, though indications may be revealed. To look at a mountain is one thing, but to look into the inner recesses of the earth, through surface indications is another. Every geologist, every miner, knows that, in determining the contents and actual conditions of a mountain by surface indications, even with extensive workings, which, after all, constitute but slight explorations compared with the whole mass, such difficulties are necessarily and invariably encountered as to produce differences of opinion, considering the same physical facts. Inductive reasoning has not attained such a high state of perfection as to lead all men, viewing the same parts, to the same conclusion as to the whole. This is especially true when the investigation of a portion of a thing is attended with great difficulty. In cases of stratified rock, where the beds are regular, it is comparatively easy to determine the location of a vein; its strike and dip; but where the beds are broken, tilted, and fractured, and in places fissures running in all directions, the investigation of one party may lead to very erroneous conclusions as to the formation and contents in general, or as to the location and course of a particular section or ledge, a small part of its location and course only being definitely known.

The mining laws of the United States are framed upon the ideas of the practical miner as to what constitutes a lode or vein, rather than those of the geologist. In this case, the testimony of practical miners, familiar with the conditions upon this part of the Mother Lode, is overwhelming that the Argonaut vein is continuous from the apex to the lowest level. Needless to state, all the expert witnesses for defendant concur in that testimony.

While the plaintiff in this case relies upon developed exposures only to substantiate its theory, and its claim to extralateral rights by virtue of its apex location, it contends that continuous development by defendant in its workings has disclosed interruptions or breaks in the so-called Argonaut vein which demonstrates that there is no continuity of the vein shown, as required by law. This, to my mind, seems to be the most serious objection to the adoption by the Court and qualified mining men of the inference of these experiences.

The Continuity of Veins

No arbitrary rule has been laid down which defines exactly what must be shown in order to establish the continuity of a vein. In speaking of this subject it was said by the Supreme Court of Montana, in Butte & Boston Mining Co. *v.* Societe Annonyme des Mines de Lexington, 75 A. State Rep., 513:

> "Laws of continuity," says Webster's Dictionary, "the principle that nothing passes from one state to another without passing through all the intermediate states." Speaking exactly by this definition, it would often be very difficult, if not impossible, for the challenged proprietor of a mineral vein to convince a jury of the continuity of a vein from one part to another, for there might not be continuity by actual contact of the parts of contiguity, which the precise word may literally mean must exist. Were such a rule inexorable, a failure of proof would not infrequently be brought about by the inability of the miner to prove continuity without transition through intermediate states. The miner, therefore, might fall short of that exact measure of evidence required to establish a continuity of vein which excludes any interruption between one and another part of the identical thing, and, judged by too closely interpreted significations, the continuity of the vein would be lost. * * * Now, the miner's object is to disclose and mine the mineralized portion of the vein, and to do so economically. But he will not necessarily continue his exploitation from an initial point. He may work at numerous points on the vein, or he may drive a tunnel through extraneous rock to tap the vein at a point quite remote from his other workings.

It was said by the Supreme Court of the United States in Iron Silver Mining Co. v. Cheesman 116 U. S. Rep., 529; 29 L. Ed., 715:

Now a vein containing the precious metals is by no means always a straight line contact of uniform dip or thickness or richness of mineral matter throughout its course. Generally the veins are found in what when the mineral is taken out of them constitute clefts or fissures in the surrounding rock, with a well defined wall above and below of different kinds of rock, as porphyry on one side above or below, and limestone on the other. So long as these enclosing walls can be distinctly and continuously traced, and the mineral matter of the same character found between them, there can be no doubt that it is the same vein. But sometimes the cleft between the enclosing rock, called in mining parlance the country rock, diminishes so as to be scarcely perceptible. Sometimes for a short distance the fissure disappears entirely, and again is found distinctly to exist a little further on. Again it is seen that, although the underlying and superposing country rock is there, the mineral deposit ceases to be found, but following the fissure it reappears again very soon. It also happens that both fissure and mineral come to an end and are found no more in that direction, or, if found, so far off or so deflected from the original line as to constitute no part of that vein. Of course, it is sometimes easy to see that it is the same vein all through. It is also easy to see in some instances the vein has run out, has ended. But there are other cases, of a class of which that before us is one, where it is a matter of extreme difficulty to lay down such rules for the guidance of a jury as will best aid them in arriving at a just verdict.

The Mother Lode Folio of the Geological Atlas of the United States at page 8, says:

Thus there may be many small veins or stringers together constituting what has been called a stringer lead, or stringer lode. Most of the large mines of the Mother Lode are upon leads of this character, and their veins are really aggregates of many veinlets.

W. H. Wiley, a witness for defendant, testified at the trial:

Veins, as I have seen them, are rarely distinct planes with two defined walls and one streak of quartz or other material between them, but they are usually complex, and in the case of the Mother Lode, there is no variation from this rule of complexity. They have been termed stringer veins. It is an apt designation in describing portions of these lodes.

J. W. Finch, an eminent geologist, a witness for plaintiff, in speaking of the Jackson vein, said:

With its parallel stringers of quartz, there is a representation of a true stringer vein.

Other testimony in reference to stringer leads might be quoted, but that of these two gentlemen is selected because they were chosen by the respective parties to the action to accompany the Judge of this Court upon the view of the property, to point out for inspection the various places deemed important to be seen, to obtain a fair understanding of the testimony given to support the theory of each side. If a vein were always an ore-bearing filling of a single fissure, the difficulties encountered in this case and the wide divergence of experts' opinions would not exist. However, tested by the foregoing quotations, from the opinions of the Courts and of geologists it does not seem that the inference drawn by the witnesses who are experienced in mining development in this district, is unwarranted by the evidence, when they say that the so-called Argonaut vein is continuous in its downward course through the placer lands of plaintiff, even though admittedly short interruptions in the vein are shown to exist.

In the presentation of its evidence to substantiate its claim by virtue of its apex rights, the burden was upon the plaintiff, Kennedy Extension Co., to show, by a preponderance of evidence, the apex and continuity of the Jackson vein, in order to overcome the evidence on the part of defendant in its attempt to show apex and continuity of the Pioneer vein; that it to say, that if the conditions were reversed, and plaintiff had been in possession, and mined the ore and minerals from a segment of the vein in dispute, under a claim that it constituted a part of the Jackson vein, less satisfactory evidence would be required to retain them than is now required to recover their value from the defendant, Argonaut company.

As before mentioned, there has been no continuous development to show the continuity of the Jackson vein. In support of its claim, plaintiff relies upon surface cuts, an exposure in the 180-ft. level of its mine, with drifts and upraises therefrom, an exposure in the 400, the 800, and the 950-ft. levels, with raises and cross-cuts on this last-mentioned level, below which it is claimed that there is a union with the Muldoon gouge vein, which connects it with a vein from which the ores and minerals in dispute were extracted. The patent for the Jackson quartz claim was applied for upon a discovery vein other than the so-called Jackson vein.

It devolved upon plaintiff, in its claim of extralateral rights upon this secondary vein, to show the existence of the vein to an extent necessary to cover that part of the vein in dispute, from which the minerals and ores in dispute were taken.

Hayman *v.* Wheeler, 29 Fed. Red., 347.
Argonaut Con. M. & M. Co., *v.* Turner, 48 Pac. Rep., 685.

Apex of Discovery Vein

Now, it is claimed that this apex comes to the surface and is not what is known as a blind apex. A series of cuts or trenches was made, which it is claimed show the course of this apex. Every witness for defendant, practical miners and experts, are positive that nothing is disclosed in these cuts which can be called a vein. As to the witnesses for plaintiff: Mr. Perry stated that a fissure was shown in each one; that there were numerous stringers of quartz east of the fissure, irregular and running in different directions. Mr. Devereaux, who had had more experience in mining upon the Mother Lode than any of the other witnesses for the plaintiff, in giving his testimony as a witness for plaintiff, said, that these stringers of quartz are a common occurrence in a slate country, whether near a large vein or not, and, as to some, he did not consider them a part of the Jackson vein. All the witnesses for plaintiff, however, are posi-

tive that the Jackson apex is sufficiently disclosed. The indications specified, with the other testimony, are sufficient, of course, to warrant an inference of the existence of the apex, but they also indicate that a different inference may be drawn. To me, however, it seems difficult to understand how this vein, with its apex at the surface, should remain undiscovered until the commencement of this action, after so many years of mining activity in this country.

There are vexatious and embarrassing questions involved in this case, some of which seem to be impossible of an entire and satisfactory solution by the human mind, looking at them from an impartial standpoint. Each side, apparently, can see no merit in the claim of the other, but, viewing the entire testimony of each side, weighed in the scales, it seems almost evenly balanced; but, as before indicated, this Court is largely influenced in its decision by the preponderance of the testimony of practical mining men familiar with its history, and its disinclination, upon the evidence produced, to take the property from the possession of the Argonaut company, which it has obtained by its discovery and labor in prosecuting the work upon what it had every reason to believe, and was generally supposed, to be the Argonaut vein. It was the intention of the Court to discuss in detail many of the interesting features of this case left untouched, but the opinion has been delayed through sickness and pressure of other labors, and undoubtedly both parties to the litigation will find more satisfaction in the announcement of a decision than in the perusal of a protracted opinion.

The Court is of the opinion and decides that the continuity and identity of the Argonaut vein is sufficiently shown to meet the requirements of the law; that the evidence does not satisfactorily establish the course of the apex of the Jackson vein: that the defendant, Argonaut Mining Co., is entitled to retain the proceeds of the ores and minerals extracted from the segment of the vein in dispute, and to a judgment for its costs. Let findings be prepared accordingly, and served and submitted in accordance with the statute.

Production and Uses of Tungsten

By O. J. STEINHART

Much erroneous information from time to time appears with regard to the metal tungsten and its minerals, so that some notes on the subject, especially with regard to the commercial value and uses of these minerals, may be of interest.

The most important of the tungsten minerals are wolframite, or wolfram as it is generally called, hübnerite, ferberite, scheelite, and wolfram ochre, or tungstite. Wolframite, hübnerite, and ferberite are essentially tungstate of iron, with varying percentages of manganese, and contain up to 76% of tungstic acid (WO_3). Scheelite is tungstate of lime, and contains as much as 80% WO_3 when pure.

As regards the occurrence of tungsten minerals and their main geological associates, it may be briefly stated that they generally occur in the older rocks of pre-Cambrian and Cambrian periods. Wolframite is also found in quartz veins in granite and also in pegmatite, often near and in contact with metamorphic schists.

Tungsten minerals are frequently found in conjunction with cassiterite. Their separation from the latter generally offers no serious difficulty by means of electromagnetic methods, but it is a difficult problem sometimes to separate very finely crystalline tin oxide and wolframite, especially in the presence of sulphides and arsenides. Such mixed concentrates have to be roasted, with the result that the cassiterite becomes coated with a fine layer of magnetic iron and is attracted by the magnet, so that further chemical treatment is necessary. In milling mixed tin-wolfram ores it is generally found that the losses of wolfram are greater than those of tin.

Many misstatements have been made as to the uses of tungsten. Writers have often copied notes in books on chemistry to the effect that wolfram is used to a considerable extent today in the textile industries and for the manufacture of certain bronzes. The total amount of wolfram consumed for this purpose would not exceed a few hundred tons. By far the most important application of tungsten metal and ferro-tungsten is the manufacture of self-hardening high-speed tool steel, which contains as much as 20% tungsten in conjunction with smaller proportions of other metals.

Another important application for tungsten is the metallic filament lamp. The consumption of metal, however, for this purpose is of subordinate importance, for one ton of wolframite should suffice to make 18,000,000 incandescent lamps.

It is also reported that tungsten is used in the manufacture of armor plate, but as facts referring to this subject are naturaly kept secret by the various governments, definite information is difficult to obtain. A further use, which, however, is not of great importance, is the employment of tungsten steel for the permanent magnets in telephones.

Prices are often based on 65% WO_3, and deduction of 2d. to 3d. per unit made for every unit below 65% down to 60% WO_3, below which figure a still greater deduction is demanded by buyers. It may be said that wolframite and its varieties form by far the greater portion of the world's supply, and scheelite is of secondary importance. Scheelite generally realizes from 1 to 3s. per unit less than wolframite.

Wolframite is easily identified by means of its streak, which is reddish brown, as compared with tin oxide, which is much harder and of a grayish white. If tungsten-bearing minerals are powdered and boiled for a few minutes with strong hydrochloric acid and metallic zinc added to this liquid, the yellow tungsten acid suspended and in solution will change its color to blue, owing to the formation of lower oxide of tungsten.—*Financial Times.*

DISCUSSION

Readers of the MINING AND SCIENTIFIC PRESS *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Tin Mining in Tasmania

The Editor:

Sir: In your issue of January 17 is a letter by M. G. F. Sohnlein, under the above heading, referring to an article by Mr. Tait of October 18 dealing, among other things, with the Anchor mine. As published in the yearly report, the figures are confusing.

There are two mines worked together, the Anchor and the Australian, the items (1) total ore treated, 104,732 tons; (2) black tin saved, 188.6 tons, includes both mines. The tin per ton, 3.42 lb., referred only to the Anchor mine. The correct figures are:

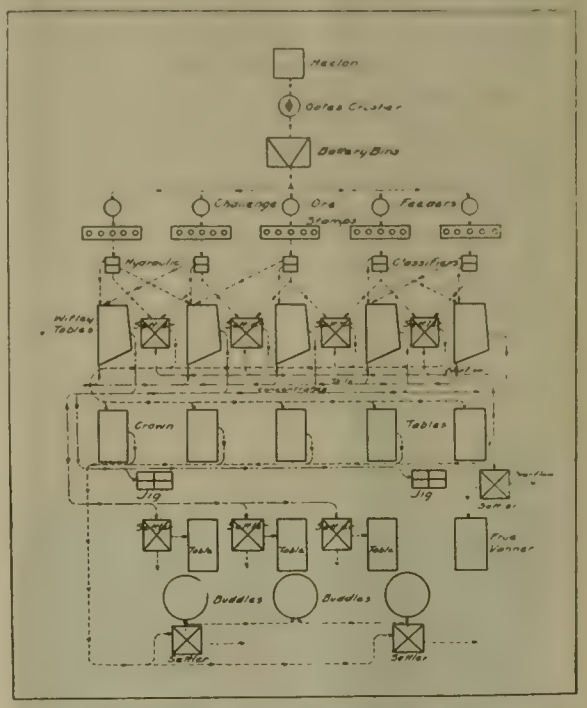
	Anchor.	Australian.
Stone crushed, tons	76,197	28,525
Black tin saved	134 t. 7 cwt.	63 t. 19 cwt.
Pounds per ton	3.42	5.02
Tons per stamp in 24 hours	5.38	6.11
Cost	3/6	3/6¼

These appear in another portion of the report. In all cases long tons of 2240 lb. are referred to.

His other assumption, however, that 50% is lost, is not borne out by experience. From our sampling, grab samples from the ore on the way to the battery, periodical sampling of pulp from the mortar boxes, individual sampling of tailing from different tables, and continuous automatic sampling of all the tailing, my conclusion is that the loss is not nearly so great. An examination and a sampling of the tailings deposited in the stream and on the flats below the battery, indicates a still smaller loss. As I am not satisfied with any of the results, however carefully they are worked out, I do not care to publish them. At the same time, it does not appear to me that the loss is greater at any time than 25%, that is, on Anchor ore—it would probably not exceed 1 lb. of oxide per ton of ore treated. On Australian mine ore, the proportion would be less.

It is only of late years that the Australian mine has been worked, and the average value of the ore for about ten years at the Anchor mine was 3.42 lb. oxide. The period referred to in the editor's footnote, in which a loss of $8500 was incurred, was for the financial year 1909-10. In some years a fair profit was made; for instance, in 1906-7, 153,738 tons was treated for a return of 2.206 lb. of metallic tin per ton, or 3.28 lb. black tin, at a cost of 55 cents; for that year 87.24% stamps crushed 5.85 tons per stamp in 24 hours, with a net profit of over £5000. With a constant water supply, a good run, and a decent price for tin, we can make a fair profit on ore with an average value of 3.42 lb. oxide. Unfortunately, for some years this has not been possible, and our yearly output has been reduced so that either the profit has been small or a loss has been made.

The stone worked is granite of varying degrees of hardness. Of late years it has been much harder, reducing the capacity of battery and increasing costs. As will be seen from the crushing returns (Anchor, 5.38 tons per stamp in 24 hours; Australian, 6.11 tons per



APPROXIMATE FLOW-SHEET, ANCHOR MINE, LOITAH, TASMANIA.

stamp), the Australian stone is easier crushed and resembles the stone from the Anchor some years since. More or less overburden has to be removed, consisting of surface soil and barren granite. The latter is usually decomposed and capable of being hydraulicked, but contains hard masses and seams, in some cases forming 50% of the material. These have to be blasted and trammed to spoil banks. In some cases this overburden is over 70 ft. deep, and overlies only 30 or 40 ft. of profitable ore.

The stone is run in some cases by gravity to the crusher station, but in most cases is hauled up inclined roads by friction winches. The crusher station consists of a No. 8 Heelon (Hadfield & Jacks); the

stone from this is elevated by a bucket elevator to a No. 4 Gates crusher, and from this goes to bins from which wagons are filled that run by gravity about 12 chains to the battery bins. Challenge feeders deliver the ore to 100 head of stamps in two sheds of 50 each. The stamps are nominally 1000 lb., but really about 900. From the boxes the pulp proceeds to simple two-compartment hydraulic classifiers. In the two sheds the arrangement of the concentrating plant is slightly different and immaterial alterations are continually being made. In the first instance, the products of classifiers went to two sets of double-compartment Harz jigs, but the ore was so poor that these were very imperfect concentrators. I would not care to use the jigs on a tin ore that did not contain at least ½% of fairly coarse tin. These jigs also required a considerable amount of power, and dressing water. In the present practice, the first and second classifier products go to shaking-tables (Wilfleys, Cards, or tables of our own design and construction). The overflow from classifier goes to settlers and thence to other tables. From the tables we get firsts and seconds, those from first floor go to jigs that remove any topaz or other heavy sand, pieces of iron, etc. They are then further cleaned by hand in a hydraulic dresser, and are bagged. These we can get up to 73 per cent.

The overflow from first settlers goes to other settlers that feed Frue vanners or shaking-tables. The tailing from tables on top floor goes to settlers that feed other shaking-tables, and from second floor to settlers that supply Borlase buddles on the bottom floor. These are very inefficient machines, but as they only require cleaning up about every six weeks, and only then produce a hundredweight or two of oxide, their presence or absence is not a serious matter. The concentrates from all these are re-dressed on the hydraulic dresser when coarse, and are dressed in a hand buddle and kieve or tossing tub when fine. The slime is first dressed on a Frue vanner and re-dressed in hand buddle and kieve. The tailing from all these is handled and re-dressed over and over again in the anciently approved Cornish method. The seconds we get up to 68 to 70%. This scheme is indicated approximately in the attached flow-sheet, which, however, omits many of the minor steps.

Many slime machines have been tried, including one of my own (which was a failure), canvas strakes, canvas belt tables, circular tables, etc., and we can find none better suited to our circumstances than the Frue vanner. It is not so efficient, however, as the shaking-table on the coarser tin, as it is of less capacity. The rubber belt also requires frequent renewal, and when the price of rubber is high we can make a complete shaking-table which will outlast many belts for less than the cost of one.

The ore is a good milling one, and fairly coarse crushing releases nearly all the tin. Tyler slotted screens with an aperture of 0.054 in. are used. More than half of the tin will pass through a 200-mesh screen. Power is from water, with two supplies, the main one of 380 ft. head, the smaller with 500 ft. head applied through a number of Peltons. For normal work, nearly 1000 cu. ft. per minute is required, and very rarely is available. The opening of the country for cattle grazing, and bush fires, has rendered the supply precarious, and the steep hillsides, broken into many narrow gullies, make water conservation on a sufficient scale impossible. Many schemes have been considered for improving the power supply, but financial difficulties have prevented their construction. The main water-race is about 30 miles long and contains several miles of timber flume which is always suffering damage from bush fires, floods, droughts, and falling timber. The earthen portion does not suffer so severely, its principal enemy being the 'platypus' (called for short the *Ornithorhynchus paradoxus*), which burrows into the banks and lets the water out.

The minimum rates for labor are $1.92 to $2.04 per 8-hour day. The local men usually are a fine class physically, use their brains, and are reliable. The casual hands are not so satisfactory. In the early days of the mine, rock-drills were used, but the result was not satisfactory. Lately hammer drills have been used with success for drilling the boulders.

It will be seen that there are facilities for cheap work, and that our costs could be reduced with a constant water supply. On the other hand, on the west coast of Tasmania, with a severe climate, and higher wages rate, there is the Renison Bell tin mine (which I am also responsible for), with a 10-head battery and an output of barely 20,000 tons per year, where the working costs at present do not exceed $1.44. This does not include prospecting and development costs, which at present are high, sometimes exceeding the amount spent in mining. The tin oxide here is much finer and more difficult to save than that at the Anchor and Australian mines. I am at present doubling the battery, and hope to reduce costs and increase output considerably.

I trust that I have supplied all the information desired by Mr. Söhnlein.

JAMES B. LEWIS.

Melbourne, Australia, April 21.

[The résumé of the milling practice at the Anchor property presented by M. Lewis will undoubtedly answer Mr. Söhnlein's query. We regret, however, that a more detailed analysis of production costs and milling results are not available. It is evident from the above letter that an extraction of much better than 50 per cent of the tin is being made, which with the confusing manner in which the Company's returns are published accounts for the apparent discrepancies. That low costs are common in tin mining is also evidenced by the returns from Mt. Bischoff, where the cost per ton of ore mined, which is mostly by open cuts, crushed, concentrated, and smelted at Launceston, 100 miles away, is only $1.15 per ton. With such a cost, comparatively low grade ore may be profitably handled.—EDITOR.]

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling and smelting.

MICE AND MICE are kept at the rescue stations of the U. S. Bureau of Mines in this country, and at rescue stations abroad, and form part of the rescue equipment at some mines. In testing for gas in mines small animals may be used repeatedly without danger of their being less susceptible to carbon-monoxide poisoning after many exposures than after the first, if they are allowed to recover between exposures, according to George A. Burrell, Frank M. Seibert, and I. W. Robertson. Canaries are less resistant to carbon-monoxide poisoning than mice, chickens, rabbits, guinea pigs, or dogs. It is recommended that canaries be used whenever possible and that at least three of them be carried by an exploration party. Men may display distress in the presence of proportions of carbon monoxide as small as 0.10%, whereas small animals in the same atmosphere may show no signs of being affected.

TEMPERATURES of air and rock in the St. John del Rey mine, Brazil, during the four hot months of 1913-14, namely, December, January, February, and March, are as follows, according to the annual report of the superintendent, George Chalmers:

Horizon number	Depth on incline, ft.	Air, Deg. F.	Rock, Deg. F.
Adit	300	77	78
8	2300	84	82
10	2800	85	85
11	3100	85	87
12	3409	86	88
13	3700	87	89
14	4000	89	92
15	4300	90	94
16	4600	91	97
17	4900	96	101
18	5226	97	104

All temperatures were taken in the downcast. A large Sirocco fan is in continuous operation, and another is being installed. When the workings are all connected with the main ventilating system, the following air temperature is expected: horizon 18, 92°; 17, 91°; 16, 90°; 15, 89°; 14, 88°; 13, 87°; 12, 86°; 11, 85°; 10, 84°; and 8, 82°. Rock temperature at the time of opening horizons is as follows: 8, 85°; 10, 89°; 11, 91°; 12, 94°; 13, 96°; 14, 99°; 15, 101°; 16, 103°; 17, 106°; and 18, 108°. The past year shows a slight reduction compared with the previous year.

FENDER CHAINS are being installed at the various locks at Panama to prevent vessels from possible injury to lock gates. There will be 24 chains in all, of which 15 have been made, and about four have arrived at the Canal Zone. They are the last of the large items of the lock operating and protective devices to be installed. The delivery of the chains, which are of unusual size, and present many difficulties in manufacture, has been uncertain. Chains have been under order at three different American chain works simultaneously, and the Panama canal is now inviting tenders from Europe for the remaining nine. The chains average from 418 to 434 ft. in length, and the two for protecting the lower guard gates at Miraflores locks are each 784 ft. long, being specially arranged on account of the tidal fluctuation. They weigh about 85 lb. per foot, nearly three times as much as the heaviest rails on the Panama railroad. The links are made from bars 3 in. diameter, and each link in the principal part of the chain is 17 in. long by $10\frac{3}{4}$ in. wide. The chains are designed to withstand normally a tension of 220,000 lb., or approximately 100 gross tons, which is about 50% of their breaking load.

GLACIERS in Alaska have been studied by the United States Geological Survey, and in a report on the coastal glaciers of Prince William sound and Kenai peninsula by U. S. Grant and D. F. Higgins the following is the summary: Some of the glaciers described, the Valdez, Shoup, Columbia, those of Port Wells and the Bear, have been under observation on several occasions during a period of 10 years. On the whole, the glaciers here studied do not give uniform evidence as to a general retreat or a general advance within the last half century; some are evidently in a period of retreat and others in a period of advance, and the general balance between retreat and advance cannot be accurately determined by data now at hand. The accompanying halftone shows a glacier on the Iskoot river.

GLACIER ON THE ISKOOT RIVER, WRANGELL DISTRICT, ALASKA.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

NEW YORK

MINING IN MEXICO.—GRENFELL FAILURE AND THE CANADIAN AGENCY.—DIVIDENDS PASSED BY MINING COMPANIES.—CHINO BONDS.—OIL IN JAPAN.—BUTTE & SUPERIOR NEW CLAIMS.

The success of the Constitutionalist troops in Mexico is steadily putting one after another of the mining districts within the territory controlled by the rebels. Operations at Cananea and Moctezuma have not been seriously interfered with, and the American Smelting & Refining Co. is about to start its Chihuahua plant again. The Velardeña, Torreon, Matehuala, and Aguascalientes plants are now all in Constitutionalist territory, and as far as safety to the operating staff goes, could be blown in. But the first requisite for smelting operations is good transportation facilities, and, though the railroads are available, they are kept busy moving troops. It is reported that very little damage has been done to the smelting plants, and that the mines are in good order.

The Grenfell failure in London has many ramifications, one of which is the probable collapse of the Canadian Agency's mining operations in Nicaragua. This Company had taken an option on the Siempre Viva, which is controlled by New Orleans investors; the Bonanza, owned by Joe La Pierre; the Lone Star, owned by Richard McGinnis; and the Mars, a small property; all of them gold mines in eastern Nicaragua. Development work has been progressing in good shape, but in its present condition the Canadian Agency will probably have to let the options lapse, and the proposed consolidation of these properties will fall through.

At first thought it would seem that the present 'psychological' depression of business should have no effect on mining, but in one way or another it apparently has. Since January 1 the following mining companies have passed one or more dividends: American Zinc & Lead, Assets Realization, Copper Range, Dominion Steel Corporation, Mines Company of America, Mohawk, New Idria, Pennsylvania Steel, Quincy, and Tonopah Extension. The Calumet & Hecla reduced its distribution from $6 to $5; New York, Honduras & Rosario, from 3% to 2%; Old Dominion, from $1.25 to $1; Utah Consolidated, from $1 to 50c.; and the United Globe Mines, from $7 to $4. Some of these companies suffered from the strike in the Lake Superior region, and others from the trouble in Mexico; but the net result is that mining as well as general business is in a period of depression.

Out of the Chino bond issue, convertible into stock at $25, all but $3000 has been converted. The Bingham & Garfield Railroad bonds, exchangeable for Utah Copper stock at $50, have not been completely taken up, and $657,000 is still outstanding. The exchange privilege ceased on July 1.

Duluth investors have formed a new mining company, the Cactus Consolidated, organized under the laws of Delaware, with a capital of $1,000,000.

At the end of May, oil wells of the Nippon Oil Co., at Kurokawa, Akita prefecture, were gushing with considerable force. According to K. Ito, one of the Company's officials, work was started on one well early in April, and oil was struck at 1368 ft. The other five wells in the district, which required pumping, then started to flow to the surface. Until capped, the new well produced about 12,000 bbl. per 24 hours. Very little gas accompanies the oil

On account of the Butte-Milwaukee Copper Co. selling its property to the Butte-New York Copper Co., the stock of the latter being controlled by the Butte & Superior Copper Co., the Butte & Superior secures five claims adjacent to its mine at Butte, and six claims in the Argenta district of southern Montana. The Butte-Milwaukee claims are a valuable addition to the Butte & Superior property.

About 65% of the gold output of Peru in 1912 came from copper ores treated at Cerro de Pasco, according to figures just published. This revival of one branch of mining stimulates others.

TORONTO, ONTARIO

BLACK OIL STRUCK 70 MILES FROM THE WHITE OIL OF CALGARY.—CANADIAN GOLDFIELDS SYNDICATE TO BE LIQUIDATED.

Another find has been made in the Calgary oilfields, followed by a renewal in a somewhat milder form of the excitement resulting from the Dingman well. Crude black oil was found in the Monarch well on June 17 at a depth of 808 ft., and is believed to occur in quantity, but drilling was suspended until the well could be capped to avoid a rush of oil. The find is considered encouraging, as showing the extent of the field. The Monarch well is situated 30 miles west, and 6 miles south of the town of Olds, and is about 70 miles northwest of the Dingman well. There was a flurry of stock speculation when the announcement of the discovery reached Calgary, and the shares of the Company, of the par value of $1, sold as high as $50. The Monarch is capitalized at $200,000, and controls a territory of 122,952 acres. The second well on the Dingman claim, distant about 100 yards from the first, was at the last report down 250 ft. The first well will remain closed until ample storage facilities are obtained. The directors have ordered twelve 12,000-gal. tanks to be installed near the well. The pressure is sometimes as high as 360 lb. per sq. in., so that it is considered advisable to proceed with caution lest the flow of oil should become uncontrollable. The Calgary boom excites but a languid interest in Eastern Canada, and does not appeal to the speculative public to any extent. Heavy losses in Cobalt and Porcupine ventures and real estate at fictitious values, combined with the tightness of the money market, have rendered the lambs a good deal less frolicsome of late, and more disposed to heed the warnings of experts and newspapers against reckless speculation. Reports of other oil discoveries in the Calgary field and at other western points, have appeared, but have so far been unconfirmed.

At a meeting held in Montreal on June 18, the directors of the Canadian Goldfields Syndicate decided on a legal distribution of the assets of the Company, a meeting of the shareholders being called for June 28 to authorize liquidation proceedings. The plan proposed is that the properties in British Columbia be put up at auction in Montreal on August 4, and sold to the highest bidder. The Consolidated Mining & Smelting Co. stock held by the Company, together with any money received from the sale will be distributed among the shareholders *pro rata*. The Syndicate was organized at the height of the Rossland boom to trade in the shares of mining companies, but with the exception of the transaction which secured it 4270 shares of the Canadian Mining & Smelting Co. its ventures proved unprofitable.

WRANGELL, ALASKA

AREA AND HISTORY OF DISTRICT—OPERATIONS IN THE THIBERT CREEK, DEASE CREEK, STIKINE, GLACIER, WOEWODSKI ISLAND AND LAKE BAY, AND ISKOOT RIVER DISTRICTS

The Wrangell mining district embraces a total area of 5130 sq mi., of which 2200 is mainland and the rest islands. Kuprenof island is the largest with an area of 1080 sq miles. Fort Wrangell is the second oldest settlement in Alaska, having been established early in the nineteenth century by the Russian American Fur Co. and subsequently was a trading post of the Hudson Bay Co. Gold was first discovered on the bars of the Stikine river in 1862, and the following year a Russian expedition was sent from Sitka into that district. In 1873, McCullough and Tibbitts, two prospectors, found their way across the Rockies, hunted for gold on the coast side of the range and started down the Stikine river. Natives directed them to Bock's bar, ten miles below Telegraph creek, where flour gold had been found. They reported the discovery of rich gold in what became known as the Cassiar country of northern British Columbia and Wrangell became the supply centre for the gold rush that ensued. An American garrison was established there. The Cassiar properties are the remnants of the richer placer deposits, and present activity is concerned with the low-grade deposits.

The Dease Creek syndicate has purchased the property of the Boulder Creek Mining Co. on Thibert creek, a tributary of Dease lake, and hydraulic operations are being conducted. Fifty men are operating four giants, the water being obtained from Boulder creek, where a 220-ft. head is available. The Company is owned by Lord Beauclerk and Warburton Pike.

W. M. Ogilvie, a son of former Governor Ogilvie of Yukon Territory who was the founder of the Yukon Gold Co., has been successful, it is said, in organizing a company in Montreal to operate a dredge in the Dease Creek flats. He prospected there last summer with an Empire prospecting drill and found a pay-streak at a depth of 40 ft. on the White Horse lease, which was purchased from J. Hyland. He returned recently and took the drill to McDames creek, where he now is prospecting. Bench ground in that district is looked upon as favorable for hydraulicking. Ten Chinese miners, who are remnants of a band of 50 which started work in the seventies, still work on the creek.——G. H. Pendleton, working on his claims 12 miles from the mouth of McDames creek, is finishing a bedrock drain two miles in length which he hopes will overcome the water trouble.——R. W. Mitchell and Finlay Mitchell are operating a hydraulic plant on Little Deloire creek, a tributary of Thibert creek. Pumps were taken in this summer and automatic gates and flumes are used to control the water. The Mitchell brothers have been working on the creek for 11 years.——The Dufflemeyer bench leases on Dease creek have been acquired by J. G. Galvin, a miner formerly of Nome, Alaska. Last winter two bedrock drains were installed, one 200 and the other 150 ft. long. Returning to Wrangell last month, he reported having found gravel assaying $6 per cubic yard. He brought out $400 in coarse gold obtained by panning. He intends to install hydraulic equipment before winter.——Captain C. Conover operates a lay on placer ground at the mouth of Clearwater creek on the Stikine river and is taking out a few thousand dollars each year.——The Dease Creek properties are 400 miles inland from Wrangell. A journey of 160 miles by river steamer to Telegraph creek is necessary and from there a land journey of 72 miles and the rest of the distance by river boat from Dease lake.

L. Kirk, mining on the Stikine 25 miles below Telegraph creek, has two adits aggregating 500 ft. in length, which have been driven to open a deposit of bornite. Eighteen miles inland, J. F. Callbreath is prospecting a deposit of copper ore near Glenora.

The Johnson-Olson, Smith and Nelson properties in Glacier and Ground Hog basins on the mainland 15 miles from Wrangell and eight miles from tidewater have been optioned to W. D. Grant, United States deputy marshal at Wrangell. The three groups comprise 15 claims. On the Johnson-Olson property, adit work aggregates 150 ft., on the Smith, 125 ft., and on the Nelson 45 ft. The altitude of the properties is 3000 ft. A test shipment of 15 tons of ore has been made, part to the Treadwell mill and part to the Tacoma smelter. The average yield was $46.80 per ton. Engineers representing three companies will make an examination of the properties during the first week in July, according to present advices.

The Olympic Mining Co. claims on Woewodski island are being developed by E. E. Harvey. A 200-ft. adit and a 150-ft. winze comprise the present development. The Maid of Mexico property, three miles inland from the Olympic claims is also being developed.

Development continues on the Jackson No. 1 and Jackson No. 2 copper claims at Lake bay, which are owned by Allen McCullough, N. M. Tate, D. P. Gass, M. L. Burke, and L. Rinehart. A tram roadway has been built from tidewater to the claims, a tunnel has been driven 40 ft., and a 30-ft. winze sunk. Two other shafts aggregating 80 ft. make up the rest of the work. Four tons of ore shipped to the Tacoma smelter assayed 5% copper. One hundred tons of ore are on the dump, awaiting shipment.

ORE BUNKERS, JUMBO MINING CO., SULZER, ALASKA.

Burdell & Dickson have from 18 to 12 ft. of galena ore on their claims on the left limit of the Stikine 12 miles below the mouth of Clearwater. Samples assayed $200 to the ton. John Sales is developing a free gold property on Eagle Crag mountain, on the left limit of the Stikine, 45 miles from Wrangell. Berg & Son have a galena and a quartz property on Arens creek, 18 miles from Wrangell. A three-mile road has been built from the beach to their claims, preparatory to starting development work.

The Iskoot river is demanding the attention of the mining men of the district, although the inaccessibility of the region makes development costs prohibitive. The Iskoot is a tributary of the Stikine on the south side, entering about six miles above the international boundary line. A group of 14 claims seven miles below the cañon on the Iskoot is owned by P. C. McCormick, C. M. Coulter, Alex Vreatt, E. S. Busby, George H. Whitney, Bruno Greif, John Maloney, and F. E. Bronson. Nine of the claims will be crown granted (patented) this fall. A chalcopyrite deposit from 3 to 6 ft. wide has been traced with surface pits for a distance of 600 ft. Four adits have been driven, each 60 ft. long. Thirteen different veins have been developed since the claims were first staked in

1909. J. O'Sullivan, of Vancouver, B. C., has reported three assays of ore from the claims as follows: (1) 102.8 oz. silver, 18.4% copper; (2) 0.06 oz. gold, 41.0 oz. silver, 65% lead; and (3) 0.01 oz. gold, 6.75 oz. silver, 7% lead.

The rock exposures are slates, limestones, schists, and greenstones, highly metamorphosed. Chalcopyrite occurs in sheared zones of greenstone and also in quartz veins which cut the series diagonally. A report of the Tyee Copper Co. smelter at Ladysmith, B. C., shows the result of a test shipment of ore weighing 2324 lb.: copper, 10.45%; silver, 44.18 oz.; gold, 0.06 oz.; total value $44.11. The owners now are completing plans for another smelter test to be made before winter. The Iskoot is not navigable because of the rapidly changing current.

PLATTEVILLE, WISCONSIN

Dull Markets.—Spelter Stocks.—Prices.—District Production and Deliveries.—Buyers of Ore During the Month.

The month of June showed general depression in both metal and zinc ore markets. This, according to one of the leading smelter representatives operating in this field, is due to 75,000 tons of spelter remaining unsold, and now being carried on the inventories of the spelter manufacturers of this country. This representative added that no improvement in the metal markets need be anticipated for several months, if even then, but that as far as this field is concerned he looked for no greater curtailment in production than has already taken place. Production of raw concentrate declined considerably, and shipments include about 1000 tons of reserve ore carried over in bin for several months. The total reserve held in the field at the close of the month was a little over 5000 tons, the Wisconsin Zinc Co. reporting that it alone was holding 3000 tons of this amount. One of the leading buyers for the field reported the following average of prices for the month, including all grades produced in the Wisconsin field: 30%, $12.50; 35%, $16; 40%, $20; 45%, $24; 50%, $30; 55%, $34; and 60%, $38 to $40. Lead ore was out of favor all the period, metal ruling at $3.80 per cwt., with the best bid reported for ore at $45 per ton. Producers showed no inclination to respond and only three cars were shipped. Pyrite was off, and only one producer made any pretense to offer ore in quantity, shipments totaling less than one-half that usually sold. Carbonate of zinc ore ruled high, but producers were offered no market, and they contented themselves by cleaning-up their product and holding it in anticipation of a better demand.

Deliveries were made for the month by districts as shown in the following table:

Districts.	Zinc Pounds.	Lead Pounds.	Sulphur Pounds.
Galena	4,984,000	80,000	.....
Benton	4,216,000	.....	1,990,300
Hazel Green	2,410,000	60,000	.....
Cuba City	2,046,000	.....	.....
Livingston	1,920,000	.....	.....
Harker	986,000	73,610	.....
Platteville	924,000	.....	.....
Shullsburg	894,000	.....	.....
Linden	820,000	.....	.....
Dodgeville	342,000	.....	.....
Mineral Point	124,000	.....	.....
Highland	108,000	.....	.....
Montfort	78,000	.....	.....
Mineral Point Zinc Co.	2,988,400	.....	.....
Total	22,840,400	183,610	1,990,300

The gross production of concentrate for the month from all mines aggregated 17,710,320 lb. and net refined ore deliveries to smelter 11,234,730 lb. The Mineral Point Zinc Co., as usual, set the pace in bidding at all points in the field, and carried off the bulk of open market offerings. Heavier consignments of high-grade ore were made during the month and the field is prepared to make a better showing in this respect than ever before. The Dodgeville district, idle for several years, has come to life once more in the McKinlay mine, which is shipping regularly, and from which regular reports are now expected.

Sales were distributed among the buying concerns as follows: Mineral Point Zinc Co., 5094 tons; National Separating Co., Cuba, 1032 tons; Campbell Magnetic Ore Separating Works, Cuba, 640 tons; American Metal Co., 611 tons; Illinois Zinc Co., all premium ore, 558 tons; Empire Roasters, Platteville, 451 tons; American Zinc Co., Hillsboro, Illinois, 434 tons; Linden Zinc Co., 392 tons; Grasselli Chemical Co., 400 tons; M. & H. Zinc Co., La Salle, Illinois, 324 tons; and Joplin Separating Works, Galena, Illinois, 85 tons. The total was 268 cars, which is about 100 cars less than usually reported prior to April, 1913.

The northern half of the field appeared flat most of the month, as far as operations were concerned, while the opposite was true of all the districts in the southern half of the field.

YERINGTON, NEVADA

Bluestone Mine.—Pinegrove Development.—The Rockland Mine, Orebodies, Mills, and Proposed Treatment of the Ore.

It is locally reported that the Mason Valley Copper Co. has a bond on the Bluestone mine. Shipments are being made to the smelter at Thompson, and the sale of this property has aroused a great deal of interest in the district. It is one of the oldest mines in the copper belt, and considerably more than 1,000,000 tons of ore is said to be blocked out. The ore is a chalcopyrite, disseminated through altered limestone.

The Pinegrove Nevada Gold Mining Co. has been operating its 10-stamp mill all winter. Reopening of the old Wilson mine by this Company has stimulated prospecting in the district, and several discoveries of gold ore have been reported.

The Pittsburg-Dolores Mining Co. is operating the Rockland mine, three miles south of Pinegrove. This property was discovered in 1868 and has been operated at various periods since. The orebodies are in a fissure, formed by the intrusion of a wide rhyolite dike into granodiorite. Wherever the best orebodies are found today, the fissure is wide. The mine is opened by a series of adits and a depth of about 1000 ft. has been obtained. At the present time new chutes are being constructed, and some of the old drifts are being cleaned out to be ready for production by the time the new mill is completed. The first mill on the property was built about 1870 in Keene cañon, one mile north of the mine. It was destroyed by fire within a few months. After a number of years, during which time the high-grade ore found was hauled to the Wilson mill at Pinegrove, the property came into the hands of Gov. Blasdell of Nevada. He built a 10-stamp mill at the mine, and used the Washoe process in treating the tailing. Most of the development work in the mine was done during his ownership, and until the mill burned. After Blasdell's death the property was idle for some years. In 1902 it was acquired by the Nevada Chief Mining Co., which built a 5-stamp mill and concentrated the tailing from the plates. Later, a 15-ton cyanide plant was installed, but was not very successful, as it was found impossible to leach the tailing if it contained any slime.

The ore has always been difficult to treat. Ground to 100 mesh only about 20% of the precious metals can be caught on plates, and the best ore, which is a hard quartz containing pyrite, contains practically no free gold. Much of this was left in the mine and used as fill in the old stopes. In 1907 a dry-crushing mill of 75 ton daily capacity was erected, 14 by

2.5-in. Chilean tube mills being used for fine crushing. The product from these was carried in sixty 30-in. leaching vats; but as the mills would not grind finer than 10-mesh, no extraction of silver was the rule observed. The present owners of the property are building a modern cyanide treatment plant. All details of the proposed treatment are not available at the present time; but it is known that the product from the tube mills is to be ground to 150-mesh in a tube mill, and the slime agitated in the usual way. Extensive tests conducted by the management and by various testing plants have shown that an extraction of 95% can be obtained without serious difficulty. If such proves to be the case in actual practice, the mine should become a profitable venture.

GUADALAJARA, MEXICO

SITUATION IN TEPIC, AND ATTITUDE OF THE CONSTITUTIONALISTS.—EVERY MINE IN JALISCO SHUT DOWN.—MINING MEN KILLED.—CASADOS MINE LOOTED.

An American mining man of Tepic, Arthur F. Flynt, who recently arrived in San Francisco, states that mining operations are at a standstill in that territory. Mr. Flynt had just completed a 20-ton cyanide plant at the Purisima mine, a property that he had been developing for several years, and

HOSTOTIPAQUILLO DISTRICT OF JALISCO

had been milling at the Zopilote mine, another Tepic property that he had under lease from a German company. He remained in hiding at one of his mines following the American occupation of Vera Cruz, and up to a short time before the capture of the City of Tepic by the Constitutionalists, going into the Tepic capital after the rebels entered there. While in the capital he talked with General Obregon, the Constitutionalist commander, who told him that the friendship of his followers for the Americans would continue as long as no move toward intervention was made, and that the lives and property of Americans would be protected. If the Americans made any further advance into Mexico they would have the Constitutionalists to fight, the General said. Mr. Flynt reports that after Vera Cruz was taken, the Federal forces in Tepic confiscated all the property of the Grant Bros. Construction Co., the American concern that built the Southern Pacific railroad through Sonora, Sinaloa, and Tepic as far as the Tepic capital. Supplies of the Waters Pierce Oil Co. also were confiscated.

Letters received from the British and [illegible] representatives at Guadalajara state that all mines in the state of Jalisco, without a single exception, are closed. The former owners and executives acting for the Mexican administration at Mexico City are now having after Americans interests in Mexican territory still controlled by the Federals. It is understood that managers of Jalisco properties have no intention of resuming operations until peace has been restored, and guarantees for life and property again exist.

The only killing of foreign mining men as a result of the anti-American outbreak following the Vera Cruz occupation occurred at the El Favor camp in the Hostotipaquillo district of Jalisco, C. B. Hoadley an American, and G. E. Williams an Englishman, losing their lives. Hoadley was assistant mill superintendent at El Favor, and Williams was accountant. Both foreigners were stabbed to death, and later Hoadley's head and face were horribly mutilated to secure several gold-filled teeth from his mouth. Walter Neal, manager at El Favor, who was stabbed in the back, has entirely recovered from his injuries since reaching the United States, and now is acting as consulting engineer for the MaKeever interests, owners of El Favor, who also have properties in Montana and Arizona. The Casados silver-gold mine in the Hostotipaquillo district of Jalisco has been temporarily confiscated by Mexicans. The mine is the property of the Consolidated Mining Co. of New York and Los Angeles. It is stated that the Mexicans held the mine until the dynamite and other supplies found there were exhausted, and that high-grade ore to the value of ₱25,000 was taken out and disposed of to Mexican ore buyers. The Federal troops in the district either were powerless to drive off the looters or made no effort to do so.

BULAWAYO, RHODESIA

WORK OF THE RHODESIAN GEOLOGICAL SURVEY.—GEOLOGY OF GATOOMA DISTRICT.—CUSTOM MILLS SUGGESTED.—ASBESTOS AND CHROME IRON ORE DEPOSITS.—THE NEW MINES.

From an economic point of view, the report of the director of the Rhodesian Geological Survey for the year 1913 is certainly the most important that has yet been issued. This deals with operations for the third complete year since establishment of the department, during which period work was concentrated on the goldfields surrounding Gatooma in Mashonaland, which is the centre of what is probably the most extensive and valuable mineralized area in the territory.

About four or five miles from Gatooma is the Cam & Motor property, which is one of the three leading mines of Rhodesia. Close to the Cam & Motor are the Eileen Allanah and Eiffel Blue mines. The Gatooma district as a whole may be subdivided into other subsidiary areas, such as the Golden Valley and Shagari, each of which includes numbers of properties of some importance, the majority of them being worked by syndicates or tributing parties. In the Shagari district the gold-bearing belt consists of greenstones and felsites. Judging from the location of the successful mines, the greenstones appear to be the more favorable country rock, with the qualification that it is not the areas of pure greenstone, but areas of greenstone containing small bodies of felsite that are most productive. The larger bodies of felsite also contain numerous gold-quartz veins; but a number appear to be of small size, though rich in gold down to water-level. They have not been opened to any appreciable depth below this. Although large orebodies, requiring a considerable amount of capital for development and treatment will no doubt be discovered from time to time, the number of rich veins of the smaller size makes the district a favorite with the individual worker and small syndicate.

In his report, the director of the Survey, H. B. Maufe, makes a valuable suggestion in regard to the Shagari area, as fol-

lows: "The cost of a plant for treatment, and of its transport and erection, and frequently the lack of sufficient water at hand, are factors which retard the working of these veins. The Shagari district is one of those which should receive consideration in the event of a decision to erect custom mills, as recently suggested by the president of the British South Africa Co." Although the subject of custom mills is perhaps a little outside the province of a geological survey, this in no way detracts from the importance of Mr. Maufe's recommendation that the Shagari area should justify the erection of government-owned mills. Hitherto, custom mills, such as are provided by certain Australian governments, have been given but scanty attention by Rhodesian and South African authorities. A little money has been spent in this direction in Natal and Zululand, but generally speaking the South African governments have done practically nothing to directly help mining enterprises among the smaller capitalists. If the recommendation of the director of the Rhodesian survey is heeded, it may mark the commencement of a new epoch in mining in South Africa.

In other ways, the latest report of the Survey should be of considerable value to prospectors, as it contains a number of facts of interest relating to the distribution of gold veins in the Golden Valley and Shagari districts, and the character and mode of occurrence of different types of veins. Not much can as yet be said regarding the distribution of the gold within the veins themselves, as little really valuable information is as yet available. In the report, Mr. Zeally contributes some valuable observations on ancient workings in granite country east of Gatooma. It is of particular interest to notice that a conclusion announced in the previous year's report, namely, the close association of the gold ores with felsite, finds many examples in the areas considered in the present document, and is strikingly illustrated in the case of the Golden Valley district.

Discoveries of extensive deposits of asbestos and chrome iron ore in the Victoria district of Mashonaland are attracting a great deal of attention at present, both in Rhodesia and Jonannesburg. A company with a capital of £125,000 has been formed to acquire and work the occurrences. A. H. Ackermann, Clement Dixon, Colin Campbell, and other mining engineers have reported favorably on the properties. The asbestos venture is known as the King's Asbestos, and in the course of his report Mr. Ackermann, the resident mining engineer of the British South Africa Co., stated: "I am much impressed with the possibilities of this asbestos property, and although little work has been undertaken to prove the extent of the area, indications at present are certainly most encouraging, and lead me to venture the opinion that it will be the means of opening a new and extensive industry in Rhodesia." The most favorable features in connection with this property are the high quality of the asbestos in the rocks as so far proved, the finding of profitable asbestos in every working place in the area referred to and outside, the facilities for a cheap system of bench mining, the proximity of a continuous supply of water and cheap labor, and the past satisfactory results of the owner's operation, which were undertaken under most adverse conditions. Of the chrome iron deposits, Mr. Ackermann says that it is not possible to gauge the extent of the deposits on account of no development having so far been undertaken. He suggests that immediate steps should be taken for the opening of these deposits, and said: "A few months' serious development work on these deposits should open up sufficient profitable chrome to justify the extension of the railway from Victoria to the bottom of the hill." It is understood that the discoverer of these deposits is Mr. Turner, who is well known on the Rand. Chrome ore production of Rhodesia in 1913 was 56,794 tons. Reports of a discovery of tantalite in the Victoria district are also current, and it may be that this area, which has so far been considered to be of agricultural value only, will yet develop into an important mineral-producing region.

The large new producing gold mines, such as the Shamva and Cam & Motor, have already had a favorable influence, and the gold output of 64,894 oz. in March easily beat all previous records. From now on a steadily increasing monthly return may be anticipated. The Shamva is understood to have made a profit of about £11,000 in April, and the Cam & Motor, despite treatment troubles, is reported to be doing well, treating 11,120 tons in May for gold worth $65,000. The Bell is also said to be securing good results. As these mines get into full working order, better yields will be forthcoming. The Antelope's production so far has been disappointing. The Falcon is expected to commence crushing within the next three or four months. As to the other mines, it may be noted that sinking the new vertical shaft has been temporarily suspended at the Globe & Phoenix, to allow of the erection of a new head-frame and hoist plant. The Eldorado Banket mine is reported to have opened some rich shoots of ore recently. This property's output in May was $44,000 from 4954 tons, with a profit of $20,000.

JOHANNESBURG, TRANSVAAL

Mineral Output of South Africa.—Transvaal in April.—East Rand Proprietary Property.—Litigation.

Exclusive of diamonds, the total value of the mineral output of the Union of South Africa for April was £3,193,255. Gold mining in the Transvaal, although slowly improving, has not fully emerged from under the cloud of uncertainty caused by labor troubles, the output of gold in April only totaling 687,988 oz. valued at £2,922,388, compared with 792,082 oz. valued at £3,364,550 in May, twelve months ago before labor troubles started. In April, the Transvaal had 92 producing mines with 9803 stamps and 293 tube-mills at work, yielding 687,816 fine ounces of gold. Considerable attention is at present devoted locally to the figures of the gold output of the Rand on account of the fact that since the labor troubles of July, they have until the last two months consistently shown a decline, in place of a steady increase as before. This decline has in many quarters created the impression that the Rand has reached its zenith as a gold producer, and the previous confident tone has given way to pessimism, so much so, that even the Chamber of Mines seems to have been affected thereby, as shown in the recent statement submitted to the Economic Commission. As far as possible, the Mines Department has attempted to minimize the bad effects produced by this statement; but the fact remains that some time must elapse even if the gold output of the Rand again assumes the steady progressive increase so characteristic of the industry prior to last July.

The last quarterly report of the East Rand Proprietary Mines shows that the shrinkage of profits indicated at the recent annual meeting has already begun and that the amount of development accomplished is still on the wrong side. The Company has now about £250,000 standing to the credit of the development suspense account, a good deal of which will have to be spent before the ore reserves of the concern are placed in a satisfactory position. The difficulty still continues of finding sufficient faces where the expenditure on development seems to be justified, a difficulty likely to be experienced until the area beyond the water dike is drained. When it is stated that a large quantity of water, estimated to flow at least at the rate of 3,000,000 gal. per day, has to be overcome, much of which has to be pumped from a depth of 4000 ft., the difficulties of the position will be easily recognized. Taken on the whole, therefore, it seems probable that at the East Rand Proprietary the position will probably grow much worse before an improvement can be expected, so that the outlook is anything but encouraging.

An interesting case between the Langlaagte Consolidated mines and the Victoria Falls & Transvaal Power Co. Ltd. has just been concluded in the Supreme Court. The former claimed damages from the latter through the latter failing to supply the requisitioned power at the time agreed on, and was awarded damages to the extent of £29,000. At one time it seemed likely that several similar cases would be heard, but most of the groups affected compromised with the power company. Another interesting law case was that in which F. Gaut claimed compensation from the Apex mines for pointing out the outcrop of the Main Reef series lying on the Rietfontein property, between Boksburg and Benoni. This claim was made under a 20-year-old agreement, but it transpired from the evidence how little was known of the character of the Main Reef series so long ago. The judgment was to the effect that a few floating boulders of conglomerate had been taken by Mr. Gaut for the indication of the outcrop of the Main Reef, and he therefore lost his claim for compensation to the amount of £30,000. An interesting question arose during the trial as to what really constituted an outcrop, no less than six expert mining engineers and consulting geologists failing to satisfy the judge in this respect. The trouble arose owing to the conglomerate bed occurring as a sub-outcrop, and it was left for the judge to define an outcrop as 'the place at which a bed actually outcropped at the surface.'

MELBOURNE, AUSTRALIA

QUEENSLAND MINERAL INDEX.—MOLYBDENITE.—INSTITUTE OF MINING ENGINEERS.—ELECTRICAL WORK IN AUSTRALIA.

The Queensland Government has issued a 'Queensland Mineral Index and Guide,' which constitutes the first attempt made by the mines department in any of the states to advertise the mineral resources of that state. It cannot be said that the production is quite up to the best standard of Canadian and American work in the same line, but it is not so very far behind, and in accuracy and thoroughness it leaves nothing whatever to be desired. Australia has always been too anxious to keep her good things to herself to do very much advertising; but this publication is only one of many signs that a more liberal policy is being entered upon. There is, however, much to be said for the hint suggested by the *Australian Mining Standard*, that it is not very much use advertising the mineral resources of any state till the laws have been sufficiently liberalized to offer some inducement to foreign capitalists to put their money into local mining properties. Without something like real security of tenure they are not likely to take the risk of any great investment of capital.

It is amusing to note how suddenly molybdenite has become prevalent throughout the whole of Australia. Queensland has mines which it claims to be the best in Australia; New South Wales makes similar claims, with perhaps less warrant; Victoria is working some deposits on which the government geologist has just reported; Western Australia and South Australia both report discoveries which, as a matter of course, are expected to prove valuable; and it is understood that Tasmania also has its discovery of the mineral. There is no need to point out to readers of the *Press* that all these discoveries are closely connected with the extraordinary increase in the market value of the metal. It is not unnatural that when the metal is wanted it should be looked for; but it is surprising to learn of so wide a distribution of so supposedly rare a mineral. In some cases of course, the presence of the mineral was known previously, and the market rise has led to the exploitation of deposits hitherto neglected; but it would not be very surprising to learn that one or two of the discoveries are not quite so 'molybdenous' (if such a word may be coined) as is represented.

The annual meeting of the Australian Institute of Mining Engineers was this year held in Melbourne and was a poor affair attracting a much less representative gathering of the leaders of the profession than it has done hitherto. The arrangements were by no means satisfactory, and the program was uninteresting. Victoria is a state that does not offer much of interest to up-to-date mining men; but certainly a poor selection was made of what it had to offer. Bendigo is unquestionably the most interesting field in the state, the most extensive in its operations, and the greatest centre of mining industry. Yet Bendigo was not visited, nor was Ballarat, Daylesford, or Ararat. Instead of these, a visit was paid to Walhalla, once famous owing to the yields of the Long Tunnel and Long Tunnel Extended, but now worked out. The only other place honored by a call was Wonthaggi, the scene of the government's experiment in

PART OF THE STATE OF VICTORIA.

coal mining, an experiment for which a strong effort is being made to have it regarded as a success, but which would in point of fact be regarded as a failure if it were being worked by a public company instead of by the state. [The mine produces about 2000 tons of coal per day.—EDITOR.] Altogether it cannot be said that the Australasian Institute of Mining Engineers is on the up-grade.

A leading article in the *Australian Mining Standard* on 'Electric Work in Australia' has attracted considerable attention, and, strangely, but significantly enough, has been generally endorsed by some of the large electrical firms. The article begins with a statement that "the work of the Victorian and Australian cities requires to be put upon an entirely new basis," and proceeds to ask, "why incompetent workmen should ever have obtained a footing there. Men are not permitted to touch gas pipes or water pipes without possessing a license. Why, then, should absolutely unlicensed men be allowed to meddle with the important work of effecting electrical installations in either dwelling houses or business houses? It is believed, and the belief is probably not very far from the truth, that there are more incompetent men engaged on this work than in any other part of the building trade; and the amazing thing is that the insurance companies have not before this taken a hand in the matter, and insisted on the electrical work being done to their satisfaction before they will consent to insure properties in which the electricity has been installed."

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ARIZONA

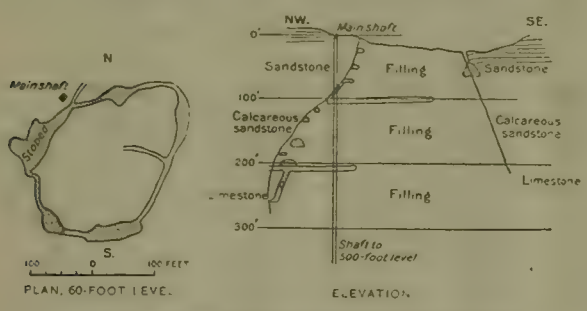
Gold, silver, copper, lead, and zinc were mined in Arizona in 1913 to the value of $70,875,027, according to Victor C. Heikes of the U. S. Geological Survey, showing an increase, as compared with 1912, of $3,824,243. The value of the gold production in 1913 was $4,023,911; silver, $2,384,647; copper, $63,228,127; lead, $710,370, and zinc, $527,972. There were 438 mines producing these metals in the state in 1913, as against 445 in 1912, and the total quantity of ore sold and treated was 7,931,862 short tons, an increase of 1,091,780 tons.

Cochise County

Sulphide ore has been opened in limestone in the Calumet & Arizona company's Cole area at Bisbee.——The Copper Queen test mill for the low-grade ores of the Sacramento hill and Czar shaft upper levels is nearly completed. Churn-drilling is still under way in this area.——The Shattuck mine is developing well, and ore shipments amount to 400 tons per day.——The Mascot Copper Co., operating at Dos Cabezas, is to construct a line from the South Pacific near Willcox and connect with the Maricopa Copper Co.'s line at Dos Cabezas, a distance of 18 miles. A company called the Mascot & Western Railroad Co. has been incorporated with a capital of 5000 shares at $100 each.

Mohave County

The Grand Gulch mining district is described by James M. Hill in *Bulletin* 580-D of the U. S. Geological Survey. He examined the mines there in November 1913. The district is most easily reached from Moapa, Nevada, on the main line of the San Pedro, Los Angeles & Salt Lake railroad, and 28 miles northwest of St. Thomas, Nevada, the supply point for



PLAN AND ELEVATION OF THE GRAND GULCH MINE.

part of southeastern Nevada and northern Arizona. The climate is typical desert weather, and there is a fair quantity of timber available. The Grand Gulch mine is 54 miles east of St. Thomas. It has been developed by a shaft 500 ft. deep, and levels have been driven at 100, 200, 300, and 400 ft. Owing to the peculiar shape of the orebody the levels are generally of circular plan. At 200 ft. the ore zone is about 300 ft. diameter. In the upper portion of the mine the ore is in sandstone, in the lower portion in limestone. The ore consists largely of malachite, azurite, and brochantite, with irregular masses of chalcocite scattered through it. The ore does not extend below a depth of about 250 ft., there being no copper minerals at 300 or 400 ft. The copper was deposited in the upper workings by generally downward-moving waters. Fifty men were employed in the fall of 1913. The Bronze L. mine is 3 miles southwest of the Grand Gulch, and has been opened by a 200-ft. incline shaft, now caved to about 100 ft. The ore minerals are largely sulphides, with smaller amounts of azurite and malachite. The Copper King mine is 10 miles east of the Grand Gulch mine, near the Colorado river. Every two months a carload of 23 to 26% copper and $3 to $4 silver ore is shipped by Bishop Whitehead.

Yavapai County

(Special Correspondence.)—There is a revival of mining in the Thumb Butte district, and miners are busy at many claims.——The Little Jessie mine, at Chaparal, is producing ore again, and gold ore is being sent to the Hayden smelter.

Phoenix, June 28.

CALIFORNIA

Amador County

A retaining dam is being erected by the Kennedy company to store the tailing delivered on Bright ranch by the wheels described in this journal of May 9, 1914.——The Bunker Hill company has declared its monthly dividend of $5000, making $30,000 for the current year, and $732,000 to date.——More miners are being employed at the Plymouth, preparing the mine for supplying ore to the new mill, which is well under way.

Eldorado County

A 12-drill 2-stage air-compressor and other equipment has been installed at the Oro Fino mines, Shingle Springs, controlled by the Tredwood Syndicate, Limited, of London. Development of the lower levels is now under way. C. H. James is resident manager.——Seven mines, in the Volcanoville district, near Georgetown, known as the Ruby Consolidated Mines, and including the Aphrodite, Pluto, Proserpine Wedge, Garfield, Garfield Extension, and Little Gem have been bonded to a corporation headed by W. I. Smith from W. C. Green.——The fiftieth anniversary of the Bullion Bend hold-up, in which the Washoe stage was robbed of gold worth $60,000, was observed at Placerville on July 2. The men were captured and several killed, but the metal was never recovered.

Mariposa County

(Special Correspondence.)—John McAllester and associates have taken a working bond on the Sweetwater group of claims, which has a 10-stamp mill and other equipment.——Herman Schlagerter of San Francisco has been visiting his brother Charles A. Schlagerter at Mariposa, and has examined the Hite mine on the south fork of the Merced river, which is idle for want of capital to put the necessary equipment on the property.——There has been nobody from the State Mining Bureau in this field since 1896, until F. L. Lowell came here recently. He has some difficulty in properly finding unpatented claims of recent location. It is suggested that county supervisors could pay the salary of a Bureau officer, and have the mining areas thoroughly examined, as the appropriation of the Bureau is limited for this work.——Judge J. J. Trabocco of Mariposa, in the case of Sidney *v.* Pierce on injunction proceedings has increased Sidney's bonds from $1000 to $4500. This case involves the title of the Buena Vista copper mines in the Green Mountain district, in which Sidney claims the property by prior location, and has sued Pierce to recover the property. Pierce located the property July 9, 1912, and has been developing it, and mined and shipped $35,000 worth of copper ore.——The Sunnyside mine at Sherlock, owned by Mrs. Emma

Klopp of Oakland is a promising property, and a good deal of prospecting has been done. Besides the mine equipment there is a mill with rock crusher, two 1000-lb. stamps, Hendrie disc-discharge mortar, Chilean mill plates and a concentrator. The output in 1913 was 300 tons of $20 ore. The No. 1 mine near Hornitos has been sampled by T. C. Parker, and machinery may be erected by the Merced owners. The Monte Cristo claims have been examined by A. M. Rockwell of Los Angeles. Homesteaders locating on mineral land which is of no value for agricultural purposes in this county is quite a scandal here and should be stopped. The Virginia mine is being troubled by men who have filed a homestead on the ground from which the mine secures its water.

Mariposa, June 24.

Plumas County

Rich ore has been opened in the Arcade mine near Greenville by the owner, D. McIntyre. Diving suits are being used by W. Wright and A. B. Knapp to prospect gravel in the north fork of the Feather river, near Belden. They are working for about 30 minutes at a time in 10 to 15 ft. of water.——Sluicing and other work is in full swing on Nelson creek, and there will be plenty of water for another month.

Shasta County

The Mountain Copper Co. has arranged to install at Keswick, 50-hp., 60-hp., 75-hp., and 100-hp. induction motors which have been purchased from the General Electric Company.

Siskiyou County

Owners of the Great Northern mine, an old producer, are mining ore for a test run. If satisfactory, the old McCook mill will be moved to the property.

Trinity County

(Special Correspondence.)—Everybody has had a good season's hydraulicking. Lorenz Bros. have just finished a satisfactory run on the old Junkan's ranch, or lower Weaver Creek mine.

Weaverville, June 30.

Tuolumne County

(Special Correspondence.)—The collar of the App mine shaft is being repaired, and other work is going on with a view to resuming mining. It is understood that a portion of the mill will be put in working order at once for milling the ore on surface.——The Burnham mine, on Knights creek, recently bonded to M. Johnson, is yielding high-grade ore. A 480-ft. adit is being driven, through which two veins will be worked.——Sinking and driving is in progress at the Franco Contention mine, in the Jupiter district with 30 men. The prospects are most encouraging, and additional machinery, including a large hoist, will be installed in the near future.——At the Ditch mine, the 1650 and 1800-ft. drifts are being extended toward the rich shoot that made a record for the property nearer surface a few years ago. The mill is operating continuously with good results.——The Leap Year gravel mine, near Jamestown, has been bonded to George Tatton by Joseph Hoskins, and an effort will be made to open the auriferous deposits, which are believed to be but a short distance from the point reached by the former operators.——Thirty-five stamps of the milling plant of the Shawmut mine are in operation. The ore is conveyed from the hoist in the mine to the mill in electrically operated cars, an improvement which was only recently finished. A portion of the force employed is still engaged in making repairs and improvements that will add greatly to the efficiency of the plant.——It is reported that negotiations are under way for the consolidation of the Mack and Longfellow mines under new management.——The Mt. Zion mine, in the Groveland district, is being reopened by Ernest Caplinger. The shaft has been cleaned and repaired to the water level and some development work will be started in the upper workings soon.——The Company operating the River Gravel mine at Jacksonville has been engaged in cutting a trench to divert the waters of the stream and at the earliest possible time a retaining dam will be under way. The Company expects to wash a large quantity of gravel this summer.

Sonora, July 7.

COLORADO

La Plata County

The new Cave Basin district is 335 miles from Denver, of which 325 miles is over the D. & R. G. line to Ignacio, then 10 miles by stage to Bayfield. The district is over 9000 ft. above sea-level. The ore, which occurs in limestone, contains gold, silver, and copper. Some high-grade ore was shipped to Durango last September. A fair amount of prospecting is now being done on the various claims.

Teller County (Cripple Creek)

Estimates of the June output of the district, made on July 1, give the following totals:

Plants.	Tonnage.	Av. val.	Gross val.
Golden Cycle	31,000	$20.00	$ 620,000
Portland, Colorado City	9,500	20.00	190,000
Portland, Cripple Creek	18,800	2.40	45,120
Smelters	4,060	55.00	223,300
Stratton's Independence	11,823	2.50	29,557
Colburn-Ajax	4,140	7.00	28,980
Wild Horse	1,200	3.24	3,888
Neville-Free Coinage	600	6.00	3,600
Gaylord-Dante	1,500	2.30	3,450
Kavanaugh-Jo Dandy	1,850	1.40	2,590
Isabella mines	750	2.00	1,500
Total	85,323		$1,151,985

The Vindicator company and lessees shipped about 3500 tons, worth $165,000. The United Gold Mines, worked under lease, produced 400 tons of ore. From the Abe Lincoln 450 tons of $21 ore was mined. Lessees at the Dexter extracted 665 tons, worth $12,000.——The Golden Cycle was the only company to pay a dividend in June, the amount being $45,000. ——July dividends are estimated at $250,000.

IDAHO

Bonner County

In a raise between No. 4 and 1 levels in the Idaho-Continental mine, 26 miles from Porthill, there is 6 ft. of high-grade and 6 ft. of mill ore. The raise is up 330 ft., and will be finished in 30 days.. The 200-ton daily capacity concentrator has been completed, also the hydro-electric station on Boundary creek, midway between Porthill and the mine, together with the transmission line, and the entire equipment is ready for service at any time. The mill will start about July 15, and by August 1 crude ore and concentrate will be shipped. To facilitate handling this product, an aerial tramway, 1500 ft. long, will be constructed over the Kootenai river by the Riblett Tramway Co. Ore will be hauled to the river by 'caterpillar' engines and Troy 15-ton trailers.

Custer County

The genesis of the garnetiferous copper deposits near Mackay are described in the June issue of *Economic Geology* by Joseph B. Umpleby. The district lies at an elevation of from 5888 to 9600 ft. above sea-level. Rock formations are Carboniferous limestone, intruded by late Cretaceous granite porphyry, and trachyte porphyry. The orebodies occur within the main igneous mass, well back from its border. Most of the production has come from shoots of ore situated from 100 to 800 ft. out in granite porphyry, and two carloads was obtained from an orebody 1200 ft. back from the main igneous contact. No deposits of proved importance occur in the main limestone area. In places the orebodies are closely associated with large blocks of limestone included in the

igneous rock. Garnet rock accompanies all the important ore-shoots, and in most of the primary ore this mineral is the dominant constituent. The orebodies vary greatly in size, and even more in shape. Three principal groups are recog-

GEOLOGIC MAP AND SECTION OF A SMALL AREA SURROUNDING THE EMPIRE COPPER CO.'S PRINCIPAL DEPOSITS.

nized, one in the Copper Bullion and two above the Alberta adit. The primary ores consist of an intimate intergrowth of garnet and chalcopyrite, and the latter contains 5 to 6% copper, with a little gold and silver.

Shoshone County

A mortgage totaling $20,152 and covering the claims of 37 creditors of the Idora Hill Mining Co. has been placed on record at Wallace. The deed includes several mining claims and all tools, machinery, mills, and other equipment.

Annual meetings of the Moon Creek Mining Co., Aurora-Sampson Mining Co., Valentine Mining Co., and Four Timbers Mining Co. have been held, and the various properties owned were discussed.——A meeting of the Gertie Mining Co. was held at Spokane on June 20, when the capital was increased, and it was decided soon to begin driving a lower adit 3700 ft. long. The portal will be about 1000 ft. from the schoolhouse at Burke. A vertical depth of 1400 ft. will be obtained by the adit, which will cost from $50,000 to $65,000. A compressor plant is to be installed. A. A. Booth will be in charge of the work. The property is a promising one.——The Hercules Mining Co. will place in operation in its mines two 8-ton, 30-in. gage, 500-volt electric mining locomotives recently ordered from the General Electric Co.; and the Snowstorm Mining Co. at Larsen will install a 275-hp. induction motor and starting panel.——After an idleness of nearly two years, the result of litigation with the Bunker Hill & Sullivan company, the Caledonia mine, near Kellogg, has resumed operations. One of the stipulations in the compromise agreement that ended the controversy between the two companies was that a unit of the Bunker Hill & Sullivan mill should be set aside for the treatment of Caledonia ores. The plant has been under repair for several months and was given a trial run recently that proved satisfactory. The mill was started running one shift daily last week and is now treating about 100 tons per day. During the shutdown, connection by means of a raise was provided between the Caledonia workings and the long lower adit of the Bunker Hill & Sullivan, permitting the product of the mine to be handled through the latter at much less expense than under the former system of operating, and it is estimated that the Company now will average $40 to $45 per ton net on its ore. There is a large tonnage in sight in the mine, and engineers regard it as among the long-lived producers of the Coeur d'Alene lead-silver district. Charles McKinnis, one of the best known mining men in the Coeur d'Alene, is general manager of the Company.

NEVADA

Esmeralda County

The estimated production of the Goldfield Consolidated mine in June is as follows: Ore treated, 25,924 tons; gross extraction, $295,000; operating expenses, $155,000; and net realization, $140,000.——The Jumbo Extension company is now shipping 100 tons of ore per day to the Goldfield Consolidated mill.—A 20-ton cyanide plant, consisting of three 50-ton leaching vats, has been added to the Diamondfield Mining & Milling Co.'s 5-stamp mill. The ore averages $10 per ton.——More pumps have been ordered for the Atlanta mine. These are to be made by the Platt Iron Works of Dayton, Ohio, whose western representatives are C. C. Moore & Co. of San Francisco. The pumps are one Smith-Voile 6½ by 15-in. triplex, and one 6-in. Platt centrifugal, electrically driven. The total pumping capacity installed will eventually be 800,000 gal. per day.

Humboldt County

(Special Correspondence.)—On June 15, John F. Cowan of Salt Lake City, took his place as president of the Rochester Mines Co. The output of the property, from a depth of about 500 ft., is nearly $700,000, the ore averaging between $20 and $25 per ton. Recent work on the deeper levels has been encouraging. In the Codd lease, 4 ft. of ore was cut, 2 ft. of which is worth $35 per ton. At 800 ft. from the portal, the east vein has been cut in the main cross-cut.——The first shipment from the Rock lease on the Nenzel Crown Point property has given returns of better than $20 per ton.——About 8000 tons of good shipping ore has been developed in the Kahaler lease on the Weaver claims.——Four feet of $60 ore has been recently opened in the Buck and Charley lease in lower Rochester.——Regular shipments are being made from the Nevada-Packard lessees, Kromer and Hampton.——The Federal dredge which was sunk a few weeks ago, has been repaired and is again in operation.

Rochester, June 29.

Lander County

(Special Correspondence.)—The new camp of McCoy, found by Joe McCoy, about 17 miles southwest from Copper cañon, near Battle Mountain, is reported as promising. Gold ore is being opened, and also silver-lead ore. An engineer recently returned from this new find has described the geology roughly, as consisting of lime and porphyry lying on a granite floor, and intruded by dikes.

Battle Mountain, June 29.

Nye County

A new double-drum Nordberg hoist is being erected at the Wandering Boy shaft of the Jim Butler mine. The machine will be driven by a 125-hp. electric motor, and has a hoisting speed of 800 ft. per minute.——A larger yield is expected from the Montana-Tonopah in June. During the past week the mill treated 150 tons with 93% recovery.——The West End mill is treating 215 tons per day.——At 1100 ft. in the Extension, the Murray vein is 9 ft. wide, worth from $30 to $75 per ton.——The 1000, 1050, and 1130-ft. levels of the North Star are improving.

Storey County

All disputes on the Comstock lode have been settled, and development of the lower levels is now assured.——A tube-mill, Dorr classifier, and other machinery has arrived for the Yellow Jacket cyanide plant.

NEW MEXICO

Large gains were made in the production of gold, silver, copper, and zinc at mines in New Mexico in 1913, according to figures compiled by Charles W. Henderson, of the U. S. Geological Survey. The production of gold showed an increase of $97,480 over the output of $784,446 in 1912; silver, an increase of 94,572 oz. over the production of 1,536,701 oz. in 1912; lead, a decrease of 1,547,654 lb. from the yield of 5,494,018 lb. in 1912; copper, an increase of 22,277,742 lb. over the yield of 34,030,964 lb. in 1912; and zinc, an increase of 2,956,524 lb. over the output of 13,566,637 lb. in 1912. Despite lower average yearly prices for copper and zinc, the total value of the output was $11,694,002, an increase for 1913 of $3,166,047.

WASHINGTON

The mineral resources of this state, with statistics for 1912, are described in *Bulletin* No. 11 by Henry Landes of the Washington Geological Survey. The publication consists of 54 pages with an index and a large map showing locations of certain minerals in the state. Other reports will be prepared from time to time. The following subjects are discussed: granite quarries, sandstone quarries, limestone and kilns, basalt quarries, sand and gravel pits, coal mining, clay, the cement industry, metal mining and mineral waters. The output in 1912 and 1911 was as follows:

Metallic products	1912	1911
Copper	$ 179,192	$ 39,776
Gold	680,964	847,677
Lead	5,732	38,186
Silver	254,326	129,204
Total metallic	$ 1,120,214	$ 1,054,843
Non-metallic products:		
Clay products	$ 2,388,870	$ 2,861,758
Coal	8,042,871	8,174,170
Granite	809,201	1,345,551
Lime	234,832	228,933
Limestone	20,370	32,478
Mineral waters	17,542	14,654
Portland cement	2,012,785	1,496,807
Sand and gravel	345,289	319,760
Sandstone	344,476	301,843
Total non-metallic	$14,216,236	$14,775,954
Grand total	$15,336,450	$15,830,797

Some excellent brick is made in this state, some of which is used for street paving. The clay industry is widespread in 18 counties.

The output of the gold, silver, copper, and lead mines in Washington in 1913, according to C. N. Gerry, of the U. S. Geological Survey, was valued at $1,053,135, compared with $1,120,214 in 1912. The decrease was due to lower metal prices and a smaller production of silver and copper. The gold output has a value of $696,275; the production of silver decreased from 413,538 oz. in 1912 to 331,239 oz. in 1913. The copper production likewise decreased from 1,086,010 lb. in 1912 to 954,081 lb. in 1913. Lead production increased from 127,387 lb. in 1912 to 202,487 lb. in 1913. There were 57 productive properties, of which 12 were placer and 45 lode mines.

Mining and industrial companies which are now operating in Washington, Idaho, and British Columbia, and tributary to Spokane, paid $565,386 in dividends during the first 10 days of July. Of this, $309,800 was paid by the Washington Water Power Co., which supplies power to mines in the Coeur d'Alenes; $123,836 by the Stewart Mining Co.; $81,750 by the Bunker Hill & Sullivan company; and $50,000 by the Standard Silver-Lead company.

Ferry County

After an idleness of nearly two years, mostly due to litigation, the Quilp mine, one of the oldest developed properties in Republic will resume operations. The decision to reopen the mine was made at a meeting of the directors this week in the offices of W. J. C. Wakefield of Spokane, vice-president of the Quilp Gold Mining Company.——Attempts to consolidate the San Poil Mining Co. and the Republic Mines Corporation, which is in the hands of a receiver, are being opposed by creditors of the latter Company.

Stevens County

The raise between the United Copper lower adit and the 600-ft. level, a distance of 465 ft. on the incline, was completed in 60 days, and was in ore all the way. Ore is to be stoped from the 1000 and 600-ft. levels.

UTAH

Juab County

Ore shipments from 16 mines at Tintic during the past week totaled 147 cars.——The Chief Consolidated company has paid another dividend of 5c. per share, equal to $43,822.——The Iron Blossom company will pay another quarterly dividend of 10c. per share, equal to $100,000. Ore shipments are about 150 tons per day from the 400, 500, and 600-ft. levels.

Summit County

According to the general manager, G. W. Lambourne, the Daly-Judge mine is in good condition. A drift is being driven at 300 ft. to cut an orebody opened to that point by a raise. The rich shoots in the Daly vein are continuing to the surface. These shoots are in the form of 'chimneys,' and are from 2 to 50 ft. wide, and 15 to 50 ft. high. On the 1200-ft. level a stope has yielded ore for a length of 235 ft., 20 ft. high and 25 ft. wide, all mill ore, containing lead and zinc. Development totals about 1000 ft. per month.——The Mines Operating Co. has shipped about 20,000 oz. silver, being part of the June clean-up. Formerly precipitate was shipped, but a refinery has been installed recently at the property.

COSTA RICA

The Abangarez Gold Fields Co. produced bullion worth $4,385 from 6588 tons of ore in April, at a loss of $3857. The loss for the first four months of 1914 was $64,706. Owing to difficulties experienced of late in getting sufficient profitable ore to run the plant, it has been deemed advisable to stop operations for the present and devote the attention of the staff to underground development.

KOREA

The Seoul Mining Co., operating the Suan Concession in Whang Hai province, reports the following results for June, 1914:

Stamps working	40
Time, days	27.83
Ore crushed, tons	5,960
Total recovery	$60,562
Operating expenses	25,000
Net earnings	$35,562

MEXICO

Chihuahua

The American Smelting & Refining Co. has decided to resume operation at the Chihuahua smelter, one of the largest of the Company's plants in northern Mexico. The Company's employees have been ordered to proceed to Chihuahua and it is expected that early in July the plant will be in full operation. It is also intended to blow-in the Monterey plant in Nueva Leon, and then the Velardena plant in Coahuila.

Sonora

During the last week of June, trouble started among employees at the Mines Company of America's La Colorado mine, near Hermosillo, who are dissatisfied with conditions, probably more politically than with the Company. The trouble spread to Cananea, more in the nature of a sympathetic strike which started on July 2. There is no dispute with the Greene Cananea company. Demands of the strikers are as follows: An increase in wages of 25%; a decrease in the price of goods at the Company store of 25%; abolishment of the new labor bureau; some changes in the management of the Company hospital; and that wages in future be paid weekly. George Kingdon, superintendent at Cananea, arrived at Douglas, Arizona, on July 2, and consulted with James Douglas, the general manager. The position was regarded as serious as mill and smeltermen left their work, but 2000 returned later on. There are 200 troops at Cananea to keep order.

PERSONAL

J. B. Irving has gone to Butte.

John W. Finch was in Salt Lake City recently.

C. P. Perrin sailed from Seattle for Japan on June 27.

Walter M. Henderson Scott has gone to England for a vacation.

R. H. Richards was at Ishpeming last week and has gone to Houghton.

Sumner S. Smith came down to Seattle from Nome last week and has gone north to Juneau.

C. D. Kaeding has been made vice-president and general manager for the Dome Mines Company.

Huntington Adams has gone to Chile, S. A., where his address is in care W. R. Grace & Co., Iquique, Chile.

Morton Webber has gone to Idaho to make a preliminary examination of a placer deposit for New York clients.

W. J. Pentland is in Denver, Colorado, where his address will be temporarily in care of Dorr Cyanide Machinery Co., Denver.

H. L. Smyth is to be the head of the combined school of mines of Harvard University and Massachusetts Institute of Technology.

Samuel Newhouse, formerly a prominent mining operator of Utah, but now a resident of New York City, is in Salt Lake City on a visit.

J. Vanophem, of Brussels, president of the Algunican Development Co., owner of the Jualin mine at Jualin, north of Juneau, inspected the property recently.

W. D. B. Motter, Jr., recently manager for the Canada Iron Mines, Ltd., of Trenton, Ontario, was appointed on May 1 as manager for the Benson Mines Co. at Benson Mines, New York.

Henry Tschetschott, professor of ore dressing and metallurgy at the Mining Institute of St. Petersburg, is in the Juneau district, Alaska, studying the methods of ore treatment.

J. A. Singmaster, general superintendent for the New Jersey Zinc Co., of Palmerton, Pennsylvania, is making a tour of Europe visiting smelters and other departments of the zinc industry.

John H. Bell, formerly underground superintendent for the Aurora Consolidated Mines Co., has accepted a position as superintendent of the Nau Aug mine, twelve miles from Hailey, Idaho.

E. E. Price, who has been superintending operations at the Lower Mammoth mine of the Tintic district, Utah, during the past two years, left recently for Casper, Wyoming, where he will take charge of the Pine Dome Oil Co.'s property. William Foyer will succeed Mr. Price.

H. G. Young has resigned as manager for the Trethewey Silver-Cobalt Mine, Ltd., and has accepted the position of consulting engineer to the Algunican Development Co. of the Juneau district, Alaska, and general manager for its subsidiary companies. Mr. Young will leave Cobalt about August 1.

Obituary

Frank Robbins, who for the past fifteen years had made his home in Los Angeles, died on June 21 of pneumonia, after a brief illness. In the early days of the Eureka district, Mr. Robbins was superintendent of the Eureka Consolidated. Later he was manager for mines at Valle de los Angeles in Honduras; MacKenzie and Mann at Greenwood, British Columbia; and also of the Elkhorn at Leadville, Colorado. He also held other important positions and his loss will be deeply regretted by his many friends in the mining profession.

Edward C. Limbach, superintendent of the American Girl mines at Ogilby, California, at 1 p. m. on June 15, slipped and fell upon the drive-belt of one of the Hardinge mills, passing around the pully on the countershaft. He died two hours later. Mr. Limbach was a graduate of the Colorado School of Mines in the class of '95, and followed the profession for a number of years in Colorado and Montana and later in Loomis, Washington, where his family are living. He was a man of charming personality, always well liked by his associates in school and in the field, honest, upright, and fair. He has improved the practice at the American Girl considerably in the short time he was there, and was a valued member of the profession.

Arthur Austin, chief testing engineer at the Tooele smelter of the International S. & R. Co., was severely burned June 29 while testing an oil burner for the assay furnaces. He was using a steel barrel containing fuel oil under high pressure. The head of the barrel blew out, covering him with oil which immediately took fire from a nearby flame. His injuries were so severe that he died a few hours later. He was a son of L. S. Austin, the well known metallurgist, and was himself well started on a promising career in metallurgy. After graduating from the Colorado School and the Michigan College of Mines he entered the service of the Anaconda Copper M. Co. in 1906, from which he was transferred to the International in 1911.

SOCIETY MEETINGS

JULY	
Northern California and Southern Oregon Mining Congress, Ashland, Oregon	9-10
AUGUST	
American Institute of Mining Engineers, Salt Lake City	10-14
British Association, Adelaide, South Australia	8
Canadian Mining Institute, Rocky Mountain branch, Banff.	
Lake Superior Mining Institute, Ishpeming, Michigan	31 to Sept. 3
SEPTEMBER	
American Chemical Society, Montreal	15-18
American Institute of Electrical Engineers	not fixed
Colorado Scientific Society, Denver	3
Illuminating Engineering Society, Cleveland	21-25
OCTOBER	
American Institute of Electrical Engineers	9
American Iron and Steel Institute	23-24
Colorado Scientific Society, Denver	3
NOVEMBER	
American Institute of Electrical Engineers	13
Colorado Scientific Society, Denver	7
DECEMBER	
American Institute of Electrical Engineers	11
American Museum of Safety	11-20
American Society of Mechanical Engineers	7-8

The University of Minnesota School of Mines, at Minneapolis, begins the first semester on September 1, with 58 instructors in the faculty. There are three regular courses of study, namely, mining engineering, mining engineering specializing in geology, and metallurgy, leading to the degree of engineer of mines, engineer of mines in geology, and metallurgical engineer, respectively. The bulletin of June 1914 describes the courses and other general information.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Stocks and Bonds

SAN FRANCISCO STOCKS AND BONDS

(San Francisco Stock and Bond Exchange.)
July 8

BONDS

Listed	Bid	Ask	Unlisted	Bid	Ask
Associated Oil 6s	$ 88	90	Natomas Consol	4	12
Natomas Con	22½	25	Pac. Port. Cement 6s	100	—
Unlisted.			Santa Cruz Cement 6s	85	—
General Petroleum 6s	38	40	Union Oil	86½	87½

STOCKS

Listed.	Bid	Ask	Listed.	Bid	Ask
Amalgamated Oil	78	—	West Coast, pfd.	—	112½
Associated Oil	38½	40	Unlisted.		
Du Pont, pfd	80	84	General Petroleum	—	4½
Giant	79½	81½	Noble Electric Steel	52½c	60c
Pac. Cst. Borax, com	60	—	Pac. Port. Cement	60	94
Sterling O. & D.	—	1½	Riverside Cement	—	63
Union Oil	60	—	Santa Cruz Cement	40	—
			Stand. Port. Cement	—	18

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)
July 9.

Atlanta	$ .14	Montana-Tonopah	$ .55
Belcher	.30	Nevada Hills	.32
Belmont	6.67	North Star	.36
Con. Virginia	.17	Ophir	.19
Florence	.35	Pittsburg Silver Peak	.24
Goldfield Con	1.40	Round Mountain	.37
Goldfield Oro	.08	Sierra Nevada	.11
Halifax	.50	Tonopah Extension	2.45
Jim Butler	1.05	Tonopah Merger	.40
Jumbo Extension	.19	Tonopah of Nevada	6.75
MacNamara	.01	Union	.15
Mexican	.51	Victor	.35
Midway	.20	West End	.07
Mizpah Extension	.23	Yellow Jacket	.36

CALIFORNIA STOCKS

(Latest Quotations.)

	Bid.	Ask.		Bid.	Ask.
Argonaut	...	$7.50	Kennedy	$8.00	....
Brunswick Con.	1.50	....	Mountain King	...	0.50
Bunker Hill	1.90	....	South Eureka	1.10	....
Central Eureka	0.12	0.13			

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)
July 9.

	Bid	Ask		Bid	Ask
Allouez	$ 39½	40½	Nevada Con	$ 13¾	14
Ariz. Commercial	4¼	5	North Butte	24¾	25
Butte & Superior	36¾	37	Old Dominion	49¼	50
Calumet & Arizona	64¾	65	Osceola	77½	79
Calumet & Hecla	400	410	Quincy	57	57½
Copper Range	35¾	36	Shannon	5	5¼
East Butte	9¾	10	Superior & Boston	1¾	2
Franklin	4	4¼	Tamarack	34	35
Granby	79	80	U. S. Smelting, com	33¾	34¼
Greene Cananea	28½	28¾	Utah Con	10	11¼
Isle Royale	20½	21	Verde	82	85
Mass Copper	4¼	5	Winona		3
Mohawk	44	45½	Wolverine	38½	40

NEW YORK STOCK EXCHANGE

(By courtesy of J. C. Wilson, Mills Building.)
July 9.

	Bid	Ask		Bid	Ask
Amalgamated	$ 70½	70¾	Miami	$ 22½	22¾
Anaconda	31½	31¾	Nevada Con	13¾	14
A. S. & R., com	65¾	66	Quicksilver, com	1	2
Calif. Pet., com	19¼	20	Ray Con	21¼	21¾
Chino	40¾	40¾	Tenn. Copper	32¼	33
Guggenheim Ex	54½	55¼	U. S. Steel, pfd	109⅜	109¾
Inspiration	18¼	18¾	U. S. Steel, com	61¾	61¾
Mexican Pet., com	61¼	62	Utah Copper	57¼	57½

NEW YORK CURB QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)
July 9

	Bid	Ask.		Bid	Ask
Braden Copper	7⅝	7¾	McKinley-Dar	6⅝	6¾
B. C. Copper	1⅝	1⅞	Mines Co. Am.	2⅜	2½
Con. Cop. Mines	1¼	1½	Nipissing	5¾	6
Davis-Daly	⅝	¾	Ohio Copper	¼	⅜
First National	1½	2	Stand. Oil of Cal.	321	324
Hollinger	18	19	Tri Bullion	⅛	¼
Iron Blossom	1¼	1½	Tuolumne	¼	½
Kerr Lake	5	5¼	United Cop. com	⅛	¼
La Rose	⅞	1⅛	Yukon Gold	2¼	2½
Mason Valley	2⅜	3			

LONDON QUOTATIONS

(By cable, through the courtesy of Hollister, Lyon & Walton, New York.)
July 9.

	£	s.	d.		£	s.	d.
Alaska Mexican	1	10	0	Mexican Eagle, com	2	0	0
Alaska Treadwell	7	6	3	Mexico Mines	4	17	6
Alaska United	3	11	3	Messina	1	12	0
Arizona	1	16	3	Oroville	0	11	3
Camp Bird	0	7	6	Pacific Oilfields	0	1	3
Cobalt Townsite	1	12	6	Rio Tinto	68	15	0
El Oro	0	13	3	Santa Gertrudis	0	12	6
Esperanza	0	14	6	Tanganyika	2	1	3
Granville	0	8	9	Tomboy	1	1	9
Kern River Oilfields	0	8	9				

Metal Prices

LOCAL METAL PRICES

San Francisco, July 9.

Antimony	9 — 9¾c
Electrolytic copper	15 —15¼c
Pig Lead	4.15— 5.10
Quicksilver (flask)	$37.50
Tin	39 —40½c
Spelter	6½— 6¾c

Zinc dust, 100 kg. zinc-lined cases, 7½ to 8c. per pound.

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, July 9.—A large business is being done in copper in both domestic and export trade, but local buyers' requirements are not well covered. The price has moved up steadily all the week. Lead and spelter are quiet. Tin is steady at 31.90 to 32c., and antimony is dull at 7.12 to 7.25c. In London, copper is steady at £62 6s.3d. to £62 12s.6d., tin steady at £114 15s. to £116 5s., and bar silver steady at 25 7/8d. The American Smelting & Refining Co. is having trouble in starting up its Chihuahua plant.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date		Average week ending	
July	2	May	27
"	3	June	3
"	4 Holiday	"	10
"	5 Sunday	"	17
"	6	"	24
"	7	July	1
"	8	"	8

2	56.62	27	57.12
3	56.62	3	56.62
4 Holiday		10	56.48
5 Sunday		17	56.56
6	56.25	24	56.21
7	56.37	1	56.58
8	56.25	8	56.12

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	....
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask

or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending		Week ending	
June 11	38.50	June 25	38.50
" 18	38.50	July 2	38.50
		" 9	37.50

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	....
Feb.	41.00	39.00	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
July	2 3.90	May	27 3.90
"	3 3.90	June	3 3.90
"	4 Holiday	"	10 3.90
"	5 Sunday	"	17 3.90
"	6 3.90	"	24 3.90
"	7 3.90	July	1 3.90
"	8 3.90	"	8 3.90

Monthly averages.

	1913	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	....
Feb.	4.33	4.02	Aug.	4.60	....
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec	4.02	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
July	2 4.75	May	27 4.93
"	3 4.75	June	3 4.90
"	4 Holiday	"	10 4.88
"	5 Sunday	"	17 4.85
"	6 4.75	"	24 4.85
"	7 4.75	July	1 4.75
"	8 4.75	"	8 4.75

Monthly averages.

	1913	1914		1913.	1914
Jan.	6.88	5.14	July	5.11	....
Feb.	6.13	5.22	Aug.	5.51	....
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	....
Feb.	49.07	39.76	Aug.	41.75	....
Mch.	46.95	38.10	Sept.	42.45	....
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
July	2 13.35	May	27 13.98
"	3 13.35	June	3 13.86
"	4 Holiday	"	10 13.75
"	5 Sunday	"	17 13.65
"	6 13.40	"	24
"	7 13.50	July	1 13.28
"	8 13.60	"	8 13.11

Monthly averages.

	1913.	1914.		1913	1914.
Jan.	16.54	14.21	July	14.21	....
Feb	14.93	14.46	Aug.	15.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

COPPER PRODUCERS' ASSOCIATION REPORT

The Copper Producers' Association statement for June shows a decrease in production and increase in stocks on hand. The details are as follows:

	Pounds.
Stocks of marketable copper of all kinds on hand at all points in the United States, June 1, 1914	84,342,641
Production of marketable copper in the United States from all domestic and foreign sources during June	141,310,000
Deliveries for consumption, June	45,927,000
Deliveries for export, June	73,350,477
Stock of marketable copper of all kinds on hand and at all points in the U. S., July 1	97,142,863

Recent changes in surplus have been as follows, in pounds:

	Increase.	Decrease.
June 1913	.....	14,569,619
July	690,330	.....
August	.....	15,280,908
September	.....	8,531,043
October	2,773,288	.....
November	15,363,047	.....
December	43,509,438	.....
January 1914	.....	4,142,182
February	.....	8,924,833
March	.....	13,762,533
April	5,727,682	.....
May	14,005,640	.....
June	12,768,022	.....

COAL AND COKE PRODUCTION

The following data, covering 1913, is from the U. S. Geological Survey:

	Miners employed.	Coal mined, tons.	Value.	Coke made, tons.	Value.
Alabama	.....	.....	$.....	3,323,664	$ 9,627,170
Arkansas	4,660	2,234,107	3,582,789	.....	.....
Illinois	.....	.....	.....	1,859,553	8,593,581
Indiana	.....	.....	.....	2,727,025	13,182,136
Iowa	15,679	7,490,641	13,431,061	.....	.....
Kansas	12,479	7,202,210	12,036,292	.....	.....
North Dakota	.....	495,320	750,652	.....	.....
Tennessee	11,263	6,903,784	7,883,714	.....	.....
Texas	.....	2,429,144	4,288,920	.....	.....
Virginia	9,162	8,828,068	8,952,653	.....	.....

Each of these states produced more coal than in 1912. Alabama coke output was 348,175 tons over the previous year, and this increase was from by-product ovens. These yielded 2890 tons per oven, against 212 tons from the beehive type. Coke made in Illinois and Indiana comes from West Virginia mines. Iowa is primarily an agricultural state, and excepting the coal used by railroads, the sale depends on rural communities. Kansas operators had little to complain of in 1913. The North Dakota output is all lignite. The year was satisfactory in Tennessee. Texas produces lignite and bituminous coal in equal quantities.

PRODUCTION of abrasive garnet in the United States in 1913 amounted to 5308 short tons, valued at $183,422, according to the U. S. Geological Survey. This was the largest in the history of the industry, and an increase of 361 tons in quantity and of $20,185 in value, compared with the production for 1912. The industry was confined to three states, New Hampshire, New York, and North Carolina.

TIN STATISTICS for June show the following movements, according to L. Vogelstein & Co. of New York: Shipments of standard metal to America, England, and Europe, 7894 tons; deliveries, 8995 tons; visible stocks, 18,562 tons; average price, 30.60c. per lb. Figures for May were 11,744,887, and 19,663 tons, and 33.25c. respectively.

BULLION received at the San Francisco mint during June was as follows: Gold, 143,156 oz. worth $2,959,303; and silver, 21,632 oz. worth $12,114. The coinage executed was $3,000,000 in double eagles, and $21,500 in one-cent pieces. Coin, bullion, etc., on hand at the end of June amounted to $246,370,370.83.

THE LAKE SUPERIOR MINING INSTITUTE will hold its nineteenth annual meeting at Ishpeming and Detroit at the end of August and beginning of September. A first-aid demonstration will be held, and the mines visited at Ishpeming.

ARTIFICIAL GRAPHITE manufactured at Niagara Falls in 1913 was valued at $973,397.

COMPANY REPORTS

INTERNATIONAL NICKEL COMPANY

The twelfth annual report of this Company for the financial year ended March 31, 1914 shows gross profits amounting to $6,[illegible],786. After deducting depreciation, exhaustion of mines and all other charges, the net profits amounted to $4,792,665. Dividends on the preferred and common stocks to the amount of $4,337,306 were paid, and the sum of $454,759 was carried forward. The assets of the Company are placed at $53,941,207 of which $9,210,442 are current assets, cash on hand being $3,243,673. During the year, the unsatisfactory conditions prevailing in the steel industry, coupled with lower prices received for the output of copper, resulted in the earnings being slightly less than for the previous year. Many improvements have, however, been made in the smelter and at the mines which will result in a greater output at lower costs. The benefit of these expenditures will probably be felt during the present year.

HAMPDEN CLONCURRY COPPER MINES, Ltd.

The report of this Queensland Company covers the half-year ended February 28, 1914. In the six mines, a total of 3187 ft. of development was done. The Duchess shaft was sunk to 727 ft. Three winzes, sunk below the 550-ft. level, have opened 18 to 20% ore at depths of 97 to 126 ft. Reserves in this mine are estimated at 67,000 tons. At 350 ft. in the Hampden, a sulphide orebody has been opened for 220 ft., it being from 4 to 9 ft. wide, averaging 10% copper. This ore contains less than 20% silica. No. 1 shaft was sunk to 523 ft. A low-grade shoot was cut at 490 ft., and driving at 500 ft. has opened ore assaying 10.1% silica, 51.2% iron oxide, 39.1% sulphur, and 3.8% copper. Reserves total 57,000 tons. Seven per cent ore was opened at 200 ft. in the Trekelano mine. Reserves in all mines are estimated as 241,000 tons averaging about 10% copper. Ore smelted was 33,105 tons producing 6,855,760 lb. copper, 1023 oz. gold, and 26,172 oz. silver. The revenue was £222,158, profit, £65,847; and dividend, £35,000.

LUCKY TIGER-COMBINATION GOLD MINING COMPANY

This Company has its general office in Kansas City, Missouri, and controls the Tigre Mining Co., which operates mines and mills at El Tigre, District of Moctezuma, Sonora, Mexico. The report covers the calendar year 1913. The reports of the consulting engineer, James W. Malcolmson, and general manager, L. R. Budrow, contain the following information:

Development totaled 4984 ft., of which 2400 ft. was diamond-drilling, the latter cutting the Kelley vein on No. 3 level 150 ft. east of the main vein. No. 2 level cut this shoot, which has developed about 300 ft. of a good grade of ore. Cross-cuts were driven on No. 1, 3, and 3½ levels to cut the vein. No. 3 reached it, and 89 ft. of driving was done in ore. The other cross-cuts have since cut the vein. Stoping was started on this vein in February, 1914. Work on the main Tigre vein totaled 2291 ft., and on the Sooy vein, 39 ft. Development cost 59.2c. per ton. There was 56,081 tons of ore broken, of 9.2c. per ton. Concentrate produced was 2358 tons, assaying, 0.493 oz. gold, 285 oz. silver, 2.32% copper, and 12.05% lead. Broken ore in stopes amounts to 28,907 tons. Mining cost $2.80 per ton.

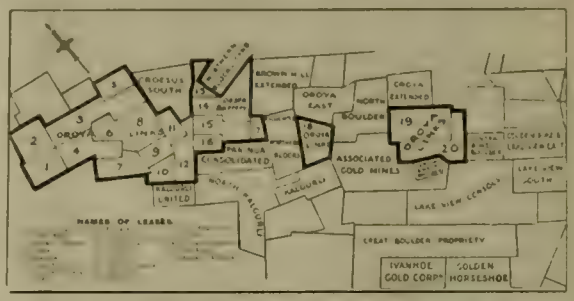
The mills crushed 68,528 tons of ore, and the cyanide plant treated 64,757 tons of current and 21,778 tons of dump tailing, at a cost of $3.99 per ton. Ore transport to the mills cost 9.2c. per ton. Concentrate produced was 2358 tons assaying, gold 1.85 oz., silver 4.1.18 oz., lead, 6.6%, and copper 1.%. The mills yielded 4199 oz. gold and 1,220,028 oz. silver, valued at $811,456. The total recovery was 92.8%. By shutting down the old mill a saving of about $2,500 per month will be made. The gross value of ore milled and shipped was $1,[illegible],526, or at an average of $4.[illegible] per ton.

Net realization from operations was $729,657, and including cash at the beginning of 1913, the total available was $871,077. Out of this, 12 dividends were paid totaling $450,062, and the cash on hand at the end of the year was $125,943.

OROYA LINKS, LIMITED

As will be seen from the accompanying map, this Company controls a large area at Kalgoorlie, Western Australia, on which it is doing a considerable amount of work, also 50 tributers or lessees, who mostly worked in the oxidized ores. The report covers the year ended December 31, 1913. The superintendent is P. Fitzgerald, and general manager, Bewick, Moreing & Company.

Development in the various claims totaled 5960 ft., also station cutting and surface trenching. The expenditure was



CLAIM MAP SHOWING OROYA LINKS PROPERTY AND OTHER PRINCIPAL MINES AT KALGOORLIE.

£14,526, equal to 50c. per ton milled. A good deal of work was done at and above 750 ft. in the Eclipse mine; the Croesus Proprietary shaft was sunk from 750 to 935 ft. (now 945 ft.), the lode being cut at 932 ft.; work was confined mainly to the oxidized portion of the Brownhill west lode; and in the Oroya north block, the Magazine lode worked by tributers was followed down to the boundary in rich ore, but above 110 ft. there was nothing of importance disclosed. Ore reserves are estimated at 146,775 tons worth $5.82 per ton, an increase of 32,466 tons and 16c. per ton in value. Tributers on nine claims mined 4183 tons of ore yielding £9589, on which the royalty was £1831. Results were as follows:

Ore extracted from five mines (Eclipse and Oroya North mainly), tons	139,130
Gold from 50-stamp mill, slime and concentrate plant, etc.	£151,819
Net profit in Western Australia	15,899
Forward to 1914, including balance from 1912	18,180
Cash at bankers, in hand, and on loan	61,916
Total cost per ton	$3.86

During the first quarter of 1914, 35,630 tons of ore was treated at a profit of £4826.

INSPIRATION CONSOLIDATED COPPER COMPANY

The Inspiration property in Gila county, Arizona, is the scene of great activity. Aside from mine development, a mine plant, a 10,000-ton concentrating plant, and the testing of the flotation process at the rate of 600 tons per day is under way. The report of the general manager, C. E. Mills, covers the year 1913. The property now totals 2857 acres. Underground preparation for ore extraction continued,

and development totaled 37,760 ft., making a total of 110,609 ft. to date. There was hoisted 47,200 tons of 1.86% copper ore, and 196,783 tons of waste. Ore on hand in stockpiles amounted to 195,000 tons, averaging 1.79%, at the end of the year. In the Live Oak claims 17 holes were drilled an average depth of 241 ft., and 6,858,000 tons of carbonate and sulphide ores, assaying from 1.33 to 1.45%, was developed. Churn-drilling has been very satisfactory. Reserves are as follows:

Class of ore.	Tons.	Copper Per cent.
Sulphide	45,000,000	2.00
Low sulphide	28,322,000	1.26
Oxidized	12,445,000	1.34
Mixed carbonate and sulphide	3,876,000	1.24
Total	89,643,000	1.64

Mining operations will probably be confined for many years to the higher-grade ore.

Surface equipment at Inspiration for a capacity of 10,000 tons per day is as follows: Steam power-plant of three 6000-kw. generators, head-frames for two main shafts and receiving bin of 2000-ton capacity, two electric hoists of the Ilgner system, air-compressors to supply 11,000 cu. ft. per minute for mine drills, high-pressure compressor for underground locomotives, coarse crushing plant with four No. 8 gyratory crushers and eight 48-in. disc grinders, ore storage bins on railroad at mine to hold 25,000 tons, ore-bins at mill to hold 12,000 tons, concentrating plant 1½ miles from mine, water supply plant of 5,000,000 gal. daily capacity, and 7½ miles of standard-gage railroad to the mine, mill, smelter, and connecting railroad. The plant should start at the end of 1914.

To provide the funds necessary for extensions to original plans, etc., five-year 6% convertible debenture bonds, amounting to $4,500,000 were authorized. Assets totaled $20,586,996, including $1,781,146 cash. Liabilities include accounts payable, $127,836; and 10-year 6% convertible bonds, $6,000,000.

MOUNT LYELL MINING & RAILWAY COMPANY, LTD.

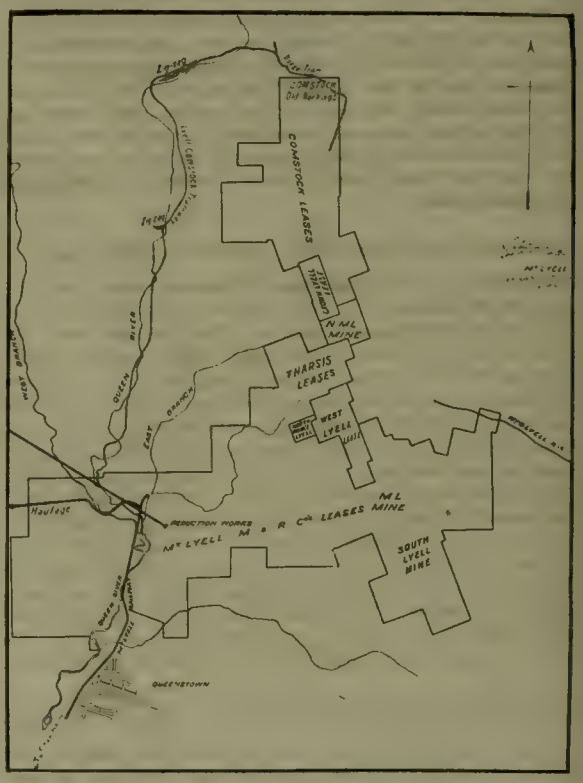
The report of this Tasmanian company covers the half-year ended March 31, 1914, and is replete with data on mining, smelting, and new power scheme; with photographs, plans of the district, and of the North Lyell mine. The combined reports of the general manager, Robert C. Sticht; engineer in charge of mines, R. M. Murray; local superintendent, Basil Sawyer; metallurgist, R. P. Roberts; chief mechanical engineer, G. W. Wright; superintending engineer of railways, E. Carus Driffield; and engineer for supplies, Huntley J. Clarke, contain the following information: At the Mt. Lyell mine, overburden was removed from benches No. 2a, 3a, 3b, 4c, and 5. Ore was broken from No. 4 bench. Only 19,934 tons was taken from the open-cut. No. 6, 7, and 8 levels underground were actively worked producing 88,507 tons. Diamond-drilling 545 ft. yielded promising results. This mine supplied 5021 tons of pyrite (45% sulphur) for the Company's chemical works in Australia. Ore reserves in the parent mine amount to 2,097,072 tons averaging 0.531% copper, 1.96 oz. silver, and 0.0275 oz. gold.

Prospecting was done in the south Mt. Lyell mine.

The north Mt. Lyell mine produced 60,461 tons of ore, and 120 tons of copper precipitate from underground water. A station was cut at the 1100-ft. level for a new hoist winze being sunk to open the orebodies below this level. Work was also started to connect the 200, 700, and 850-ft. levels with the Crown Lyell shaft. Ore reserves in the North Mt. Lyell are 1,025,651 tons averaging 6% copper, 1.33 oz. silver, and 0.005 oz. gold.

Prospecting was done on five levels in the Lyell Comstock mine. Development in all mines totaled 4531 ft., including 1836 ft. of drilling. The blast-furnaces treated a total of 163,513 tons of ore, fluxes, etc., Mt. Lyell supplying the basic, and North Mt. Lyell the silicious ore. The average mixture smelted contained 2.49% copper, 1.62 oz. silver, and 0.028 oz. gold. From 9360 tons of matte, there was produced 3433 tons of blister copper, assaying 98.78% copper, 67.5 oz. silver, and 1.312 oz. gold per ton, equal to 3391 tons of copper, 231,740 oz. silver, and 4504 oz. gold. Costs were as follows: Mining, $2.43; smelting, $2.13; and converting, 30c., a total of $4.86 per ton, against $5.32 in the previous term.

After deducting all charges, the net profit was $298,000. With the balance from the previous half-year, the amount available was $2,980,000, out of which $385,000 was paid as dividend No. 17 of 30c. per share. On June 15, 1914, No. 18 was paid, amounting to $300,000, or 24c. per share. Assets show a surplus of $1,680,000 over liabilities.



PLAN OF MT. LYELL PROPERTY AND DISTRICT. THE NEW POWER PROJECT IS SITUATED A FEW MILES NORTH.

Rainfall at various points in the district was from 31.18 to 68.28 in. on 87 to 119 days. Good progress is being made with the Lake Margaret hydro-electric scheme, the plant being well under way, and all transmission poles erected. Power should be available in September, 1914.

An experimental plant has been erected at the smelter to test ore by flotation methods. Trials on North Mt. Lyell ore have been made, and those on Lyell Comstock were satisfactory.

The three chemical and superphosphate plants in Australia operated in the usual satisfactory manner. The South Australian interests were amalgamated with those of the Wallaroo Phosphate Co., Ltd., and a new company registered. The railways were kept in good order, the revenue being $97,000, and expenditure $77,000.

The Company's metal production since August, 1903, is: Copper, 127,498 tons; silver, 10,626,593 oz.; and gold, 321,104 ounces.

RECENT PATENTS

1,097,530.—Electric furnace working with an electric arc of A.C.s for melting and extraction of metal from ore. Peter Kr[illegible]ng, Christiania, Norway.

An electric furnace comprising a closed melting chamber, a vertical charging shaft above the chamber, provided with a plurality of extensions with charging apertures, said apertures being normally closed by the charging material, a flue leading from the melting chamber through the material being charged, said flue extending through the shaft, and a plurality of electrodes extending into the melting chamber substantially as described.

1,098,282.—Process for treating so-called carnotite and associated and similar vanadium and uranium minerals. Herbert N. McCoy, Chicago, Illinois.

A process of treating carnotite and allied ores, consisting in heating the ore in presence of sulphuric acid until a mass is obtained which is solid when cold and which contains substantially all of the vanadium and uranium in a readily soluble condition, extracting the soluble constituents from the said mass, treating the solution thus obtained to recover the values therefrom, and treating the residue for the concentration of its radium content.

1,098,183.—Ore concentrator. John L. Signorette, Los Angeles, California.

In an ore concentrator, the combination with a base, of resilient supports carried by said base, a tray mounted on the support, a longitudinally extending bumper bar connected with the bottom of the tray, a standard mounted on the base adjacent to each end of the tray, resilient means for reciprocating the tray, means carried by the standards adapted to be engaged by the bumper bar during the reciprocation of the tray to jar such tray and independent adjusting devices for the resilient means and last-mentioned means whereby the shock at either end of the reciprocation may be regulated.

1,100,217; 1,100,218; 1,100,219; 1,100,220; 1,100,221; 1,100,222, and 1,100,223 have been granted to Charles Butters, Oakland, California, covering apparatus for filtering slime. This includes, respectively: (1) a suction filter-leaf having means for admitting water thereinto to dislodge a cake therefrom, and a relief valve in communication with the upper portion thereof to relieve said leaf of air as water is admitted thereto. (2) in a suction filter-leaf, the combination of a frame, filter media carried thereby and a water-supply pipe for cake-dislodging purposes connected to said leaf, said pipe having an opening to atmosphere near its point of attachment to the leaf; (3) a filter-leaf having means for equalizing the external and internal water pressure thereon while said leaf is submerged; (4) a suction filter-leaf having a manually operated valve connected with a submerged portion thereof; (5) the step in the process of treating slime which consists in running water through the filtering means while submerging said means in the slime; (6) a filter-leaf having a header, a frame, filter media mounted on said frame and supported by said header, and a perforated pipe mounted on said leaf above said header; and (7) the process of dislodging slime cakes from filter-cloths, which consists in saturating without pressure substantially the entire surface of the cloth while the cake is thereon. Patent 1,100,267, consisting of a filter medium for a suction filter-leaf open across the bottom was granted to William Arma Stedman, of Wonder, Nevada, assignor to the Butters Patent Vacuum Filter Co., a corporation of Nevada.

RECENT PUBLICATIONS

Effect of the Soot in Smoke on Vegetation. By J. F. Clevenger. Smoke Investigation Bulletin 7, P. 26. Illustrated.

Boletin de la Sociedad Nacional de Mineria, No. 201-2, and 203-4. P. 96 and 87, Ill., maps, index. Santiago de Chile, 1913, and 1914.

Some Graphic Methods for the Solution of Geologic Problems. By W. S. Tangier Smith. Reprint from *Economic Geology*. P. 58. Illustrated.

The Manhattan Schist of Southeastern New York State, and its Associated Igneous Rocks. By Charles Reinhard Fettke. From *Annals* of the New York Academy of Sciences. P. 68. 15 plates.

Petroleum Industry of California. By J. H. G. Wolf. Reprint of address given April 17, 1914, before the San Francisco chapter of the American Society of Civil Engineers. P. 17. Maps and charts.

Geology of the Standing Rock and Cheyenne River Indian Reservations, North and South Dakota. By W. R. Calvert, A. L. Beekly, V. H. Barnett, and M. A. Pishel. *Bulletin* 575. P. 49. Ill., maps.

Mineral Resources of Washington, with statistics for 1912. By Henry Landes. Bulletin 11. P. 55. Maps. Washington Geological Survey, Olympia, 1914. This will be reviewed in another issue of this journal.

Mining Advance Into the Inland Empire. A comparative study of the beginnings of the mining industry in Idaho and Montana, eastern Washington and Oregon, and the southern interior of British Columbia; and of institutions and laws based upon that industry. By William J. Trimble. A thesis submitted for the degree of doctor of philosophy at the University of Wisconsin. P. 254. Map. Madison, Wisconsin. Price, 40 cents.

Coal, Oil, Gas, Limestone, and Iron Ore Map. Revised edition by the West Virginia Geological Survey, February 1, 1914. It contains a thorough revision of the coal, oil, and gas developments, several anticlinals being added and others corrected from later observations. The names and addresses of 918 coal companies operating in the state are given by counties, as well as the locations of their mines. The names of many new towns, post-offices, etc., are added, and the valuable iron ore deposits of the state are also indicated on this map, and all the special features of previous editions corrected and brought up to date, showing the approximate areas of the several coal series, as well as the oil and gas pools. Scale 8 miles to the inch. Price, enclosed in strong envelope and delivered by mail, 50c. each.

Kanawha County. By Charles E. Krebs, D. D. Teets, Jr., W. Armstrong Price, and I. C. White. West Virginia Geological Survey publication. P. 679. Ill., maps, 38 plates, index. Morgantown, 1914. In addition to the description of the Kanawha coal series and all the geologic features of the county, the geologic map gives the structural contours on the Pittsburgh coal horizon north from the Kanawha and Elk rivers, and on the Kanawha Black Flint south and east of the Elk and Kanawha rivers, as also the location of the anticlines and synclines showing their relations to the several oil and gas pools of the county. The soil map and report of the experts of the U. S. Department of Agriculture covering this region of the state should prove of especial value to the agricultural and horticultural interests. Price, with case of maps, delivery charges paid by the survey, $2.

New Machines and Devices

A New Use for Belt Conveyors

Using a belt conveyor for the rapid transportation of wet concrete is quite a new departure and especially so is the elevation of such material on belt conveyors, owing to the tendency of the water to separate out and run back. However, by speeding up the belt to over 400 ft. per minute this tendency is overcome and the success of this method can be appreciated through the fact that over 2000 cu. yd. of wet concrete were thus conveyed to the forms in a working day of 10 hours in the construction of the Pacific Gas & Electric Co.'s dam at Lake Spaulding.

The concrete is mixed in a house on the mountain side, not shown in the illustration, where five one-yard mixers of the revolving drum type are kept in constant operation, which discharge the mixed concrete directly upon the horizontal belt conveyor traveling at a speed of about 400 ft. per minute. This conveyor discharges into a gravity chute leading down the hillside to the first elevating belt conveyor, which carries it upward at an incline of 18° to a tower erected on the dam, from which it is chuted down to another belt conveyor, operating at an incline of about 15° and again carried up to the final gravity chute. The conveyors used in this installation were furnished by the Meese & Gottfried Company of San Francisco, through whose courtesy the halftone is also presented.

BELT CONVEYORS HANDLING CONCRETE AT LAKE SPAULDING DAM.

The Fulton Iron Works of St. Louis, Missouri, in Bulletin 'A' describe the Fulton-Tosi oil engines, which are a high compression Diesel type engine. This particular engine is built in the vertical form and with two, three, and four cylinders. It is claimed the engine may be started from cold within one minute without any trouble or time consuming preliminaries. The points of advantage claimed for this particular engine are the open 'A' frame construction, permitting easy access to main bearings; the cylinder is cast in the form of a removable liner from hard iron; all valves are in separate cages and in the cylinder head; timing as well as fuel valve may be varied while the engine is in operation; starting valves are operated by air; a direct connected injection air compressor forms an integral part of the engine; and a continuous system of lubrication with a filter and cooler in circuit is a part of the equipment. The engine is adapted to all classes of fuel oil.

Autotraction Drill Rigs

The drilling of deep blast holes of relatively large diameter is coming to be more general practice in the conduct of all large mining operations, in railroad work, quarries, and all classes of large excavations. To meet the demand for drill rigs to drill deep vertical blast holes the Sullivan Machinery Company offers the autotraction drill. The purpose of this machine has been to serve the public with a drill which will drill deep holes faster and at a less expenditure of labor and power than the heavy tripod or cable drills, which are the two methods in common use. Toward this end the Company has designed the autotraction drill which permits of the length of run or feed of from 10 to 20 feet, thus obviating the frequent stops necessary to insert longer steel in the well-known tripod types. Another advantage claimed for this drill for deep hole work is the ease and speed with which the autotraction drill can be moved from a completed hole to the site of a new one. The moving of a 4½ or 5-in. tripod drill, as those with experience will appreciate, is a slow job requiring several men. As compared with drills of the cable or well-boring type, the autotraction machine, with its reciprocating air or steam-driven piston is claimed to be a much faster driller. These outfits consist of a vertical standard or carriage, carrying a rock-drill cylinder attached to a heavy iron recoil block, which is suspended in guides, or ways, by steel cable passing over a sheave and alternately paid out or taken in, as needed, by a hoisting drum. The standard and hoist are mounted on a wagon truck made of structural steel. A 2-cylinder reversible engine provides power for the hoist and for moving the outfit from place to place.

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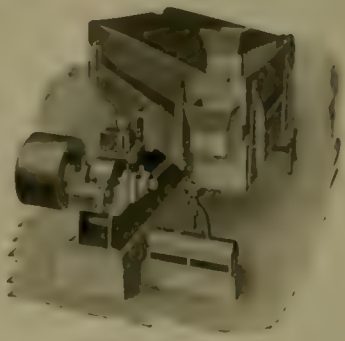

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AMONG OUR CONTRIBUTORS

Who writes a paper is often as important as what is said. Our own opinion on what the Administration at Washington will do in Mexico has large value—to us; the President's opinion has value to everyone interested. In the nature of the case, much of what is written is opinion. Even when the most conscientious effort is made to state facts, and facts only, the personal equation enters because in the mere choice of facts to present, judgment is exercised as to their relative importance. The *Press* tries especially to have its articles authoritative and we have many friends to thank that it succeeds so well. Most of its contributors are well known men and need no introduction to our readers, but we have thought some might be interested in a bald statement of Who's Who as applied to a representative number.

Mr. MAURICE SUMMERHAYES is the manager of the interesting mill that he describes so clearly. The Porcupine-Crown Mine, Ltd., by the way, is owned largely by the same people who have done so well with the Crown Reserve at Cobalt.

Mr. W. B. BLYTH, who calls attention to the need of a standard of hardness if tube-mill tests are to be accurately compared, is an Australian who occupies the responsible position of chief metallurgist for Bewick, Moreing & Co. at Kalgoorlie.

Mr. D. F. HIGGINS is an American geologist resident in Korea. He was trained at the Universities of Illinois and Northwestern University, from which schools he graduated. Before going to the Far East he saw field service with the State Geological Survey of Illinois and the Geological and Natural History Survey of Wisconsin.

Mr. G. T. JACKSON, to give him the correct initials, is mine superintendent of the Perseverance division for the Alaska Gastineau Mining Co., which it will be remembered is the name of the operating company of the Alaska Gold Mines Co.

Mr. F. R. IGALSBE is one of the field officers of the Forest Service who has learned of the practical operations of the mining law and come to know prospectors through the fellowship of campfire and trail.

Mr. E. E. HURJA is an experienced observer and writer who is visiting the important mining districts of Alaska this year in the interest of the *Press*.

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EDITORIAL

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AN 'absolutely new discovery' in metallurgy heralded some time ago as the Clapp process, which would make "extraction recoveries as follows: copper ores, 96 to 99.6 per cent; nickel, 99.6 per cent; iron and lead, 96.7 to 99.6 per cent," and would "revolutionize mining in the Western states," for some unknown reason has failed to revolute. There must be a reason.

THE passing of Victoriano Huerta from Mexico's political arena marks another change in the aspect of Mexican affairs. In that no good could possibly result to the Mexican people from his continuance in office, with revolution, secession, and bankruptcy ever upon the ascendency, it can only be hoped that in the reconstruction which now seems pending, broader political foundations, which will meet the requirements of the mass of the people, will be laid and peace will ensue. *Adios* Don Victoriano *y salud a su sucesor.*

HALF-WATT NITRO LAMPS, the latest development in the field of electric lighting, according to report bid fair to modify the present methods of illuminating. The advance which this new lamp marks may be better understood by a comparison of efficiency with the time-honored carbon filament and its current consumption of over six watts per candle-power. The new half-watt nitro lamp is of the tungsten filament variety with the bulb filled with nitrogen gas. At present the lamps range in size from 600 to 5000 candle-power, but with the perfection of methods of manufacture it may be expected that the half-watt nitro lamp, which is equally suited to both alternating and direct current, will be available in all of the commercial sizes.

DECORATION of Mr. Charles F. Rand with the Order of Isabella by the King of Spain is a pleasing recognition of his humanitarian and other services in Cuba during the Spanish-American war. It almost makes us regret that America has no official 'Order of Merit,' since it could so worthily be bestowed upon Mr. Rand as recognition from our side of his equally great work in the interest of sanitation and improvement of living conditions in time of peace. We shall have the pleasure shortly of printing a description of this work written by Mr. Rand himself. The able president of the Spanish-American Iron Company is an exponent of successful business on the highest plane, and we are glad to congratulate him upon an honor worthily won.

ANNUAL drilling contests, which are the ancient sport of the mines and have long formed the chief attraction in many of the mining camps on the Fourth of July, were in evidence this year as usual. Results are recorded in the 'Mining Summary' of this issue. While first-aid contests have come to divide attention, brawn, drill-steel, and granite continue to hold the centre of the stage.

SCRAP METALLURGIST is a degree not conferred by any of the accredited technical schools, but is nevertheless a real vocation amounting to a profession, according to Mr. William Jacobus, the original 'scrap metallurgist.' While most of us will associate the 'scrap metallurgist' with the 'ragman,' we must admit that Mr. Jacobus is worthy of an S.M. at least, if he has saved the Navy Department $2,000,000 a year by the institution of his methods in disposing of scrap metal.

WHILE the Australian Labor Federation is debating the feasibility of insisting upon the dismissal of all non-union men from the Australian goldfields, the Chamber of Mines of Western Australia announces that it will close every mine in that region rather than be dictated to by labor unions. Mine operators and labor have always maintained amicable relations in this district having met in convention every three years and adopted a labor agreement. It is to be hoped that this policy may be continued and a crisis avoided, since if the business of mining continues it must be at mutual profit of men and operators.

MINERAL LANDS on Indian reservations is the subject of a bill recently passed by the United States Senate. According to the new regulation, all lands containing the minerals, kaolin, kaolinite, fuller's earth, china clay, and ball clay, within such parts of Indian reservations as have heretofore been opened to settlement and entry under acts of Congress which did not authorize the disposal of such mineral lands, shall be open to exploration and purchase and be disposed of under the general provisions of the mining and coal-land laws of the United States, and the proceeds arising therefrom shall be deposited in the treasury. Senator Sterling of South Dakota, who proposed the bill, claims it to be of considerable importance to his state, in that deposits of fuller's earth of economic importance await such action to be profitably exploited. Recent produc-

tion statistics of the United States Geological Survey show the production of fuller's earth in 1913 to have been 38,594 tons, valued at $369,750, which is an increase of about $65,000 over the preceding year. The imports of fuller's earth during the year totaled $146,001.

THE Committee on Mines and Mining, to whom was referred the bill to provide for a commission to codify and suggest amendments to the general mining laws, has reported it back to the House of Representatives with the recommendation that the proposed code shall not deal with lands containing deposits of coal, oil, gas, phosphates, or soluble potassium salts, and that the bill be passed as amended. This amendment was suggested for the reason that the deposits named occupy a somewhat different status from the other minerals with respect to formation, methods of mining, and their use. The Department of the Interior has recommended legislation peculiarly adapted to the development and disposition of coal, oil, gas, phosphates, and potassium, which bills are now pending before the Senate and House committees on public lands. In the event of this bill being passed, which seems highly probable, there will undoubtedly be a commission created to make a thorough and exhaustive investigation of the subject and report its conclusions to Congress. The time is opportune for a discussion of the proposed revision, and we therefore take pleasure in presenting a discussion of the subject by Mr. F. R. Ingalsbe under the title of 'The Mining Law—Proposed Revision,' together with another contribution written by Mr. Clarence K. Colvin. Both recognize the importance of the subject, and their different viewpoints are both interesting and timely. We trust that a complete discussion of the subject will bring out the opinions of those interested so that revision may be undetraken with full knowledge.

THE American Petroleum Society, which was organized to promote the science of petroleum technology, gives promise of becoming a most useful organization, and it is to be hoped that the membership campaign now being conducted will meet with the hearty response of those interested either directly or indirectly in the production and use of petroleum, bitumen, and gas. The importance of the oil and gas industry is evidenced by the value of the production in the United States last year, which amounted to over $250,000,000, approximately 71 per cent of the world's supply. In 1907 the technologic branch of the United States Geological Survey, acting under authorization of Congress, undertook a comprehensive study of petroleum and its products, which work was and is being continued by the Bureau of Mines. It became evident to those in charge of the work that without the coöperation of the many men engaged in the industry and the funding of their knowledge for the advancement of the industry, this study would lose much of its effectiveness. The object of the Society is to consider, primarily, subjects relating to the science and technology of petroleum and its products, with the purpose of investigating those phases of the subject which are of direct and pertinent value to the industry, to join the wisdom of the scientist to the knowledge of the practical oil man for the advancement of the industry. In that the leading petroleum associations of the United States plan to make this society the arbiter of standards for the trade, it at once gains a prestige which other new societies of the other industries might only hope to attain after years of organization. At the present time there are not only a number of individuals but there are about 44 different committees in 43 different societies in the United States which are investigating subjects pertaining to petroleum with no forum available for the general discussion of this subject. That there is a need for this society is apparent and its success as an organization should be assured. The first annual meeting will be held in New Orleans on October 15, 1914, and the second in San Francisco from October 25 to 30, 1915, where the Society will act as host at a World's Petroleum Congress.

LEAD POISONING

Lead poisoning as contracted by employees of the smelters and refineries in the United States has recently been the subject of investigation by the Department of Labor. While the results of the investigation are largely statistical, they show conditions at the works toward correction of which real effort should be made. At the 19 plants, employing about 7400 men, investigated in the United States there were no less than 1769 cases of lead poisoning during the year 1912. From the cases reported it is seen that the exceedingly high figure of 22 per cent of the employees at these plants have been afflicted with lead poisoning. The hospital records at nine plants showed that 5 per cent of the employees were afflicted with this malady.

Of the plants investigated there were three which used blast-furnaces and large flue systems. While these plants employed only about 1000, or 13.5 per cent, of the total 7400 employees involved in the investigation, there were 387 cases of poisoning reported at these smelters. The figures presented may be, and probably are, in some instances exaggerated, as there is a tendency among workmen to attribute all of their ills to their vocation, regardless of origin, but it cannot be denied that there is an unnecessarily high percentage of men poisoned and a stronger effort toward reducing the prevalency of this disease should be made.

Lead poisoning became a very serious problem with the Austrian ore hearth workers in 1889, when there were 14 cases of lead colic among 61 men at one smelter. A change in working conditions whereby the hours of labor were reduced, four men working alternately in pairs for two hours at a time during each 12-hour shift and having rest periods of 24 hours between, resulted in such improvement that in 1902 and 1903 not a single case was recorded among the 49 men employed at the

same smelter. In Great Britain in 1912 there were only 37 cases of lead poisoning among 2089 men employed at lead smelters, or less than 2 per cent. In Austria and Germany conditions are said to be less favorable. The governments of these countries are at present regulating this phase of the industry and a marked improvement is reported in recent years. The experience at the Port Pirie smelter in Australia is also worthy of notice. Here a number of years ago, lead poisoning was exceedingly prevalent and the management undertook investigation and correction of existing conditions which has practically eliminated the disease. In addition to reducing smelter fume and dust to the minimum, the Company made it a rule, and this is important, that every man wash before eating.

In order to prevent lead poisoning, the cooperation of the men is as essential as is modern construction with every possible means of preventing dust and fume, and adequate sanitary appliances. Most operators agree that it is one thing to provide sanitary facilities for the men in the way of change rooms, wash rooms, dust-free lunch rooms, respirators, and the like, and it is another to get the men to take advantage of these facilities. In the majority of cases the laborer is lax, and the only remedy is a rule making violation of sanitary regulation cause for dismissal. The matter is largely one of habit, and when the men see results of these regulations in the form of a decreased number of cases of lead colic they will realize their value.

SULPHUR PRODUCTION

One of the curious things about mining is that while the production of certain mineral substances is generally regarded by everyone as the application and extraction of that ancient art, the exploitation and extraction of certain other substances, no less truly mineral, is scarcely considered, even by the profession, as being really mining. Roughly speaking, the digging of metallic mineral out of the ground is true mining; the digging of a non-metallic mineral (excepting coal) is something else. Conversely, if a substance is desired for its metal content, its digging is mining; if a non-metallic constituent is the object of the quest, its extraction from the ground usually fails to rise above the level of quarrying. Possibly one reason why quarrying is considered less dignified than mining is that a 'porphyry copper' is operated by a highly paid and efficient staff, while a quarry struggles along with ordinary laborers, paid about $2 per day, under the direction of a $250 per month superintendent, who nevertheless manages to keep operating costs down. Similarly, the small size of the producing units may be the reason why the digging of the 350,000 tons of pyrite each year produced in this country for its sulphur content does not usually come to mind in a hasty review of the mining industry of this country. The production of sulphur, whether from ore containing the elemental substance, from barren pyrite, or from the copper-bearing pyrite of Spain, is at least a distant relative of real mining, and one that can scarcely with good grace be relegated to the back door and the attic chamber.

The smelting industry is so busily engaged in burning off its sulphur and allowing it to escape into the atmosphere, keeping a wary eye on agriculturists and politicians the while, that it is easy to overlook the annual return from the sulphur which is being utilized. The value of the sulphur production of the United States last year has been estimated by Mr. W. C. Phalen, of the United States Geological Survey, at $5,500,000. The chief difficulty about sulphur is that it occurs abundantly in places where nobody wants it, and is generally absent from those places where it is required. Since it commands only a comparatively low price, the production of sulphur-bearing material involves business considerations rather than mining technology. Thus, for example, pyrite is imported from Spain to points on the Atlantic seaboard, since the railway freight in this country, with additional handling charges, makes the domestic pyrite cost more in the vicinity of the principal ports than imported material. Sulphur from Sicily used to be imported into the United States in considerable quantities, but of recent years the Louisiana sulphur has been produced and sold so cheaply that Italian imports only amounted to 125 tons of sulphur in 1913, according to Mr. Phalen. Two-thirds of the total sulphur imported comes from Japan, most of it entering at Portland and Hawaii, though some of it enters San Francisco in competition with the copper-bearing pyrite of California. The Hall process, in course of development at Coram, is likely to cause a change in the California situation, but can scarcely affect other points; for freights will not permit the California sulphur to compete with the Louisiana and Japan product at any great distance from its point of origin.

The Louisiana producers are now carrying the war into Africa, and competing with Italian sulphur on its own ground. The principal American company has established a distribution depot in Rotterdam and has chartered steamers for carrying its product. The Sicilian producers are rather dejected, as working costs there go up as the mines go down. Wages go higher, because of the emigration of laborers to America, while the Italian government has restricted the granting of concessions. Some of the deposits have been worked out, and corresponding new discoveries have not been made, so that there is every reason to believe that the Sicilian output will steadily decline. The increasing production of sulphuric acid by the copper smelters is also a factor in the sulphur situation, though probably not a disturbing one; for the smelters are commonly so situated that they cannot compete to advantage with the present makers of acid on account of freight rates. The smelters will, in many instances, have to create a market for their acid, and, since its output of sulphuric acid is often called the index of a country's civilization, progress will thus be made.

GENERAL VIEW OF THE PROPERTY OF THE PORCUPINE

Continuous Decantation at the Porcupine Crown Mines

By MAURICE SUMMERHAYES

The Porcupine Crown Mines is situated on the T. & N. O. Ry., 250 miles from North Bay in the Porcupine mining district, Ontario, Canada, and one-half mile from the town of Timmins. In February, 1913, a small amalgamating mill was built and put into commission primarily for the purpose of testing the mine sampling and also for producing revenue.

The small mill was operated until November 15 of the same year during which time experiments made (both in the laboratory with cyanide tests and the mill on a larger working scale) indicated that the continuous decantation process would be the most economical. This was erected and running by November 15 without interfering in any way with the existing mill, which was made a unit of the new one, the amalgamating plates during the erection of the larger mill being placed in a temporary building which was later removed.

The factors determining the choice of the process were: (1) short time factor for solution of gold; (2) low solution strength required (1.25 lb.); (3) rapid settlement of pulp; (4) low costs of installation and operation (5) small quantity of water required.

The ore is a hard quartz containing approximately 1% of iron pyrite. The grade of mill-run varies from $15 to $30 per ton. Some of the gold is coarse, but generally it is fine and freely disseminated in the quartz gangue, often associated with the pyrite. With the ore proper from 10 to 20% of country rock is sent to the mill.

Crushing and Elevating

The ore is delivered in cars from the shaft house to the mill, where it is weighed and dumped upon a grizzly spaced 1½-in. The oversize falls into an ore-pocket of 60 tons capacity and feeds a No. 3 Chalmers & Williams bronze ball gyratory crusher set at 1½-in. The discharge from the crusher joins the undersize from the grizzly and feeds a vertical belt elevator carrying 120 buckets 9 by 9 in. traveling 225 ft. per minute; this delivers the ore to a short conveyor belt 16 in. wide traveling 200 ft. per minute, which distributes the ore in the bin equally to each battery of ten stamps. The ore bin has a capacity of 265 tons.

The ore is fed to twenty 1050-lb. gravity stamps by standard Challenge feeders. The stamps drop 102 times per minute. The height of drop is 7½ in. and height of discharge 4 in. A stamp duty is obtained of 8.8 tons for the 2½-mesh screens. The battery posts are 12 by 26 in. for the side posts and 20 by 26 in. for the king posts. The top girt for the 20 stamps is framed in one piece giving the 20 stamp structure considerable extra support. Fairlie belt tighteners are used. The mortars are standard narrow type for quick discharge and coarse crushing.

Two and one-half and 6-mesh screens are used on the batteries and varied to suit the mill requirements. The 2½-mesh has openings 0.25 in., and the 6-mesh has openings 0.111 inch.

Classifier and Tube-Mill Closed Circuit

The stamps discharge to two Dorr classifiers, a duplex in circuit with a 5 by 16-ft. tube-mill and a simplex in circuit with the 4 by 20-ft. tube-mill. The 5 by 16-ft. makes 29 r.p.m. and the 4 by 20-ft. 31 r.p.m. The elevation of the classifiers is such that the discharge from the tube-mills will flow by gravity back to the classifiers. In the case of the 5 by 16-ft. tube-mill, this was accomplished by adding 4 ft. to the standard length of classifier, the oversize being fed to the scoop with a

CROWN MINES COMPANY, LIMITED.

solution jet regulated to give 38% moisture. With the 4 by 20-ft. tube-mill the desired result was obtained by increasing the radius of the scoop, the one used having a radius of 52 inches.

Twenty-four feet above the tube-mill floor are placed two amalgamating plates, 9 by 5 ft., receiving the slime discharged from the tube-mills, which is elevated by a triplex plunger pump and suitably diluted. The slope of the plates is 1½ in. per foot. The plunger pump has ball valves, the seats of which in time wear elliptical in shape, necessitating the use of a small amount of air to assist the pump, and later the valve seats must be taken out and reseated.

The plates have now been in use six months without material damage. The amalgam forms on the plates as a hard skin, and is removed with a scraper, care being taken not to get down to the copper. It is impossible to keep the plates soft and in good condition for catching fine gold, as practised in modern amalgamating mills, and this is not attempted. It does, however, pick up the heavy coarse gold, for which purpose only it is required. About 30% of the total recovery is made from these plates.

CYANIDING

The cyanide plant essentially consists of five 30 by 12-ft. Dorr thickeners, working in series, with an agitator, 16 by 16 ft., between thickeners No. 1 and No. 2, together with the various pumping and precipitating apparatus. The pulp is delivered to a No. 1 thickener at a ratio of 5.25 tons solution to 1 ton solids. The overflow from this tank is the 'pregnant solution.' All of this solution is not necessarily precipitated. If the overflow is of lower grade than required, a portion is allowed to by-pass to the pump returning the solution from No. 2 thickener to the battery storage, which is allowed to build up in value to a limited amount (see tabulation following).

The underflow or thickened pulp is directly connected by 4-in. piping to the suction end of two 4-in. diaphram pumps. These are set 3½ ft. above the level of the solution in the tank. These pumps will handle pulp containing as low as 25% moisture over short periods of time. Each pump has a sufficient capacity to handle the maximum output of the mill, thus leaving one pump in reserve. There are two speeds and three lengths of stroke to vary the volume pumped, giving ample variation to accommodate the mill tonnage.

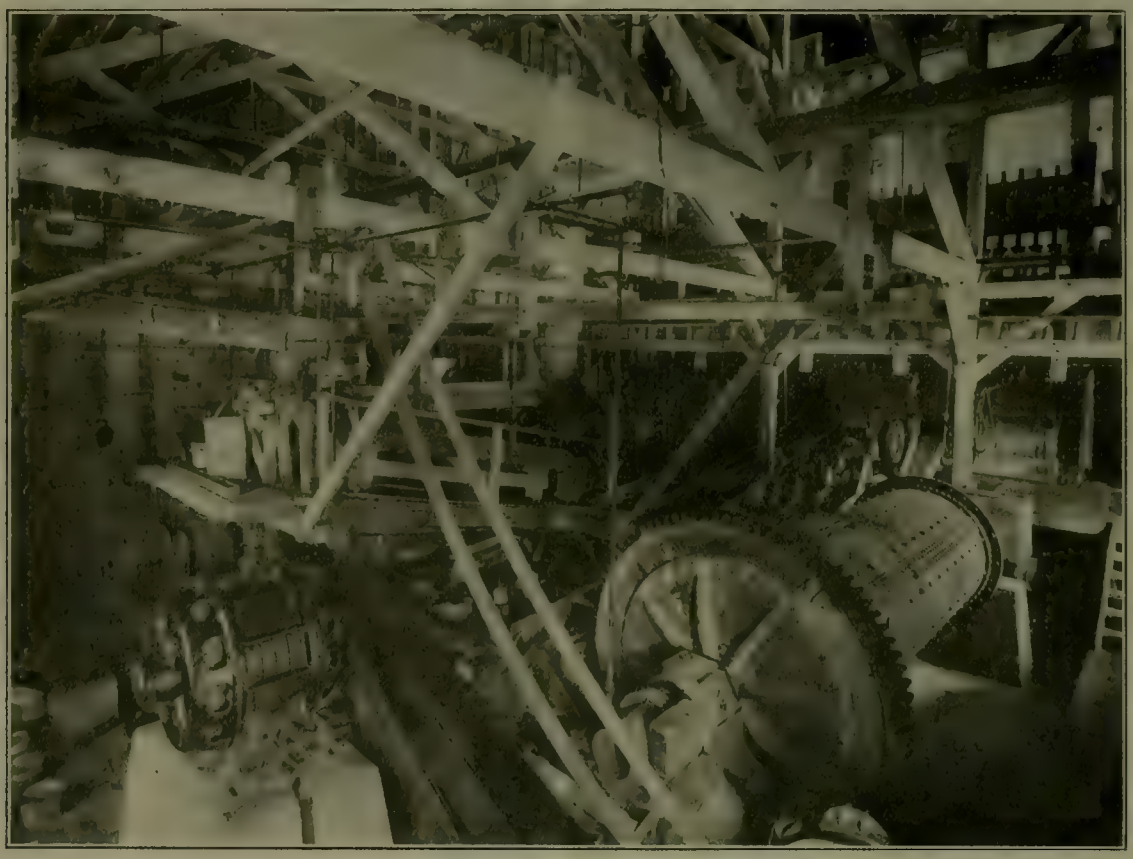
The thick pulp (35% moisture) from No. 1 flows from the diaphram pump by gravity to the agitator. Here the moisture is raised by adding barren solution until the same has reached 60%. One-third of the cyanide is added at this point, the balance at the tube-mill feed. The pulp is discharged from the agitator continuously to thickener No. 2. Then from this point to thickeners No. 3 and No. 4 the decantation is continuous, each tank having a 2-ft. elevation above the next preceding, giving the overflows a gravity flow from No. 5 to No. 2.

The barren solution from the precipitating presses is delivered to No. 4, a small portion going to the agitator. Water only is added to No. 5 equal in amount to the solution leaving with the thick pulp as tailing, thus maintaining a constant volume in the circuit. No. 5 is discharged through a spigot, with an average moisture content of 30% only. The diaphram pumps in each case raise the thick pulp at 35% moisture from the various tanks as already described for No. 1. The solution overflows pass by gravity from No. 5 to No. 2, while the pulp flows in the opposite direction from No. 2 to No. 5. The value of the barren solution from the precipitating presses varies from 1 to 3c. per ton solution. The average assay values of the pulp and solutions in the various tanks during the months of March and April are shown in the tables.

PRECIPITATION

Zinc dust is used as the precipitant and is fed to the suction of an Aldrich triplex pump by a Merrill zinc-

dust feeder. The pump raises the emulsified dust and solution to two 52-in. Merrill precipitating presses. These presses are used alternately for periods of 15 days, when regular clean-ups are made. By this system all delays are obviated and a press is in reserve. One-sixth of a pound of zinc dust per ton of solution has been found sufficient. The barren solution carrying 1 to 3c. per ton flows by gravity to No. 4 thickener and the agitator. The grade of precipitate obtained was $27.50 per pound from pregnant solution averaging $2.87 per ton.



A CORNER OF THE MILL, SHOWING STAMPS AND TUBE-MILLS.

Refining

The process in brief consists in acid treating the precipitate with sulphuric acid, filtering, washing, drying, fluxing, and briquetting the resultant material. This is smelted in a Rockwell furnace.

For acid treating a wooden lead-lined tank, 4 by 6 ft., fitted with a mechanical stirrer is used. The ratio of acid to water is aimed to be kept at 1 to 5, the amount of acid required is three-quarters to one times the weight of dry precipitate treated. The time allotted to acid treating is 6 to 8 hours. The sludge from the acid tank is run into a Perrin press and the strong filtrate of $ZnSO_4$, etc., allowed to run into a wooden tank to settle until the next clean-up. The material in the press is subject to a thorough washing with hot water, which is run to waste. The time for filtering and washing is about 12 hours.

After thoroughly draining and partly drying, the treated precipitate is dropped into a 6 by 11-ft. steam dryer and the moisture reduced to about 10%. The precipitate is mixed with the required amount of flux and briquetted in a Grath Little Giant brick press. Drying, fluxing, and briquetting take about 15 hours. The briquetting machine is made by the Illinois Construction Co. and will handle, when operated at maximum capacity, 960 lb. per hour of mixed precipitate and flux.

The briquettes are charged to a double chambered No. 2 Rockwell furnace using crude oil as fuel. About 8 hours are allowed for the charge to melt down before pouring. The resulting bullion averages about 750 fine in gold and 90 in silver or 840 in precious metals. The slag carries $400 to $500 per ton. Some matte is produced which retains a small amount of gold and silver.

The following are the acid and fluxes used per 100 lb. precipitate:

	Pounds.
H_2SO_4	75 to 100
After acid treatment	
Borax glass	11.5
Soda	5.7
Silica	3.0

Itemized Cost per Fine Ounce of Bullion Produced
Amount per Month

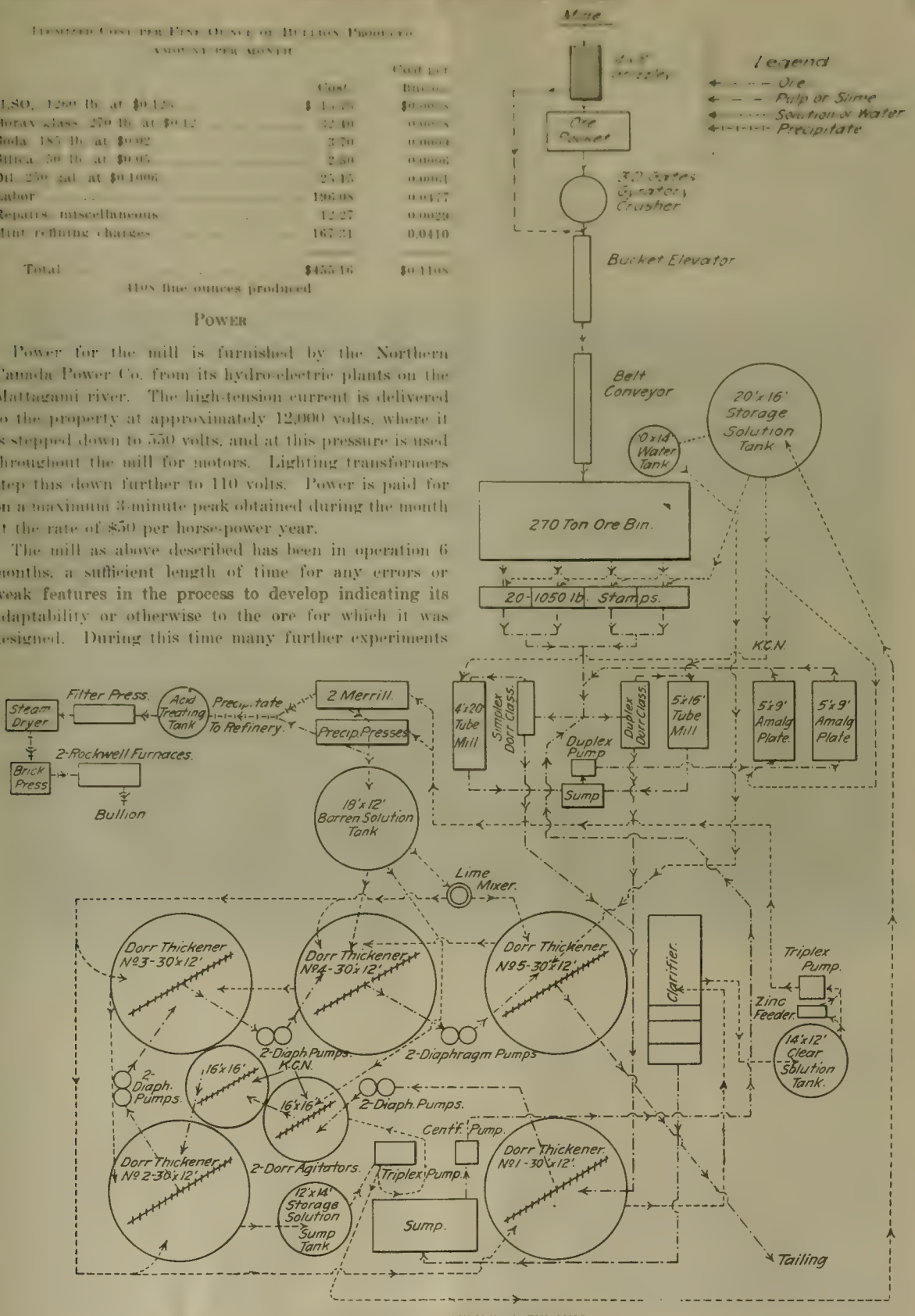
	Cost	Cost per Bullion
H_2SO_4, 1260 lb. at $0.125	$ 157.50	$0.0038
Borax glass, 270 lb. at $0.12	32.40	0.0008
Soda, 185 lb. at $0.02	3.70	0.0001
Silica, 50 lb. at $0.05	2.50	0.0006
Oil, 250 gal. at $0.1006	25.15	0.0061
Labor	196.08	0.0477
Repairs, miscellaneous	12.27	0.0029
Mint refining charges	167.31	0.0410
Total	$455.16	$0.1108

4108 fine ounces produced

Power

Power for the mill is furnished by the Northern Canada Power Co. from its hydro-electric plants on the Mattagami river. The high-tension current is delivered to the property at approximately 12,000 volts, where it is stepped down to 550 volts, and at this pressure is used throughout the mill for motors. Lighting transformers step this down further to 110 volts. Power is paid for on a maximum 3-minute peak obtained during the month at the rate of $50 per horse-power year.

The mill as above described has been in operation 6 months, a sufficient length of time for any errors or weak features in the process to develop indicating its adaptability or otherwise to the ore for which it was designed. During this time many further experiments



FLOW-SHEET OF PORCUPINE CROWN MILL.

have been made, more especially toward making a more complete extraction without further grinding. As may be seen by a study of the attached assay averages, a further benefit may be obtained by increasing the time for agitation, some metal continuing to be dissolved in the thickeners following the agitator. In this connection it may be stated that a second agitator is now in process of erection. Re-cyaniding the washed tailing pulp with the working solution for 12 hours indicates that not more than about 3c. additional can be expected to be recovered without finer grinding.

of March and April. These are the labor, stores, and power costs only, and do not include proportion of assaying, administration, depreciation, etc., which are normal for a property of this size, our total operating costs for the first quarter of 1914 being $6.75, including all overhead charges.

MISCELLANEOUS DATA

	Per ton milled, lb.	Unit cost per lb.
Consumption of KCN	0.74	$0.160
Consumption of Zn	0.98	0.065
Consumption of CaO	3.50	0.005

INTERIOR OF CYANIDE PLANT OF PORCUPINE CROWN MILL.

There has been milled and cyanided 18,460 tons of ore with the plant described. The extraction has been between 96 and 97. The loss in dissolved metal content in the tailing for March and April was as follows:

	March.	April.
Value of solution per ton	$0.120	$0.100
Value of solution loss per ton of ore milled	0.052	0.043

The above result compares most favorably with any class of filter which might be used on a pulp such as that here treated. The pulp as discharged from No. 5 thickener, containing an average moisture content of only 30%, is in an ideal condition for sampling, and while this has been done by hand up to the present time, an automatic sampler will be installed in the near future.

Attached hereto are the milling costs for the months

MILLING COSTS FOR MONTHS OF MARCH AND APRIL 1914

MARCH 1914 (tons milled, 4420)

	Wages.	Material.	Power.	Total.	Cost per ton.
Crushing	$333.89	$61.60	$87.57	$483.06	$0.11
Stamps	334.23	141.26	137.61	613.10	0.14
Tube-mills	188.56	839.21	579.63	1,607.40	0.36
Amalgamation	195.27	142.56	.....	337.83	0.08
Solutions	216.92	331.73	83.40	632.05	0.14
Thickeners	219.48	4.31	104.25	328.04	0.07
Precipitation	132.68	377.88	.....	510.56	0.12
Clarifying	150.40	1.83	.....	152.23	0.03
Agitation	115.81	.....	.....	115.81	0.03
Refining	267.25	108.88	41.70	417.83	0.10
Mktg. bullion	.....	144.83	.....	144.83	0.03
Totals	$2,154.49	$2,154.09	$1,034.16	$5,342.74	$1.21

April 1914 (tons milled, 3,888)					
Crushing	$364.74	$114.90	$82.88	$562.52	$0.14
Stamps	288.43	107.44	148.21	544.08	0.14
Tube-mills	279.46	561.78	267.81	1,109.05	0.28
Amalgamating	1,000.80	125.46	27.84	1,154.10	0.30
Solution	288.11	432.86	24.97	745.94	0.19
Precipitation	128.06	292.50	24.75	445.31	0.11
Classifying			8.62	8.62	
Thickeners	215.72	4.21	67.85	287.78	0.08
Agitation	120.95			120.95	0.04
Clarifying	110.46			110.46	0.03
Refining	271.08	92.11	36.19	399.38	0.10
Totals	$2,050.50	$1,655.16	$785.45	$4,471.11	$1.25

arbitrary term used for want of a better. Any standard method of computation would have given a similar comparison.

In the description of the method adopted it is stated that the sand tested must be obtained from wet crushed samples. This principle can be safely deviated from at times, and if the sample to be tested is put through and through a sample crusher until the required weight of 20 - 40 mesh sand is obtained, the result will be accurate. The object is to keep the physical characteristics of the sand always the same. Particles of sand derived from the wet crushing of rocks, and those de-

PORCUPINE CROWN CYANIDE MILL AVERAGES FOR MARCH 1914 (142 tons per day)

	Thick. 1.	Agitator.	Thick. 2.	Thick. 3.	Thick. 4.	Thick. 5.	Battery.	Storage.	Sol. pptd.
Dissolved gold	$3.83	$2.43	$0.88	$0.31	$0.17	$0.12	$0.50	$1.38	613 tons.
Undissolved gold	2.13	1.55	1.25	0.88	0.69	0.52			Av. heads, $2.87.
Ratio pulp to sol. underflow	1 to 0.588	1 to 1.32	1 to 0.614	1 to 0.614	1 to 0.614	1 to 0.540			Av. tails, $0.04.
Ratio pulp to solution feed	1 to 5.250	1 to 1.32	1 to 5.300	1 to 4.500	1 to 4.500	1 to 1.100			
Percentage pulp to percentage sol. underflow	63 to 37	43 to 57	62 to 38	62 to 38	62 to 38	65 to 35			

CYANIDE MILL AVERAGES FOR APRIL 1914 (120 tons per day)

	Thick. 1.	Agitator.	Thick. 2.	Thick. 3.	Thick. 4.	Thick. 5.	Battery.	Storage.	Sol. pptd.
Dissolved gold	$3.17	$1.74	$0.80	$0.26	$0.14	$0.10	$0.46	$1.37	487 tons daily.
Undissolved gold	1.82	1.06	0.82	0.60	0.53	0.36			Av. heads, $2.32.
Ratio pulp to sol. underflow	1 to 0.562	1 to 1.37	1 to 0.54	1 to 0.54	1 to 0.54	1 to 0.43	1 to 5.25		Av. tails, $0.03.
Ratio pulp to solution feed	1 to 5.250	1 to 1.40	1 to 5.25	1 to 4.41	1 to 4.41	1 to 0.97			
Percentage pulp to percentage sol. underflow	64 to 36	42 to 58	65 to 35	65 to 35	65 to 35	69 to 31	16 to 84		

Tube-Mill Practice and the Hardness of Ores

By W. B. BLYTH

*A simple and accurate method for comparing the hardness of ore sand, judged from a tube-milling standpoint, has resulted from experiments which I have conducted. The principle of crushing in a tube-mill is quite different from that employed in the grinding-pan or the stamp-mill, and what might be considered as excellent crushing material for one machine may prove quite unsuitable for another. This is illustrated by the fact that the most easily ground sand shown in the subjoined table is derived from an ore which in battery parlance is the 'toughest' in the series. Institute of Mining and Metallurgy screens are used because they are the only screens available whose aperture diameter can be guaranteed for a given mesh.

Stadler's† excellent method for computing grinding efficiencies is used to illustrate the respective hardness of the ores tested, but the regrind factor is only an arbitrary term used for want of a better. Any standard method of computation would have given a similar comparison.

In the description of the method adopted it is stated that the sand tested must be obtained from wet crushed samples. This principle can be safely deviated from at times, and if the sample to be tested is put through and through a sample crusher until the required weight of 20 - 40 mesh sand is obtained, the result will be accurate. The object is to keep the physical characteristics of the sand always the same. Particles of sand derived from the wet crushing of rocks, and those derived from dry crushing in rock-breakers are always angular, but the particles derived from crushing rock in ball-mills or disc pulverizers are rounded. Naturally, the grinding result on a sample of sand will vary greatly, according as to whether the sand particles are round or angular; and this is necessary to prepare the sand by either of the processes above described. The capacity of tube-mills varies a great deal on different ores, and only experiment will indicate the work that will be performed in any given case.

In designing new plants, the duty of a grinding machine causes the designing engineer a lot of anxiety, as the expected value of the tailing is often strictly proportionate to the fineness to which the ore is ground. At present, the duty on an untested ore can only be guessed from its appearance, which is often similar. A standard preliminary small-scale test from which the capacity of a tube-mill can be accurately estimated would be of value, and the suggested scheme endeavors to supply that want. The attached table of hardness gives the tabulated results of testing sand from 15 mines, and also that derived from crushing an average sample of Danish flints. Unfortunately, it is quite impossible to get correct tube-mill crushing data in each case. I do not have sufficient faith in any method yet propounded for comparing grinding efficiencies to

*Abstract from *Monthly Journal* of the Chamber of Mines of Western Australia.

†*Trans.* I. M. M. XIX., p. 471.

attempt a comparison from the grinding results of tube-mills working under different conditions. Successful comparison can only be attempted when the tube-mills are working under similar conditions with regard to speed, pebble load, grade and tonnage of feed, etc. In only two cases in the subjoined table has it been possible accurately to compare the work done by similar sized tube-mills in the respective plants. In the case of No. 5 mine, whose sand has a regrind factor of 354.5, a tube-mill has a 30% greater capacity than on the sand from No. 11 mine with a regrind factor of 266.3.

Necessity of Having a Standard

Tests on tube-mills working under different conditions on other mines indicate that this ratio will remain about the same, but these tests cannot be accepted as reliable. An elaborated table of this nature would allow operators, working in different parts of the world, accurately to compare grinding efficiencies under similar conditions. Some standard should be established, and this is introduced as a test which can be made by any operator who can secure a set of I. M. M. screens and a 5-gal. glazed earthenware barrel. A study of technical literature dealing with grinding capacities and grinding efficiencies illustrates the fallacy of generalization. It is quite useless comparing capacities and efficiencies of grinding machines unless the ores operated on can be accurately compared.

to 2 in. diameter, and 16 lb. of water, is introduced into a 5-gal. glazed earthenware barrel and ground for 90 minutes at 60 r.p.m. A sample of the ground product is then taken, dried, and graded with a mechanical grader 40, 60, 100, and 150-mesh I. M. M. screens. The value of the grading in energy units is then calculated by Stadler's method, and this amount, minus the original value in energy units, represents the regrinding factor in the table.

Example

	Feed			Tailing		
Screen	Mean factor, Stadler	Percentage .	Energy units.	Percentage ..	Mean factor..	Energy units.
+ 40	17.5	×100	=1750	16.8	×17.5	=294.0
+ 60	....	....	....	29.2	×20.0	=584.0
+100	....	....	....	16.4	×22.0	=360.8
+150	....	....	....	6.6	×24.0	=158.4
—150	....	....	....	31.0	×26.5	=821.5
Total						2218.7

Total energy units, tailing, =2218.7. Total energy units, feed =1750. Difference, 468.7 = regrinding factor.

A table of hardness based on grinding capacity of tube-mills run under the same conditions, with regrind-

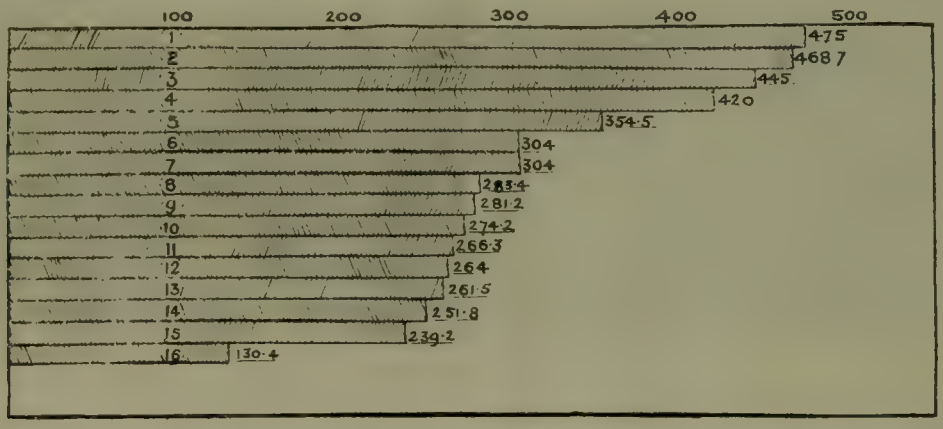


TABLE OF HARDNESS, BASED ON GRINDING CAPACITY OF TUBE-MILLS RUN UNDER THE SAME CONDITIONS. REGRINDING FACTORS IN TERMS OF ENERGY UNITS. THE HIGHER THE REGRINDING FACTOR, THE GREATER THE CAPACITY OF THE TUBE-MILL. REFERENCE TO NUMBERS:

1. Accumulated sand from crushing No. 2 ore.
2. Quartz and schist in highly-sheared dolerite.
3. Sand feed to tube-mills (Broken Hill).
4. Sand feed to grinding pans (Broken Hill).
5. Sulpho-telluride ore (Kalgoorlie).
6. Return raff screen to rolls (Queensland copper ore).
7. Queensland sulphide copper ore.
8. Blue quartz and greenstone (Murchison, W. A.).
9. Concentrated ironstone sand (East Murchison, W. A.).
10. Concentrated jasper sand (Murchison, W. A.).
11. Concentrated ironstone sand (Murchison, W. A.).
12. Queensland sulphide copper ore.
13. Concentrated ironstone sand and garnets (Yilgarn, W.A.).
14. Clean white brittle quartz (Kalgoorlie).
15. Concentrated jasper sand (Murchison, W. A.).
16. Danish flints (tube-mill pebbles).

The method of computing hardness is as follows: A sample of ore to be tested (wet crushed) is graded (I. M. M. screens) until 8 lb. of –20 +40 sand is obtained. A charge consisting of 8 lb. of sand, 8 lb. of flint, 1

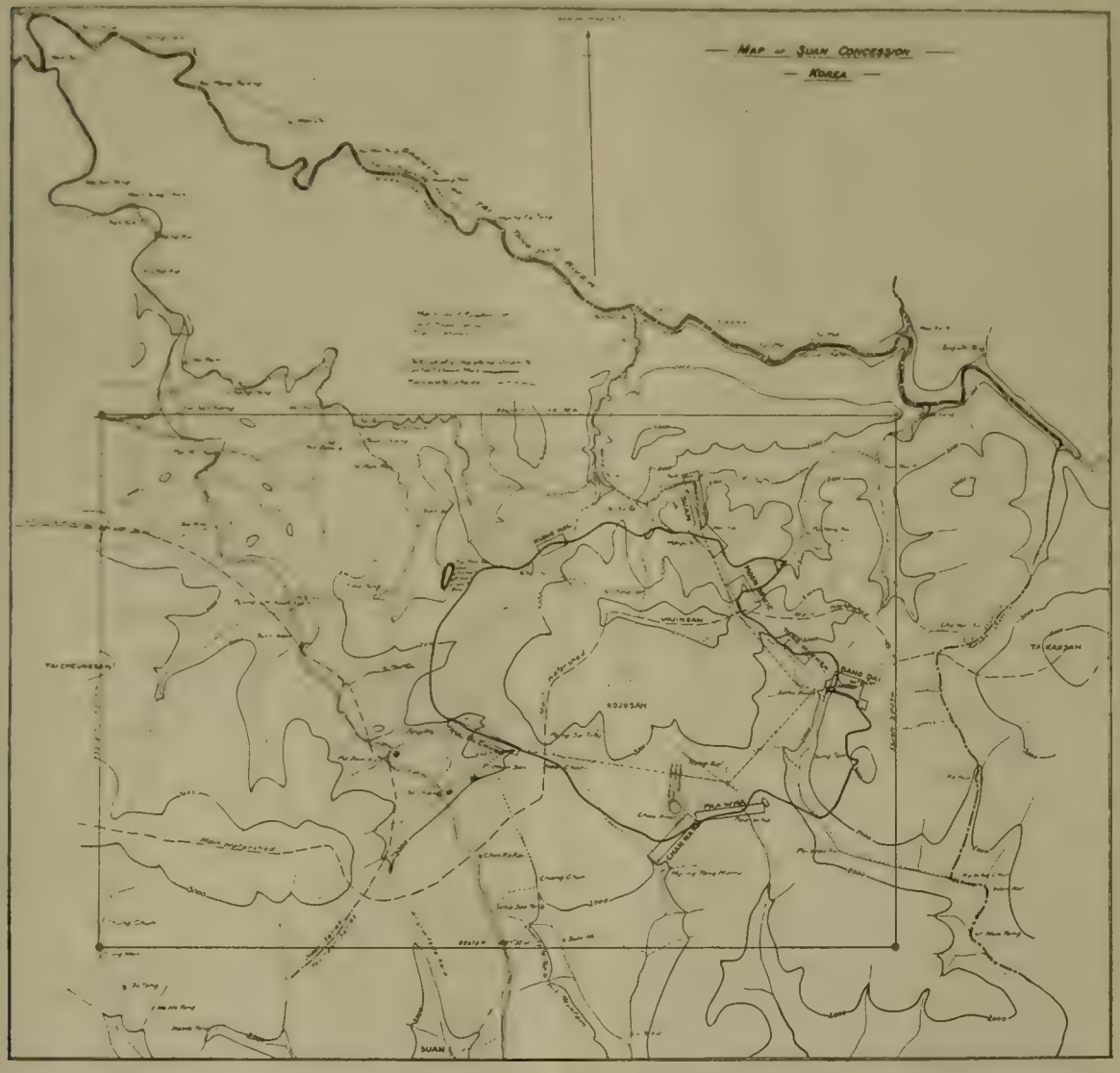
ing factors in terms of energy units, is shown in the diagram above.

The higher the regrinding factor the greater will be the capacity of the tube-mill.

Geological Report on the Calibran Contact Within the Suan Mining Concession, Korea

By D. F. HIGGINS

*The general location of the Suan mining district, Korea, is in central Korea, about 55 miles east-southeast of the city of Pyeng Yang, Korea. The Suan concession covers an area forty by sixty Korean *li*, or an area of about two hundred and sixty square miles. The area mapped in detail in the present survey is in the shape of an elliptical ring, shown by the heavy line on the map, averaging three-fourths of a mile wide and about twenty-five miles in circumference.



The general geologic features of the district mapped consist of a series of sedimentary formations intruded by a granite batholith. This granite in coming up through the outer part of the earth has uplifted and pushed aside the overlying and surrounding rocks with tremendous force. Erosion has bared the mass, showing a rim of upturned edges of the sedimentary rocks around the granite. In the immediate vicinity of the granite, the sediments have been changed — metamorphosed — to schists, marbles, and other metamorphic aggregates.

*Reprinted by permission from geological report made for the Suan Mining Company.

The granite core forms the highest part of the concession, and hence the drainage lines all go outward roughly like the spokes of a wheel. Where the streams cross the contact between the granite and the sedimentary rocks, if there is gold present at the contact, they carry the metal for greater or less distances down from the contact over the outer rocks whose upturned edges often form excellent natural riffles for catching the gold. The principal streams in the district are the Nam Tai Tong Kang, which flows westward along and near the north edge of the concession, the stream which flows northward from near Tul Mi Chung through Pai Mi Chang, about a third of the way from the west side of the concession, and the stream which flows eastward from Suktari to Oo Kang, just inside of the north edge of the concession.

Extent of the Intrusion

The general shape of the main intrusion is an ellipse, with its long axis northwest and southeast, about eight miles long, and the short axis about five miles long. The sides or contact of the main granite in general dip away from the centre of the mass. The angle of dip varies from about 30° to vertical. At no place have I seen a dip of the contact toward the granite, though a local bulge might cause such a condition to arise in some particular spot. The separate areas of granite southeast of Hol Kol are not separate intrusions. The steep granite hill back of the outcrop of the ledge at Hol Kol is almost a similar separate outcrop. A cross-section through these areas would look as shown in Fig. 1. Erosion on the east side of the ridge has reached the granite before the sediments on the top of the ridge have been taken away. More in particular, the contact at Hol Kol is as shown in Fig. 2, where the dotted line indicates the continuation of the contact in its approximate position before erosion. I show this in detail here so that it may be clear that the conformation (which, it must be remembered, is only the horizontal orthographic projection of the intersection of the surface of the contact and the topographic surface) of the contact at Hol Kol does not indicate that a sharp bend or any bend at all may be expected to the south in the east workings, but the contrary.

Fig. 1.

Fig. 2.

Near Nam Nol (and one at Tong Am) there were noted a few quartz porphyry dikes, very light in color and very much fractured into splintery and angular blocks. They have no significance in relation to the mineralization of the district. They may be connected with the Song Hyun granite.

The rocks of the region as a whole, with few exceptions, are doubtless Paleozoic in age. I would make a guess that the Suan slates and the Hol Kol limestone approximate the Carboniferous, and that the quartzite at Tol Ko Kai marks an unconformity between them and lower rocks. The quartzite at Tul Mi Chung may be a separate quartzite, but assuming that it is the same one, it may be assumed for present purposes to mark an unconformity between the Suan slates and the Hol Kol limestone on the one hand, and the Tul Mi Chung and Tong Am limestones on the other.

The fact of the intrusion causes the general structure of the surrounding sediments to be a quaquaversal one in general; that is, the sediments all dip away from the granite, or outwardly. From about Nam Nol to Tul Mi Chung there is a very important exception to this rule, however, for the sediments dip toward the granite. This anomalous condition has been brought about by the great opposition to the Unjinsan uplift offered by the Siroo Pong San massif in the western part of the concession, which was also very likely being uplifted at the same time. The contact along this place is about vertical, but the slates dipping toward the granite have probably had their east edges resorbed by the granite.

Regarding contact metamorphism, it may be said that there is evidence that there was recrystallization of the minerals and rearrangement of the elements both with and without the help of materials from the granite magma. The metamorphism is divided into two very distinct stages. In the first were formed principally silicates, and in the second were formed principally sulphides and the metallic gold-silver alloy.

The Suan Orebodies

At the Suan mine at Hol Kol there are two distinct types of ore in two distinct groups of orebodies. I shall call these the western and the eastern groups. The western group takes in the locally known 'west-

ern orebody' and the eastern group takes in the locally known 'central orebody' and the 'eastern orebody' with both its 'north split' and its 'south split.'

The western group is formed of tabular or lenticular bodies with their surface of greatest extension in the great fault zone which extends along the west side of the Hol Kol valley. The last movement on this fault has been nearly in the dip of the fault. The eastern group consists of far more irregular bodies on a series of interlocking fault zones which all together make up one large zone running about parallel to the contact and at about right angles to the west fault. The average movement in this zone was last down to the south at about 30°, probably a settling of the granite in cooling, and the zone as a whole dips 60 to 80° toward the contact in the upper levels, but seems to be about vertical in the lower levels. The western zone dips 55 to 60° to the south. The western zone continues out into the granite, while the eastern one runs at about parallel to the contact.

The distinctive minerals of the western group are tetrahedrite and dolomite in addition to the other ore and gangue minerals. Sphalerite and galena may also belong in this category. Tetrahedrite and dolomite are never found in the eastern group.

It is clear, then, that the two ores have an entirely separate origin. The western ore was deposited from gold-silver-copper-iron-zinc-antimony-bismuth-magnesium bearing solutions working laterally along the fault zone from the granite into the already somewhat altered limestone. The calcite in the limestone was the mineral most easily ousted by the newcomers. Bismuthinite is less than in the eastern group. Impregnation into the walls did not extend a very great way from the principal fault surface.

In the eastern group, gold-silver-copper-iron-bismuth solutions working upward from some source in the granite below flowed along the complicated channels of the fault zone. As in the eastern ore the calcite was most easily replaced, but diopside and phlogopite were also replaced. The presence of pyrrhotite as an important sulphide in the main east north stope ore must be emphasized here, as it has not been recognized heretofore.

The Gangue Minerals

The principal gangue minerals of the western group are calcite, dolomite, quartz, diopside, phlogopite, and a little garnet. The principal gangue minerals of the eastern group are diopside, calcite, garnet, phlogopite, an asbestos (probably a fibrous amphibole), tremolite (?), wollastonite (?), and a little quartz.

The eastern group is doubtless associated in origin with the miarolitic Hol Kol granite, and the channels deep down in the earth along which the solutions which carried the metals of the eastern group arose, are undoubtedly connected with the 'pipe' of the Hol Kol granite, which is itself a phase of the magma given off after cooling had commenced and after the mass of the batholith as a whole had become stationary.

At Kung Kol there was a deposit of pyrite and other minerals, probably including some magnetite, along the contact. Then the pyrite was partly altered to hematite and the granite to a green soft rock quite unlike the granite in appearance, and part of the limestone was made of a chalky appearance. The present digging may be at a place which is only the bottom of a deposit which has all been eroded away leaving the gold for the most part, of course, in the placers below.

The Tong Am Ore

The ores at Tong Am are different from all of the others in that they do not owe their origin to the Suan granite. They are genetically connected with certain dikes which also occur at the prospect. These dikes have been highly metalliferous. They have both metamorphosed the enclosing limestone and have imparted to it metal-bearing solutions, from which the sulphides have been precipitated. The place is very interesting in its occurrence of molybdenum and of cuprite. The latter mineral was seen nowhere else on the concession, and the former only at Peh Wha. The diorite (?) may be an offshoot from the main granite, but the indications are that it is not only separate, but much older than the granite. Some prospecting should be done at this place up the little valley in which is the main adit, several hundred feet above the adit. At that place copper float may be seen, and there is evidence of one of the dikes nearby to the northwest.

The long directions of the orebodies at Tul Mi Chung seem to be from about parallel to about 30° to the contact, and to be along shear or fault zones. They are more or less closely associated with the 'Weigall granite' and probably bear much the same relation to it that the Hol Kol ores bear to the Hol Kol granite. There is very decisive ocular evidence of pneumatolytic action at Tul Mi Chung; that is, that the circulation and work of magmatic waters has been very active, even altering the 'Weigall granite' to a form scarcely recognizable. There seems to have been considerable secondary concentration, and a critical study of the orebodies might give valuable hints as to the depth to which the deposit may be expected to go. Such a study, to be of great value, should be made before the ore on the upper level is stoped out. At Peh Wha also there has been an unusual activity of the emanations from the granite, but the gold content, at least as far as the prospecting to date indicates, seems to have been a little low.

At Sang Dai there are two large masses of so-called 'garnet-actinolite rock,' which contains also much calcite and considerable amounts of quartz and epidote as important minerals, formed by the metamorphic action of the granite. The ores are associated with certain aplite dikes which are, in part at least, a little later than the granite. The mineralogic and metamorphic changes which have taken place at Sang Dai are very complex and need not be entered into here.

Tong Mu Cheh is of interest on account of the presence of a good deal of asbestic material, and on account of the occurrence of considerable amounts of chalcocite which the Koreans mined in olden times. The diggings at Moonbowie are in a very impure metamorphosed limestone and hornfels with a great deal of garnet rock in the neighborhood. Chemical activities originating in the granite do not seem to have been very active here. At Myung Tang Morru I saw no signs of mineralization. The opening is rather far from the contact. At Chan Na Kol the mineralization present is probably of the same type as that at Peh Wha, and I have already spoken of the area between the two.

Criteria for Guiding Prospecting

From the observations made in the Suan district, the following criteria for guiding prospecting have been deduced. These criteria are probably not complete, and other persons might suggest alternative or additional ones.

(1) Leached, oxidized, rusty-looking, and copper-stained outcrops (this criterion is, of course, a general one for all districts). (2) Placers either at or below the contact. (3) Old Korean workings. (4) Contact minerals, such as tourmaline, diopside, garnet, etc. (5) Evidences on the surface of faulted or sheared zones in the rock just outside of the contact. (6) Limestone contacts are more likely places than schist contacts with the granite. (7) Especial activity of magmatic waters, as shown by the degree of intensity with which the metamorphic minerals are localized. (8) Evidences of differentiation in the magma, as shown by the presence at the contact against the granite of small bodies of igneous rock related to the granite.

These criteria are intended to apply only to deposits along the contact. Especial attention is called to the importance of the fifth and the eighth ones. The last one is the feature which separates Hol Kol and Tul Mi Chung from all the other present openings.

In outline the geologic history of the region seems to have been as follows: First, there was a granite or granite-gneiss land area, now the central granite-gneiss of the Siroo Pong San and the Tai Chung San area, on the west of the concession. This land was submerged, and on it were deposited various sediments now seen in remnants, as mica schists, folded in the Siroo Pong San granite-gneiss. The area was uplifted, folded, and eroded. It was again submerged and a series of sediments with a thin quartzite at the base was laid down. The Tul Mi Chung and Tong Am limestones belong to this period. The area again emerged from under the sea, was folded, intruded by certain igneous rocks, eroded, and submerged a third time. Quartzite, the Hol Kol limestone, the Suan slates, and possibly other rocks were deposited. After the following uplift, erosion, and intrusion by the dolerite, and part erosion, there is a great gap in the history which would require observations far outside of the region to fill. There was probably another series of sediments laid down which have now entirely disappeared from the central part of the earth. It is likely that at the same time there was a doming to the west which is now seen as the Siroo Pong San massif. With the cooling of the Suan granite sundry after actions took place, including the appearance of the Hol Kol granite, Tul Mi Chung quartz-porphyry, etc., to which are due the formation of the ore deposits around its border, and the last of which was the rising of the basalt. The settling of the region southeast of the concession while lava poured out over it and buried the former topography was the last chapter. Today the processes of erosion are busily at work leveling the mountains for the beginning of another cycle.

General Conclusions

To recapitulate the origin of the ores, referring, of course, in particular only to those along the contact with the Suan granite, one must conceive of the granite as being in a molten state or in a liquid state somewhat akin to the molten state, in which a large amount of superheated water may be thought of as acting as an exceedingly powerful solvent. An excess of potash and alumina having crystallized out as the orthoclase phenocrysts, the rest of the substances began to crystallize together with the slowly cooled magma. When the outer shell of the mass was hard it cracked to relieve the tensile stresses set up in itself by its further cooling, and through these cracks came parts of the inner unconsolidated magma, and, more important for our purposes, the water released by the solidification of the inner parts of the magma. Much evidence suggests that this water was alkaline in nature and that it bore in solution metallic sulphides such as iron, copper, bismuth, etc., as well as gold and silver in some soluble form. It contained also fluorine, boron, and silica. It changed gradually in composition. The substances, notably calcite, in the wall-rock against the granite precipitated the sulphides (and the sulphides precipitated the gold and silver), which the water exchanged for the materials of the wall rock and took its new load of non-metallic material away with it the process of metasomatism . Finally erosion bared the whole thing so that man has been able to get at the mineralized places, and locally surface water has worked a secondary concentration of the sulphides while erosion was in progress. Such is the history of the ore deposits of the Suan district. The Suan district probably offers one of the finest examples of contact metamorphic phenomena to be found in the whole world. With study and some good chemical analyses, I am certain that some of the mooted problems of the formation of ore deposits and of contact phenomena in general would be definitely settled for that district at least, and the district could be made a classic one in the annals of geology.

A Concrete Head-Frame

By C. T. JACKSON

The No. 1 vertical shaft at the Perseverance mine of the Alaska Gastineau Mining Co. has a total depth of 1544 ft. The collar of the shaft has an altitude of 2300 ft. above sea-level. The shaft is intersected by the Alexander cross-cut at a depth of 905 ft., and the main hoist is built on this level in a station cut in the foot-wall. The ropes from the drums pass up a raise and under deflecting sheaves, then up the ladder-way compartment of the shaft and over the main sheave wheels near the top of the reinforced concrete head-frame, and then return to the cages.

Owing to the collar of the shaft being on a hillside

FINISHED HEAD-FRAME AT PERSEVERANCE MINE.

and also at this elevation a very heavy snowfall being experienced during the winter months, a reinforced steel and concrete head-frame was designed, in which the sheave wheels are placed at a sufficient height to provide a safe margin for over-winding.

In building the concrete head-frame all lumber for forms, cement, and sand was hoisted up the shaft and

PLAN OF HEAD-FRAME, SHOWING POSITION OF SHEAVES.

the rock was taken from the hillside nearby and washed before using. A small gasoline mixer was used for mixing the concrete. The mixture was, 1 of cement, 3 of sand, and 5 of rock. The mixer was placed on the hillside near the rock pile at a sufficient elevation so that the concrete from the mixer was wheeled along a scaffold and dumped into the forms and tamped. The reinforcement used consisted of old 12-lb. rails and worn hoisting cable. The walls of the head-frame have a thickness of 2 ft. 6 in. at the base, and taper to 1 ft. at the top.

After the concrete had set a few days the forms were removed at the back, and a dry wall consisting of large rocks was built up to a height of about 25 ft. Loose gravel and rock was then sluiced down and placed at the back of the head-frame to a depth of about 25 ft., giving it a batter from the head-frame to the hillside, so as to take up the heavy snow pressure.

NEW PLANT on the Government Gold Mining Areas Consolidated mine, Johannesburg, during the first quarter of 1914 cost $490,000. A 50-drill Fraser & Chalmers air-compressor was installed, and good progress was made with foundations and buildings of the mill. This is to consist of the following: one hundred 2000-lb. stamps to crush 50,000 tons of ore per month, ten 6 by 16½-ft. tube-mills, amalgamating plates after the tube-mills, three sand-collecting tanks 56 ft. diameter to hold 740 tons each, belt conveyors and Blaisdell distributer to fill eight leaching vats 56 ft. diameter, six 19½ by 70-ft. slime-collecting tanks, nine 15 by 45-ft. air agitators, and a Butters filter plant.

GYPSUM PRODUCTION of the United States in 1913 was 2,599,508 short tons worth $6,774,822, compared with 2,500,757 tons and $6,563,908 in 1912. Gypsum sold crude amounted to 463,136 tons, of which 85% was used for portland cement.

The Mining Law—Proposed Revision

By F. R. INGALSBE

It seems almost self-evident, considering the many articles on the subject which have recently appeared in the mining journals, that there is a basis of fact for some of the criticisms aimed at our federal statutes relating to the locating and patenting of mining claims on the public domain. I believe that the law is good in the main, and in the discussion which follows certain changes are proposed, none of which, however, would conflict seriously with the basic principles upon which our law was written. For instance, I believe that the discovery requirement is basically sound and an annual amount of assessment work is consistent with the proper development and disposal of our public mineral lands, for it is only by development that ground can be classed as mineral or non-mineral. To do away with the discovery requirement would mean either one of two things: the Government would be confronted with the necessity of classifying all its mineral lands and alienating them from all other forms of entry, which would be an immense task, and, on the face of it, impossible; or it would mean that a leasing system must be worked out which would provide for the reversion of such lands to the Government as were shown upon exploration or abandonment to be non-mineral bearing. It seems unlikely that the mining industry of this country would look favorably at the present time upon any leasing system which could be devised as applied to the whole body of metal-bearing mineral lands, and, on the other hand, it scarcely seems probable that the Government will attempt the classification of all its public lands as to mineral character at the present time. Great cost and unsatisfactory results would probably stand in the way. If such a classification were certain of fairly accurate results the cost would probably not be seriously considered, but any field engineer who has spent a few seasons in examining promiscuous undeveloped mineral claims can fully appreciate the difficulties in the way of classifying areas on which 'gophering' has been done, not to mention those where no prospecting at all has been done. The reasons for this depend upon geologic principles which are outside the purpose of this discussion. Those persons who are prone to find fault with a Department for enforcing the mineral laws should not forget that there are thousands of mineral claims in the Western states on which not a stroke of work has been done since the day patent was issued. This condition becomes the more deplorable when we realize that our public mineral land is fast passing into private control, and it is only a matter of a few years when there will be no mineral land to patent.

Admitting that our present system is better than a new one which would entirely overthrow the present law as a whole and the interpretations of the courts for many years past, we will assume that it needs modernizing in some respects, and that Congress should provide means for universal enforcement. I believe the following points are worth consideration in detail:

1. There is considerable ignorance in some localities as to just what our law means.
2. Certain injustices are possible under the present law.
3. Opportunities for fraud under the present law exist.
4. The lode claim is not large enough to provide adequate protection to a valuable mineral discovery, hence the so-called 'protection claims' have come to be a customary means of supplying that protection, although these claims have no legal existence other than that condoned by custom.

Ignorance of the Law Too Common

If any revision of our mining statutes is made, it should be in such clear language that its exact meaning cannot be doubted; and then the Governemnt should undertake a crusade of instruction by posting the laws in all postoffice, land office, and other public buildings in the public land states, and by supplying copies of it at all public offices for free distribution to interested people, without making it necessary for them to write to the proper officials for a copy. Out of the several hundred prospectors and locators whom I have visited I cannot recall one who had a copy of the Federal mining statutes at hand.

I am satisfied that in the past, and to a great extent at the present time, a great deal of the criticism of the present law is based upon ignorance of its exact meaning and interpretation by the courts. The Government has not been careful enough to educate the public. In the course of my own work I have been asked many times by old prospectors and by officials of mining companies just what are the requirements for patenting mineral claims. Probably most of these people knew the approximate wording of the law, but they did not know the interpretation placed upon it by the courts. Some were inclined to emphasize the mineral discovery requirements, thinking it necessary to have pay ore, while others were inclined to emphasize the good faith requirements, believing that properly performed assessment work was sufficient evidence that the prospector believed he had mineral in sight or in reach and that such a condition should pass for a mineral discovery. There is little doubt that in some localities custom had condoned the latter situation before examinations were made by the Government; in fact, in some localities the mineral discovery requirements of the federal statutes were overlooked entirely by locators, and naturally when the Government inaugurated the system of examining claims which came

up for patent there were many disappointed people, a few of whom were attempting to obtain patent to land with no apparent mineral value, but with very apparent value for some other purpose, while others were in absolute good faith but did not know the actual requirements of the law.

Certain Injustices Possible

Under the present law there are certain injustices apparent, the most conspicuous one perhaps being under the placer law, which makes it possible for an association or company of 8 people to locate and hold legally 160 by doing the same amount of assessment work required of a prospector on his 20 acres, which is the maximum area he can locate as one claim. If he wishes to locate 160 acres, he must make 8 locations and do $800 worth of work, whereas if he is dishonest he will locate 160 acres as one claim by making use of 7 dummy locators, thus saving $700 worth of work, the labor of locating 7 claims and the expense of recording them. Such a law encourages crookedness, and what is the reason for such provisions? Why not require $800 worth of work of the 7 locators on the 160 acres? I am unable to answer the query to my own satisfaction. The same principle was not carried out with regard to lode locations.

Another injustice sometimes arises in cases where a poor prospector has a valuable location on which he has done his work honestly. The large company or individual with money overlaps the prospector's location and applies for patent. The prospector is compelled to resort to law for protection. To be sure, the deputy mineral surveyor should exclude the conflict when it is an earlier valid location, but he is not always in possession of the facts and may take the statement of his client, since in such cases he can hardly collect fees for time spent in such investigation. A valid mineral location should be automatically protected by the Government against such encroachments, for it often happens that the ground is lost to the prospector simply because he cannot afford to carry his case into court.

I believe an effective method of protection could be brought about by requiring every mineral location to be examined at the expense of the Government within a reasonable time after location, as to conflicts if any, location work, marking upon the ground, and roughly as to its dimensions and relation to nearby public monuments, accepted surveys, or other fixed landmark. This work would require a competent man in each important public-land mining district who would do the field work and keep complete accessible records of his work. This would also prevent another evil, which has flourished in some localities, that of staking out oversized claims. It probably would not be necessary at this time to examine the claim as to mineral discovery (unless the claim is made larger than at present), but the examiner should be in possession of any facts which tend to prove fraud on the locator's part. Such an examiner would be in a position to report quickly and accurately upon claims which were protested by neighboring locators for lack of discovery or assessment work, either at time of making application for patent or earlier if the necessity should arise. The Government would always be in possession of the facts as to whether the locations were fraudulent or valid and would place itself in a position to protect effectively the poor locator. It would also decrease largely the fraudulent locations and save to both the Government and individuals a great deal of litigation, all of which is a heavy expense and too often creates hard feeling. By thus nipping the trouble in the bud I believe that the Government would do itself and its citizens, and particularly the mining industry, a great service. It would have a tendency to stimulate prospecting by men with the physical and mental equipment for such work. If such a federal office were created it would be a good place to record all mineral locations made in the district, thus supplying the Government with such records.

Protection for Locators

In a few mining localities, where it is in most instances impossible to make a mineral discovery at an expense of $500, some provision should be made to protect a locator while searching for ore. In such districts ore is found only at depth and it is unreasonable to require a mineral discovery at the time a claim is located. I believe such districts should be set aside by the Interior Department and a plan devised for allowing prospectors to make a limited number of locations under adequate protection for a fixed period which would be long enough to allow mineral discovery to be made. In return for such protection the prospector should consent to do a reasonable amount of properly conducted work on each location each year, such work to be done with the view of making a mineral discovery at the earliest time consistent with good work. The Government should have a competent engineer in the district, whose duty it would be to supervise for the Government's interest the locating and developing of these protected claims. As soon as a mineral discovery is made on any claim it should be alienated from the protected area and subject to the general mining laws in force on the public domain at large. At the time the mining laws were made by Congress no provision was made for such a condition, and it seems only proper now that such a condition is known to exist that the Government should make adequate provision to meet the situation.

Under the Act of January 22, 1880, (26 Stat. 61) the locator is allowed the full calendar year next succeeding the one in which the location is made within which to perform first assessment work, that is to say, if a location is made in January 1914, the claimant has until December 31, 1915, a period of two years (Mills *v.* Fletcher, 34 Pac. 637), in which to do assessment work for one year. By relocating the ground every two years a valuable piece of ground can be tied up indefinitely

and put beyond the reach of locators in good faith, or even of the Government itself. This statute is notoriously abused by that class of men who make fraudulent mineral locations on ground valuable for agriculture, water power, townsite, right of way, etc., and thereby make no end of trouble. I believe this law should be stricken from the statute books and another substituted, if necessary, which would make it necessary to perform $100 worth of assessment work not later than one year from the date of location, or in case of failure to do so, automatically proclaim the location legally abandoned. And in case a claim becomes automatically abandoned there should be a period of at least one year between the date of automatic abandonment and the date on which it might be relocated by the same person or company.

The Door Thrown Open to Fraud

It has been possible in the past to locate land valuable for timber, agriculture, water-power, or townsite, as mineral claims, and even to patent such a group without having any indications of valuable mineral in sight, because the Government has not supplied the means of enforcing its laws. It is possible, even now, to do so on public lands outside of the national forests, for only a fraction of such claims are ever examined by Government officers to determine their mineral or non-mineral character. Such examination has been carried on within the forests and the records show that hundreds of claims have been canceled, after a hearing was had, because of lack of compliance with the Federal statutes. It is true that a good proportion of such canceled claims were protection claims but many cases of absolute fraud have been brought to light. A perusal of pages 5 to 10 of the United States forester's report for 1912-13 will leave no doubt as to this fact, and to my mind is a very eloquent argument for the examination of all mineral claims for which patent is asked. As to the protection claims, there is a strong argument in favor of the miner, sufficient in many cases to justify the conclusion that there is a defect in the law as it now stands.

The Size of the Lode Claim

In order to avoid the necessity—for it is often a real necessity—of making these blanket locations around a discovery, I propose the enlargement of the lode claim from 20 acres to say 40, in the form of square or rectangular tracts, laid out by legal subdivision of the public survey. Such a change would make the claim large enough for protection against speculative locators whose policy it is to take advantage of the real discoverer's labor, and at the same time would automatically do away with the necessity of extralateral rights, thus forestalling for the future the greatest cause for litigation the mining industry has had to cope with. This would automatically stop much of the injustice perpetrated by the wealthy mine owner upon the prospector and miner, under the guise of the present apex law. In case the size of the claim is increased it might be wise to require $100 worth of work for each 20 acres, or fraction thereof, in the claim and to enforce the discovery requirements very strictly in order to prevent tying up of large areas of country. I realize that this is touching upon dangerous ground, but it is presented only as a suggested way out of a real difficulty.

In this argument, for which I am personally responsible and act in no manner as a spokesman for any Government bureau, I have proceeded upon the assumption that criticism has very little or no constructive value unless it is backed by suggestions for a cure. In fact I recognize that it is absolutely impossible to make a set of mining laws which will suit every one.

Right here I can do no better than to quote from the 'Twentieth Annual Report' of the Bureau of Mines of Ontario, Vol. XX, Part 1, p. 270, 1911, where mine commissioner S. Price has so aptly expressed the situation when he says, speaking of mining laws in general: "* * * Probably no law upon the subject anywhere has ever had the unanimous approval of those working under it, for individual opinions and points of view differ even more widely than the laws. Poor prospectors and rich capitalists, men with little and those with large experience, those who want to find something to develop and those who desire merely to get something to sell, the miner who wants to work the land for the valuable mineral he expects it to produce and the speculator who desires only to hold it while neighboring development increases its value, can hardly be expected to view matters in the same light or to desire the same kind of a law; nor is the interest of any of them always identical with the paramount interest of the community as a whole to which the property in the first place belongs. * * *"

In the above argument I have had in mind justice to the poor prospector, the interests of the mining industry at large and that of the country as a whole. The difficulties in making and administering mining laws are largely brought about by unscrupulous locators and stock venders who are 'in the game for what there is in it,' and I freely acknowledge that such do not belong to the mining fraternity proper. If everyone were honest there would be very little difficulty under the present law, but human beings are still human and to some extent selfish, all of which requires that the central government should take a strong hand in the administration of its public land laws in the interests of common justice.

It Is a Curious Fact that the United States, with enormous deposits of iron ore, depends on deposits in foreign countries for most of its supply of the metals used as alloys in the manufacture of steel, such as manganese, nickel, chromium, and vanadium, according to the U. S. Geological Survey. The production of ferromanganese, spiegeleisen, and other alloys in 1913 amounted to 226,475 tons, against 128,147 tons in 1912.

DAM ON THE SALMON CREEK POWER DIVISION.

Developments of the Alaska Gold Mines Company

By E. E. HURJA

Probably nowhere in the world has mining on such an immense scale been undertaken by so many companies as in the Juneau (Alaska) district; so therefore a review of the present status of the Alaska Gastineau property, held by the Alaska Gold Mines Co., may be of interest to mining men generally. The Company has three miles of claims along an orebody varying in width from 70 to 400 ft., and carrying from $1.50 to $2 per ton in gold, with a net profit of from 50 to 75 cents per ton because of the large-scale production. The mining work of the Company is conducted from Sheep Creek, four miles south of Juneau, and the work on the power project is on Salmon creek, four miles north of Juneau. The main offices of the Company are at Juneau, with B. L. Thane in charge.

Mine Development

The underground development up to the present time includes the Alexander adit, known as tunnel No. 10, at the Perseverance mine, in Silver Bow basin, which has been extended and is now 5000 ft. long. Crosscuts are being driven from this and from the main adit, known as the Sheep creek tunnel, which connects the Perseverance workings with the millsite overlooking Gastineau channel at the mouth of Sheep creek. A vertical three-compartment shaft, 1544 ft. in depth, connects with the 8 by 10 adit having a length of 9178 ft. The work on the adit was started in November 1912 and was completed April 1, 1914. During the last six months a monthly rate of 600 ft. was maintained. Three shifts were worked on the bonus system in completing the tunnel. Thirty-three feet were made in a single day during November.

An electric tram 1¼ miles long connects the portal of the adit with the coarse-crushing plant on Sheep creek. The present gage of 24 in. is to be changed to 36 in., and the storage-battery locomotives will be replaced with the trolley system. All the mining will be conducted through the main adit, and ore hauled to the reduction plant in 300-ton trainloads.

THE OLD PERSEVERANCE MILL.

Reduction Plant

The first unit of the reduction plant of the Company probably will be completed by January 1, 1915. The coarse-crushing plant, situated on the hill 700 ft. above the beach, is almost completed. The foundation and

steel framework are completed and the machinery is now being installed. The ore falls into underground storage-bins and is hauled by a bucket line through an underground tunnel, 300 ft. long, to the fine-crushing plant. The concrete foundations for the fine-crushing plant are nearly completed, and the steel for the framework is all on the ground. The sides of the building will be of galvanized iron. After a preliminary sorting, the ore is crushed by Hardinge conical mills, then taken over amalgam tables to the concentrating department. Wilfley tables and Garfield roll mills will prepare the concentrate for the re-treatment plant. Experiments with a view to cyanidation of concentrates are still in progress. The first unit will have a capacity of 6000 tons daily.

Machine-shops, sawmill, six bunk-houses, mess-house, office buildings, and dock have been built on the beach, immediately below the reduction plant, the floor of which is 300 ft. above sea-level.

Power

The Salmon creek power project will be completed by July 25, 1914, according to statements of the engineers in charge. The first concrete for the dam, which is of the variable radius arch type, was poured July 25, 1913. The dam will have a height when completed of 177 ft., with a length along the crest of 650 ft., and the thickness at the base will be 47 ft. On June 25, 26 ft. remained to be built. Following the completion of power-plant No. 1, which is on the beach at the mouth of Salmon creek, in 1912, a 4½-mile tramway was built and building erected for work on power-plant No. 2 and the dam. Power-plant No. 1 has one unit of 1500 kw. installed. The second unit will be installed in the spring of 1915. The plant is closed down for repairs at present. Power-plant No. 2, with two generating units of 1500 kw. each, is completed, and is furnishing all the power for present operations of the Company. The beach at Salmon creek is being bulkheaded to protect the buildings and road from tide action. A concrete tail-race will be built.

In order to handle cement and supplies with dispatch, a special dock was built, with a highly practical apron track by which loaded cars of cement can be moved from the barges directly upon the tramway. Barges bearing fifteen 3-ton cars are unloaded and empty cars put on board in 40 minutes. Three hundred and five tons of cement is the record amount handled during a single day. A 2000-ft. cable tramway raises the cars 300 ft. to the steam road leading to the dam-site.

When complete, the dam will impound 20,000 acre-feet of water. Above the dam, in what will be the reservoir area, the quarry, gravel, and washing plants are situated. Belt conveyors carry gravel, sand, and cement to two mixers with a daily capacity of 700 yd. As much as 860 yd. has been poured in 24 hours. The concrete is hoisted in a 2-compartment tower 75 ft. high, shown in the halftone, for distribution. A ditch 3850 ft. long is being built to drain the north slope of the basin below the dam into the reservoir. The construction camp at the dam is roomy, clean, and well drained; shower baths, toilets, and other conveniences are provided.

Computing the width of the ore at 70 ft., the orebody

INTERIOR OF POWER-PLANT NO 2, ALASKA GASTINEAU COMPANY.

above the main adit is estimated to contain 50,000,000 tons, assuring operation of the mill for many years to come.

Costs at the Great Fingall Mine

Ore extracted from the Great Fingall mine, Western Australia, is of a free-milling class, which is stamped, concentrated, concentrate roasted and cyanided, sand leached, and slime treated in a vacuum-filter. It was mined down to the No. 18 level, a depth of 2480 ft. on the incline. Costs per ton were as follows:

Ordinary development	$0.91	Leaching sand	$0.22
Special development	0.99	Filtering slime	0.24
Mining:		Pptn. and clean-up	0.08
Breaking ore	$1.25	Disposal of residue	0.18
Filling stopes	0.12	Treating custom ore and concentrate	0.12
Tramming and hoisting	1.52		
Total mining	$2.89	Total treatment	$2.08
Treatment:		Less custom account	0.19
Crushing	$0.15		
Transport	0.04	Net treatment cost	$1.89
Stamping	0.62	Bullion expenses	0.06
Concentrating	0.04	General expenses	0.62
Concentrate treatment	0.07		
Grinding sand	0.32	Grand total	$7.36

Crude Barytes Production of the United States in 1913 was 45,298 tons worth $156,275, an increase of 7820 tons and $2962 compared with the yield in 1912. Most of this mineral is used as a pigment in the manufacture of mixed paints.

Coke Production of New Mexico in 1913 was 467,945 short tons, valued at $1,548,536, an increase of 54,039 tons and $191,590 over 1912. The coke is from the Raton field coal.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The editor welcomes the expression of views contrary to his own, believing that correct criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Workman's Compensation

The Editor:

Sir—While on a recent trip through Sierra and Nevada counties, I noticed that the workman's compensation law is not altogether popular. The general comment is, that it is hard on the small mine owner. One man who is developing a prospect, and who says he can't afford the extra tax, is employing only unmarried men. Another, has leased his mine and mill to the men, giving them a bonus of ten per cent of the net; above wages and supplies. The lease runs only 30 days, being signed over again at the beginning of each month. He says this works very well. The men are more saving with supplies, and the increase in the amount of work done, more than repays the ten per cent. But I doubt if this would evade the law in case of an accident. Being the owner, he is probably just as responsible as the man who lets a contract.

Insurance is a good thing,—for the workman,—and good for the owner, as protection against possible damage suit. But it is not fair that the mine owner should stand the whole expense when the miner is the chief beneficiary. Let the mine owner pay one-third of the tax, and the miner two-thirds. It can be deducted from his monthly pay-check, just as some of the mining companies used to hold out a dollar per month from each check for the services of the doctor.

GEO E. BIGELOW.

Brown Valley, California, June 28.

Value of Dredging Ground

The Editor:

Sir—In Mr. Decoto's article, I can see where he can prove his contention that no part area of a given area of dredging ground is representative of the total area, as regards its value, but it does not seem to me that the correct value per cubic yard of his theoretical plot has been arrived at by his method of computing the same.

I get from his article that the dredging operations are limited, in this theoretical case, by the lines connecting drill-holes No. 1, 3, 18, and 16. This being so, these corner drill-holes, taken individually, would be representative of only ¼ the area of that of an interior drill-hole, say No. 5 or No. 7. Likewise the holes No. 2, 8, 13, 12, 6, and 11 would be representative of only ½ the area represented by holes No. 5 or 7.

The computations, then, to arrive at the correct

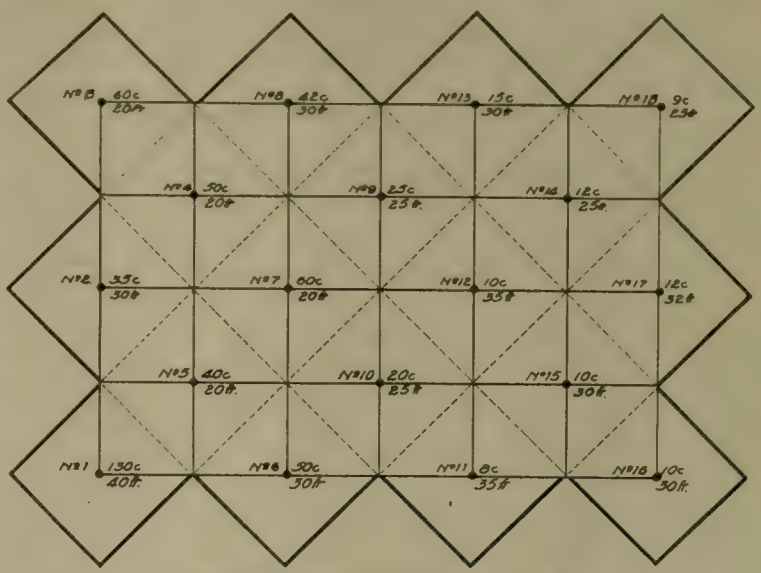


DIAGRAM SHOWING PORTION OF DRILL-HOLES.

value of the area bounded by lines connecting drill-holes No. 1, 3, 8, and 6, would be:

1	130 × (40 × ¼)	or 10.0 =	1300
2	35 × (30 × ½)	or 15.0 =	525
3	60 × (20 × ¼)	or 5.0 =	300
4	50 × (20 × 1)	or 20.0 =	1000
5	40 × (20 × 1)	or 20.0 =	800
6	50 × (30 × ¼)	or 7.5 =	375
7	60 × (20 × ½)	or 10.0 =	600
8	42 × (30 × ¼)	or 7.5 =	315
		95.0	5215

This gives the value per cubic yard for this part area of 54.89c. In a like manner, the total area gives a value per cubic yard of 28.76 cents.[1]

To get a value of 37.69c. per cubic yard as calculated by Mr. Decoto, it is obvious that the ground would have to be dredged to take in the area enclosed

[1]This gives a difference of 8.93c. per cubic yard, or 31%, which might in some close dredging propositions change a calculated profit to a loss.

by the outside boundary lines shown in the sketch. It might be posisble for a dredge to work such a boundary, but it is improbable that the operations would be so conducted.

E. Bryant Thornhill.

Cobalt, Ontario, May 20.

Revision of the Mining Law

The Editor:

Sir—I have just been reading the article, 'Revision of the Mining Law,' by Frank P. Davis, in your June 13, 1914, issue. I have given this subject, particularly the location and title of quartz mining claims no little thought and study since the question of a 'Mining Code Commission' has been agitated, and I give Mr. Davis credit for advancing some good ideas in his fifteen different suggestions. Taking them in the same numerical order, I will present some of my views of the question, in a brief manner.

1. All mining locations to be made only by citizens of the United States.

2. Size of a full quartz mining claim to be 1320 ft. on a side (40 acres) and located relative to the legal subdivisions, if surveyed. In any event, all boundary lines to be north and south and east and west.

3. Location monument, with a legible notice, a true copy of the record, posted at the discovery work.

4. Boundaries to be plainly marked with stakes, or monuments, on all sides of the claim, so that they can be easily traced. Corners established with large prominent posts (6 in. square or more) set in mound of stone, at least 4 ft. above ground, giving name, number, and identity of the corner, with right to fence but not to encroach on public trails or highways.

5. Discovery work to consist of a shaft, adit, or open cut, not less than 10 ft. deep, and more if necessary, to expose the vein in place, and it *must* show a vein, to be a legal location. This work may be done at any point within the boundary of the claim, at the option of the locator, regardless of any 'centre line.' The position of this discovery work, with relation to the boundaries, must be accurately located and appear in the record, by giving the distance from all four lines of the exterior boundary of the claim.

6. Have location notice describe the location, as far as possible, by legal subdivisions, giving section, township, range, etc., so that it may be accurately located from the field notes of record. If it cannot be located and platted from the record it is not a valid location.

7. No extralateral rights, but to own all mineral within its vertical boundary lines.

8. Claim must be recorded within 30 days from the date of discovery, at which time the discoverer must post a temporary notice, bearing date of discovery, and declaring his intention to locate and record.

9. No overlapping of claims.

10. Fix a penalty for fraudulent dating. If the title to a claim has lapsed the original owner can only secure it again by paying up his back tax, as prescribed below, and not then if it has been located by others.

11. Let the first day of January be the date from which all locations are fixed, relative to the tax, etc., so there will be no confusion of dates. If a claim is located in 1914 the tax must be paid in 1915 or it is subject to location by other parties.

12. To pay a yearly tax, until patented, of a fixed amount, on each location, in lieu of the assessment now required. Said tax to be due in the second year of the location. This tax receipt to be proof of non-abandonment. Make all unpatented claims subject to this tax.

13. Proceed to patent under the same rules and regulations that exist today. Get your survey number and a U. S. deputy mineral surveyor to mark and establish the corners. It is absolutely essential to have these monuments correctly fixed, particularly so if it is a patented claim.

14. Accept no agricultural filings in known mineral area, or reserve all mineral rights, with surface restrictions, so they can be prospected. Fix a penalty for posting 'scare notices,' such as "No trespassing on these premises" on territory that is not absolutely owned. This keeps prospectors off.

15. If the above suggestions were adopted, I can see no reason why claims should not be located by proxy or power-of-attorney.

I believe in giving the prospector and locator every possible chance, but there are some of them who abuse their rights, which is made possible by the present laws. They get 'hoggish' or 'dog-in-the-manger' like. They won't develop their locations, in fact, they can't, nor will they let any other prospector in. I know of a case, and I dare say the same condition prevails, to some extent, in every mining camp in the West, where a prospector has 20 claims, and he has held them for years. Now, it is a physical and financial impossibility for him to do this assessment work legally, yet he keeps other prospectors away. In many cases he does not make a pretext of doing the assessment, but gets very busy at midnight of December 31, posting new location notices, in his own and other people's names. I think my suggestion in paragraph 12 would remedy this.

If a person should discover something near these '20 claims' it would be impossible for him to determine whether or not he was trespassing on one of them. The description, in the location certificate is so meager, indefinite, and consequently flexible, that it would be impossible to locate the position of any one of them on the ground. The course is generally given as northeast and southwest. If there is any tie at all, it is to a pine tree or a log cabin that has long since burned down. Hence my suggestion in paragraphs 4 and 6.

In paragraph 2 I suggest the size of a quartz claim to be 1320 ft. square. I do not think this is any too large, and it would be very easy for a prospector to locate it, so there would be no excuse for his not having a valid location. For example, he locates the S.E. ¼ of the S.E. ¼ of Sec. 16, T. 19, N. R. 6 E., M.D.M., etc. Or, if the

claim cannot be conformed to the legal subdivision, in this manner he can measure off, from or to the section or quarter corner, as the case may be, any distance north south east or west to a starting point, and describe it as follows: Beginning at corner No. 1, whence the S.E. corner Sec. 16, T., R., etc., bears E. 1000 ft., thence N. 1320 ft. to corner No. 2, thence W. 1320 ft. to corner No. 3, thence S. 1320 ft. to corner No. 4, thence E. 1320 ft. to corner No. 1, the place of beginning. Suppose half of the claim was in section 16 and the south half in section 21, it would be described in the same manner, only the starting point would be on a side line instead of a corner, viz: Beginning at a point 1000 ft. W. of the S.E. corner Sec. 16., etc., thence N. 660 ft. to corner No. 1, and around to corner No. 4, thence N. 660 ft. to the place of beginning. These would be valid locations, affixed to and made part and parcel of the public survey. It is a wonder to me that something after this fashion was not adopted long ago. What is the public survey made for, if not just for this purpose; to locate and identify positively different tracts of land?

It would be possible to locate any claim desired, in this manner, so that it would cover the vein apex for the full distance. That is one reason for leaving the position of the location work optional with the locator, as suggested in paragraph 5. Another reason for this is so the locator may take into consideration the dip of the vein, relative to the vertical side lines, and locate his surface ground accordingly.

I have made particular mention of some of the features of our mining code, and, in my opinion, some of the worst things the prospector of today has to contend with, especially in the newer camps, where so many men make a practice of rushing in and staking all the ground possible and holding it for 60 or 90 days, or even longer, by re-staking it, without doing a tap, much to the detriment of the camp and a hardship to those who arrive later.

In many places I have even seen these stakes stuck in the snow. Paragraphs 8 and 10 are suggested as a remedy for this fault. And I believe if the time limit for recording was cut to 10 days, instead of 30, it would be still better. The law giving the locator 90 days to do his discovery work, survey, and record, in a way, was necessary, as it required some time to trace out the apex of a vein before it could be covered intelligently with the location. But with the claim square, as suggested, this would not be necessary, and a 10-ft. hole could be sunk in any ground in 10 days. This would mean that the 'stake hog' or 'ground hog,' as he might well be called, would have to get busy 'throwing dirt,' instead of trying to stake the whole landscape as a speculative enterprise.

As has been suggested, 'now is the time to holler.' Don't wait until the drill strikes the bottom of the shaft, and then shout, 'Look out below!'

CLARENCE K. COLVIN.

Forbestown, California, June 18.

What is the Matter With Prospecting?

The Editor:

SIR—From the point of view of an operator actively engaged in examining prospects with any promise, I would state that in my opinion the chief difficulty the prospector encounters is interposed by himself, in the form of prices and terms. These are often so severe that an examination is not justified, even on the basis of the rosy statements made. If the risk of the expense of an examination is taken, the matter usually boils down to the question of putting up cash for the privilege of putting up more.

When trade is quiet in real estate, railroad bonds, winter wheat, or mining prospects, there is always one underlying reason, namely, that sellers are asking more than the buyers can pay. The conundrum is not a difficult one from an economic standpoint. If the question were put in another form, namely: How shall we stimulate prospecting? I would say by making known prospects attractive to the operators.

If I were a prospector, and had a prospective mountain of ore, exposed at one or two points, and were sure of being able to find these points again, I would request an operator to examine it and offer him a year of development, giving him an option to purchase at from $1000 to $10,000, according to circumstances, this price to be paid within three years at a rate of not less than $25 per month. As soon as this deal was closed, and it would not take long if the one or two points of ore could really be found again, I would hunt for the next available mountain of ore and endeavor to close in due course a similar deal if such mountain were available. If my prospects were really interesting, I would hope to get a raise in my income of $25 per month once or twice a year, and come into an occasional bonus when some of the prospects proved to be more than interesting.

If I could not earn a good living on this basis, I would go into some other business, and from a safe distance, would amend my contribution to this topic. I would say it was not because prospects were held too high to be interesting to the buyer, that the business of prospecting was dying, but because there were not enough prospects to justify the search for them.

Unless more prospects are offered on terms which will justify examination and development, the art of prospecting will perish, and a post-mortem examination will probably show that it died of wilful starvation in sight of food.

OPERATOR

San Francisco, May 29.

LOAD FACTOR in electric power being supplied to 115 classes of industries by the Pacific Gas & Electric Co. of California is 59 per cent.

COKE PRODUCTION of Kentucky in 1913 was 317,084 tons.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

INDIA, RUSSIA, AND BRAZIL produce 90% of the world's supply of manganese ores.

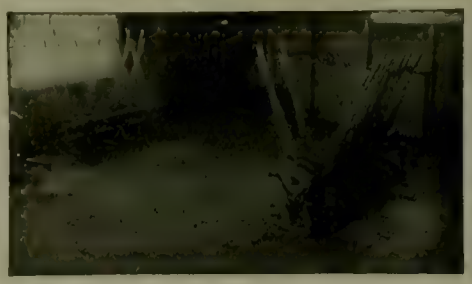
'WIRELESS' TELEPHONY is now used in the Lindsay colliery of the Fife Coal Co. in Scotland. Current is carried through the rails in the drifts. Four receivers weighing 50 lb. each have been installed, and each instrument has a battery of four cells producing current at 15-volt pressure.

A PROCESS for making pressure-sustaining coke containing a minimum of detrimental sulphur constituents, from coal, consists of adding to the coal before coking a phosphorous compound of lime, and coking said mixed mass. The process has been devised by Leon Franck, of Luxemburg, Germany.

PLUNGER PUMPS are made with several important adjuncts to permit of better operation, which may be described as follows: An air vessel, charged with air, which acts as a reservoir of energy. During the discharge stroke the air in the vessel is compressed. The energy, which is stored up in the compressed air, is given out again during the pause which takes place when the pump is changing the direction of its stroke. The water in the delivery column is thus kept in motion during the pause, and shock to the pump is reduced. The power required at the beginning of the stroke is also reduced as the force of inertia is eliminated, due to the water being kept in motion. Snifting cocks are used where the suction pipes are too small. If such is the case the water in the suction pipes rushes into the pump at a high velocity. This prevents the suction valve closing until the ram has made part of its stroke, and consequently causes a considerable amount of shock to the pump when the two columns of water come into contact. By using snifting cocks a certain quantity of air is admitted at each stroke. The air acts as a cushion to the water, and allows the valve to close at its proper time, thus reducing shock to the pump. The suction valve prevents the water from being forced back into the suction column during the discharge stroke of the pump. The delivery valve holds the water in the delivery column, and prevents it running back into the working barrel during the suction stroke of the pump.

GAS PUMPS for lifting water are coming into more general use. The Humphrey system, as installed to pump 180,000,000 gal. of water per day for London, with a fuel consumption not exceeding 1.1 lb. of anthracite coal per pump-horse-power hour, was described in the *Press* of June 28, 1913. Another Humphrey plant is to be erected at Mex, three miles west from Alexandria, for the Egyptian government. Certain lands in the district have become 'water-logged,' and it has been decided to drain Lake Mariut, having an area of 50,000 acres and 3 ft. deep, and reclaim the area under water. To do this, the lake water is to be pumped into the Mediterranean Sea, a lift of from 19 to 20 ft. from a drainage canal, over a narrow protecting ridge on the seacoast. Ten Humphrey pumps, eight of which will be sufficient to lift 792,000,000 gal. per day, are being made by Messrs. Beardmore and Messrs. Brown, Boveri & Co. Each machine will have a combustion chamber 8 ft. 8 in. diameter by 14 ft. high. The valve-box will be the same diameter and 7 ft. high, and is to have 100 valves of the hinge type, which will close on any obstruction without straining the hinges. The 'play-pipe' of the pump will slope upward so as to deliver water at the required elevation in the discharge basin. The pumps are started by admitting into the combustion chamber a mixture of gas and air. The Power Gas Corporation will supply an anthracite Mond plant capable of gasifying 44 tons per day, consisting of nine 6-ft. producers. The guaranteed consumption is 1.15 lb. coal per horse-power. Two Venturi meters will measure the water delivered from the pumps.

A DREDGE may be constructed to handle so many cubic yards of gravel per day, yet this capacity is entirely dependent on the skill of the winchman. He has control of the motors which drive the winches for side-lines,



CONTROL LEVERS ON YUBA NO. 14 DREDGE.

spuds, and other gear; also the main motor for driving the bucket-line, and lowering and raising the digging ladder. In his department, at the top of the dredge, is a switchboard and a large number of levers, by which he is able to control all operations of swinging the boat, stepping ahead, and digging gravel. The accompanying cut shows the levers on Yuba No. 14 dredge, California.

REVIEW OF MINING

As seen at the world's great mining centers by our own correspondents

WASHINGTON, D. C

'Mineral Resources of the United States' More Appropriation Wanted for This Publication. Its Value Explained by the Director of the Survey.

Congress has not proved indulgent this year to the attempt of the U. S Geological Survey to procure an extra $10,000 for the preparation of the report of the 'Mineral Resources of the United States,' allowing only $75,000 for the coming fiscal year as heretofore. An appropriation of $85,000 had been asked by the director, George Otis Smith. "Under this item," Mr. Smith told the House Committee on Appropriations, "there is taken every year a census of the mineral production of the whole country, which amounts at the present time to something over $2,000,000,000." Mr. Smith was asked how this census is obtained and thereby revealed some interesting facts as also the implied plans for the future by the Survey on this census. "It is done," he said, "by correspondence and a certain amount of visiting the different mining districts and especially of Western mining districts. The report is a very accurate statement of the mineral production of each year, by reason of the fact that we have a permanent force that is in almost constant correspondence with the individual producers. It is not like waiting 10 years and then getting in touch with the industry, for our statisticians are in constant touch with them. We believe that by the various checks we use, that is, by compiling not only the returns of the individual producers in the Western states, but by using the returns of the smelters to which the ores have been sent, and, then also, by using the double check of the statistics of the shipments which are furnished by the different railroad companies, that we have the truth of it. It may be surprising, but there have been instances where individual producers several years afterward have asked us what their production was for certain years, getting this from our books, and in some cases the return was based not so much on what the man might send in himself, but on what we learned through railroad shipments at the particular siding where his ore was loaded. We are more and more giving the public, or are trying to give the public, a fair statement of the mineral production of the preceding year on or near the first of January, that being the time that a good many people interested in the subject desire the statistics. We make these preliminary estimates, which are usually based on what we know of the eleven months previous, and then we estimate for the twelfth month. Then we are also trying to give to the public before July 1 the complete report, which gives the totals, including not only the state totals, but the county totals. Our printed report is issued first in the form of separate chapters which are devoted to particular products, like iron ore or coal or coke and later they are assembled in two volumes that make up the annual report. The work is steadily increasing by reason of the greater number of producers. I ask for an increase of $10,000 partly because I am not satisfied with the promptness with which we can issue the reports under the present appropriation, nor am I satisfied with the thoroughness with which we cover the whole field. With the additional money the telegraph would be more freely used to get the reports from the producers last to report. Sometimes the expensive part of a report is the last of one-half of one per cent, that is to get the men who are staying out to send in their returns. Ninety-nine per cent of the returns may be in, but a wait of several weeks is incurred to get the remaining one per cent. It is a decided advantage to have a geologist or clerk ready to go out from the nearest Survey office to solicit the returns in person. One such visit will keep a producer in line for several years, simply because he realizes the importance of the information to the whole industry. Offices of the Survey are in Washington, Denver, Salt Lake City, and San Francisco. The increase would also enable the employment of better men."

An inquiry by Congressman Mondel of Wyoming, as to why the statistics from certain states were lumped, brought an interesting and explanatory answer. The Congressman said he was especially interested in the showing of Wyoming. For instance after an industry, such as iron in a state was below 500,000 tons per annum that state was simply lumped in its iron with other states. "If there are only two producers in a state," explained Mr. Smith, "we will lump that state with some other state, because by giving the total production for two producers only we are giving each one of those producers information regarding the tonnage of his competitor." "What objection is there to the people knowing how much the Colorado Fuel & Iron Co. produces at Sunrise, in my state?" asked Congressman Mondel. "There is no objection," replied Mr. Smith, "unless the operators prefer to have their returns confidential. Our returns are usually confidential." Mr. Smith added that he was able to show that when Congress called for the figures of the individual production of large corporations supplying the U. S. Steel Corporation, 20 large producers were in the list. He said that the reports had practical value moreover as was shown in the case of a small miner in Missouri who was not satisfied with the prices of zinc he was obtaining and who asked of the Survey the range of prices for zinc ore. The Survey gave him a report showing the range of prices month by month, and in his return letter the miner said that through the report he had been able to get a considerable advance over the prices that the ore-buyers had been allowing him. "The big people do not need this kind of help so much as the small producers," said Mr. Smith. "The large copper mining companies, for instance, have an agency of their own whereby they keep monthly statistics. It is of course interesting and gratifying to us that when they started that system a few years ago they came to the Survey and took the geologist who was compiling the annual statistics on copper for this volume, and he has since been issuing every month for the benefit of those large producers the monthly figures on copper production." Mr. Smith was referring to L. C. Graton, secretary of the Copper Producers' Association. Legislation in Congress on mining continues to make no advance worth noting.

NEW YORK

Business Situation.—National Copper Mine.—Granby Consolidated.—Heinze Suits.—International Steam Pump Co.—Gold Hill Affair.

There seems to be something of a new undertone in New York markets. The past three years have constituted a long period of depression, a lane that seemed to have no turning. It would be too much to say that a turn in the lane is in sight. There are too many railroad receiverships and too many reorganizations obviously necessary, but there is be-

coming more and more evident a prevalence of the belief that the worst is known and has been adequately discounted, and students of underlying conditions are getting back to the position that the country's tremendous production spells prosperity. There are readjustments making and yet to be made. There are some reformations of spirit yet to be accomplished in financial circles, the lesson that service is the only work that deserves reward has been taken to heart by manufacturers, by railroad operators as distinguished from financiers much more fully than it has by the banking element that is still feeling the public disapproval. The stagnation of general business is typified by the copper situation. Domestic deliveries have been far below normal during all of the current year, while June makes a low record for the year, and a new low record for the corresponding month of the past six years. Surplus stocks show an increase, but it is so well recognized now that the producers are in control that there is no attempt to make market capital out of this feature.

At the National mine, in Idaho, while milling operations are still in the tuning-up stage, the process used has apparently overcome the question of the cost of oil, having reduced this from about 6 or 7c. to between 1 and 2c. per ton of ore treated.

The Granby Consolidated's fiscal year just completed has been a rather important one for the Company, as the management had in hand the task of putting the Hidden Creek property on a producing basis. The Company has maintained its dividend, but while producing some 22,168,614 lb. of copper the margin of profit has not been large.

Judging from appearances, the Heinze entanglement of various descriptions will receive 'Gordon knot' treatment in the near future. Heinze lies at his home ill. United Copper, Stewart Mining, Ohio Copper, are all in snarls, which, like the Amalgamated-Heinze fight in Butte, will not be unraveled, but will be cut. Unfortunately for Heinze, he no longer has an H. H. Rogers attempting to oust him from great properties, and the man who once fought the Standard Oil element in Montana to such a standstill is likely to make an almost unnoticed exit from the financial world.

The International Steam Pump Co. management has been attacked by John Drew in a suit alleging the existance of fraud in the deal by which the Pump company absorbed the Power & Mining Machinery Co. Quite recently the preferred dividends on two of the companies controlled by the Pump company were passed, and there has been some talk of the possibility of a receiver.

The 'regulars' down in the financial district have been enjoying many a good laugh over the publicity recently achieved by Walter George Newman of Gold Hill notoriety. Gold Hill was discredited on the New York Curb years ago, and Mr. Newman likewise. That he should be able to go to Washington and get officials there interested in his proposition is something of a triumph of nerve and perseverance. Gold Hill has been the vehicle of several spectacular market operations on the Curb, but as a mining operation it has been looked upon as a joke for years. Investigation into the use of official stationery resulted in wiping of the whole matter off the Senate Committee's slate as not important enough to take up time of the official, but in the meantime, Newman has reveled in the publicity so acquired. Inasmuch as gold production in the Eastern states amounted to but $165,733 in 1913, apparently Gold Hill is not the centre of a big camp. These figures given out by U. S. Geological Survey, included Alabama, Georgia, and South Carolina as well as North Carolina, within whose borders Gold Hill has its lair.

Extraction at the new Elm Orlu plant at Butte is from 96 to 97% of the zinc content of the ore. The Minerals Separation process is used.——Tests are being run at Anaconda on a 50-ton Minerals Separation flotation plant treating slime from Dorr thickeners. The first results are even better than was anticipated.

WARREN, IDAHO

BIG CREEK MINING DISTRICT: SITUATION, ELEVATION, GEOLOGY, AND NOTES ON THE MOSCOW, MCRAE-GOLDMAN, RED METAL, VICTOR-GLASGOW, GOLD COIN, AND PROBIGLO MINES.

The Big Creek district is situated in Idaho county, about 30 miles from Warren, and 60 miles from Thunder City. Minerals have been found in an area of about 17 miles north and south by 8 miles east and west, and which contains a large variety of base and free-milling ores. The district is approached from the railroad at New Meadow and Thunder City, both of which are branch terminals, over state wagon roads. Yellow Pine, the nearest settlement, is in the southern part of the district, and is reached by wagon road from the Short Line railroad at Thunder City about 50 miles distant. Approximately 30 miles of the Yellow Pine road is in the National Forest Reserve, and is well kept up. This part of the road is well constructed and

MAP OF IDAHO.

is ideal for automobiles, the grades being easy; but the other part of the road has been allowed to get in a bad state of repair. At the time these notes were written the county was doing some extensive repairing. However, in summer time the stage easily makes the through trip. Elevations of the district vary from 7100 to 9400 ft. above sea-level, and is on the extreme heads of Profile creek, Big creek, and Logan creek, which has a large amount of timber and water-power in many places. Snow in this region begins to fall late in October, and lies there until May, but most of the heavy mining is done in the middle of winter. The district, as a whole, is one of the most picturesque in the state, the innumerable water-falls, lakes and mountain peaks can be rivaled in few places. Yellow Pine is an ideal spot, there being an abundance of yellow pine saw timber there, with plenty of hunting and fishing and may some day be a great resort. The northern route into this mineral belt is over the old South Fork and Warren road which connects with the Pacific and Idaho Northern railroad at New Meadow 90 miles distant. This road crosses three high summits, one of these summits is over 9000 ft. high, and the

other two are over 7000 ft. The road as a whole is one of the worst in the state and the expenditure that would be necessary to put it in shape for heavy hauling would build a good road from Yellow Pine through the entire district.

The geology of the district is interesting and the exposures of formations afford good opportunities to study the rocks. These are chiefly altered granite, cut by late intrusive dikes. The veins are from 2 to 200 ft. wide and there are three distinct veins which traverse glaciated benches which, in many cases have been eroded and left the veins standing in bold relief. The occurrence of the intrusive dikes is quite general and they are found in numbers ranging from 2 ft. in thickness to great masses. Although the formation is cut up by numerous fissures it is not badly faulted, the orebodies being generally found in place.

The so-called Moore 'bonanza' in the Moscow mine is 250 ft. wide as has been determined by shallow surface cuts, and a good deal of free gold may be obtained from the more favorable gangue throughout the entire width by panning. The deposit on this group of claims, has been traced for over a mile, and at one point has been opened by a cross-cut adit 200 ft. long and has obtained a vertical depth of 150 ft. Two raises have been driven to the surface, and around these a 'glory hole' has been opened. The adit dump has been connected by a rope tramway hung on stumps to a five-stamp mill at the foot of the mountain. With this crude affair the owner makes a good living. The ore is free milling to a depth of 50 ft., when it changes into a rich sulphide. The glory hole has produced about 1500 tons of ore that averages $5 free gold per ton. A few samples taken from the sulphide horizon in the main adit assayed $5 in gold and silver, 85% of the value being gold. Some cyanide tests made on some of the concentrate show an extraction of 96% by grinding and agitation 8 hours in an 8-lb. solution. During the past season some well known engineers sampled this property, and one sampling of 150 ft. of the main adit gave an average of $3 per ton; while the zone 60 ft. wide, of more heavily mineralized ore, is reported to have averaged $4.40 per ton.

Continuing north from the Moore bonanza, another large body of ore is in the McRae-Goldman claims, shown by thick bands and a network of honey-combed quartz and gangue, 100 ft. wide by several hundred feet long, which yields by panning $5 to $20 gold per ton. This property is also being developed by the owners by a cross-cut adit to determine its width and average value. The claims are parallel with a large quartz vein containing some small streaks of rich ore, which were the basis of development work and a lot of wild-cat stock flotations in the early history of the camp.

The Red Metal mine, on the west vein, has a large body of brown-stained quartz which contains some sulphide and gold and a small percentage of copper is of great width. On the hanging wall side of this vein, a 5-ft. body of silver ore has been opened by two cross-cut adits to a depth of 100 ft. In 1905, the owner extracted five tons of ore from an 18-in. streak on the hanging wall, and shipped it to the Tacoma smelter, returning over $200, and 1 oz. gold per ton. The owner is now taking out a few tons which he expects to ship by parcel post.

Continuing on the same vein north to the Victor and Glasgow groups of claims, the ore is similar in character, but the gold content is much higher. In some places on these claims this is up to several ounces per ton. In several openings on the surface, small amounts of free gold can be obtained by panning, and from a shaft which is down 25 ft., ore has been extracted which assayed several ounces per ton. The main vein on this bench dips about 70° east, and several small stringers varying from 1 to 5 ft. are dipping into the main vein at an angle of about 40°. The intrusive dikes are numerous here. The owners of this property are driving a long cross-cut adit which will cut this vein system over 200 ft. below the outcrop. Another adit has been driven in the mountain lower down and has cut the centre vein of the district showing a body of sulphide ore 150 ft. wide from which assays yield $5 per ton. This property has over 800 ft. of development done.

The Gold Coin mine is situated on the east side of Profile creek and consists of a large deposit of brown oxide ore which assays well in gold. This vein traverses a glaciated bench and is cut by numerous porphyry dikes and free gold can be obtained by panning. Lead-silver ore is also found in numerous small streaks which often lie directly parallel to stringers of siderite, and which seem to be feeding into the main body of brown oxide. At the foot of this mountain placer gold is found in profitable quantities.

The Probiglo Mining Co.'s property consists of four quartz claims and one placer claim, and is situated due north from the Victor claims. The vein on this property is 150 ft. wide, as proved by several surface trenches, and gives fair assays in gold and silver along its full length. Several rich streaks of gold-silver ore have been cut between the enclosing vein material, varying from 4 to 12 in. wide and assaying high in gold and silver. The Company is planning to ship several tons of rich ore this summer, and will probably build a small mill. By driving an adit in from the foot of the mountain a depth of 2000 ft. can be obtained.

Among other properties of the district, in various stages of development are the Laufer and Davis, Independence, and Copper Camp.

For cheap power resources the district is unexcelled, as it has a number of streams which can be made to develop 50,000 hp. at moderate cost. Big creek, in connection with Profile gap, affords comparatively easy railroad construction from the main Salmon river, and up the middle fork to southern Idaho. The ultimate construction of a branch over the proposed line would come up Big creek and open up the entire district to railway transportation.

DEADWOOD, SOUTH DAKOTA

ACTIVITIES OF THE DEADWOOD BUSINESS CLUB IN MINING AND FORMING THE HEIDELBERG MINING CO.—THE HOMESTAKE'S NEW HOIST.—HIDDEN FORTUNE AND TROJAN.

In the summer of 1913 the Deadwood Business Club thought that by developing some promising mining prospect a stimulus might be given to the general mining conditions of the district. After considerable investigation on the part of a special committee appointed for the purpose, it was decided to do the first work on the Heidelberg property, in the Two Bit district. The owners offered an attractive proposition, namely, to give a one-half interest for $5000, with the agreement that the money be spent in development. Work was undertaken in August, 50 citizens of Deadwood each agreeing to contribute $100 in 10 monthly payments of $10 each. Administration of the funds and development was turned over to five trustees, two representing the owners, two representing the subscribers and these four selecting the fifth member. Payments on subscription commenced August 23, and the final payment was collected on May 23, last. During the 10 months' operations, 380 ft. of development was done in new ground, besides enlarging and timbering in a substantial manner the main adit following the ore-shoot. In the course of the work there was removed, sorted and shipped 46 tons, dry weight, of ore which netted above treatment and transportation costs, $371. In addition a quantity of ore of milling grade was piled on the dumps. Since this time (May 23) about 70 tons additional has been shipped, a large proportion of which was in the bins at that time. The ore is a typical refractory silicious material, similar to that mined in the Bald Mountain district, occurring in the upper Cambrian shales. The ore is principally sand shale enriched from a silicious 'vertical.' This vertical, which is an average of 1 ft. in width, has a course of north 25° east. The sand shale is enriched on either side of it for a distance

of 1, 2, and 3 ft. It is 1 to 3 ft. thick and above and below it is lime shale, carrying small gold content. Development along the vertical discloses its continuity for over 300 ft. Should this vertical be found to extend downward to the basal Cambrian quartzite, it is quite probable, judging from experience in other districts, that a considerable body of ore may be found.

To provide further funds for the exploration of the ore-body, a corporation with a capitalization of 500,000 shares of a par value of 25c. each has been organized. Of the capital one-half, or 250,000 shares, was issued in payment for the property, and the balance placed in the treasury. Of the property purchase stock, one-half, or 125,000 shares, was issued to the original owners, and the other 125,000 shares equally divided among the subscribers to the development fund, so that each man who paid in $100 will receive 2500 shares of stock. Officers of the Heidelberg Mining Co., the name selected for the corporation, are: Geo. V. Ayres, president; John Treber, vice-president; J. Goldberg, treasurer; and W. L. Treber, secretary. The directors are: N. E. Franklin, president First National Bank; D. A. McPherson, cashier First National Bank; Geo. V. Ayres, hardware merchant; J. Goldberg, grocer; N. J. Thompsen, lumber dealer; A. T. Roos, superintendent of property, and John Treber, wholesaler.

For several weeks, steel for the new hoist house and headframe at the B. & M. shaft of the Homestake company, has been arriving, and shortly the first consignment of machinery is expected to be delivered. Foundation work is well in hand. It is of massive construction, in some places the cement, reinforced with railroad iron bolted into the solid rock, steel cables and other steel materials, will be over 20 ft. thick. The new hoisting engine is of the compound-condensing type, built by the Nordberg firm, and is one of the largest hoisting engines ever constructed. The machine, after its completion, was erected in the Nordberg shops, and has been dismantled for shipment to Lead. It is equipped with two clutched reels to carry flat rope 5¼ by 7 in. It is designed to handle 12,000 lb. of ore from a depth of 3200 ft., using skips in balance. It has a gross weight of over 1,000,000 lb., and will require 24 freight cars to deliver it in Lead. Steam to operate it will be secured from a boiler plant close to the C. & N. W. tracks. This plant will also furnish steam for an electric generating station. Foundation work on the boiler plant is progressing rapidly, and it is planned to have the new hoist in full operation by the end of the present year.

By the purchase of the Hidden Fortune 40-stamp mill, the Golden Reward company will be enabled to increase its milling capacity to 400 tons per day. The purchase was made from the Homestake Mining Co., which came into possession of the mill a year ago, when it took over the Hidden Fortune property. The Homestake removed some equipment from the plant, but the bulk of it passes to the Golden Reward. In the mill was installed a full complement of cyanide tanks, piping, crushers, and considerable miscellaneous material. The building was well constructed, and contains a large amount of lumber which will be used. The Golden Reward company has already started to remove the plant to its millsite in Deadwood. With this addition to the capacity of its milling facilities, the Golden Reward will rank next to the Homestake as a gold producer in the Black Hills. Numerous improvements in the plant are under way, including a tube-mill, Trent replacing tank, classifiers, etc., so that even better work will be done in the future.

At the Trojan a small streak of sylvanite ore was recently discovered that gave high assays in gold. Roasted specimens were as fine as the best Cripple Creek ever produced. The Company's mill is steadily operating on a good grade of material, and shipments are regularly going forward to smelters. The Company is in an excellent position financially. It is a close corporation, and does not publish statements of its earnings, but they are known to be good.

JOHANNESBURG, TRANSVAAL

BARNATO, ALBU, AND CONSOLIDATED MINES SELECTION GROUPS OF MINES.—THE FAR EAST RAND.—DIAMOND MINING IN SOUTH AFRICA.

The feature of the first week in June here has been the large number of company meetings held. The companies controlled by the house of Barnato were particularly prominent, as this is the only group able to report substantial progress during the year. The reason for this may be found in the fact that until a few years ago this was the most backward of any mining group on the Rand, its properties were becoming almost derelict and the most antiquated in equipment. A few years ago, a change in the policy of this group was made, the Modderfontein Government Areas were secured, the Langlaagte properties were taken in hand, and some attempt made to bring the other mines more up to the mining practice of the Rand. The result now is that after the Eckstein group, the Barnato is one of the leading mining concerns on the Rand, and with the exception of their oldest mines, can compare in a satisfactory manner with those of any other group. There is, for instance, the Van Ryn Deep mine, which made a working profit of £105,022 during 1913, the working costs averaging practically $4.80 per ton. Much better results may be looked for during the current year, as working costs are declining and the gold recovery likely to go up to $8.40 per ton. Nearly 2,000,000 tons of profitable ore is developed in the mine, giving an average value by assay of $8.68 per ton. The Consolidated Langlaagte is another Barnato mine, which during the year has done exceptionally well. Working costs have been reduced 24c. per ton, while the profitable ore reserves are estimated at 2,194,408 tons worth $7.40 per ton. Like the Van Ryn Deep, this is another Barnato mine likely to yield even better results this year. The Government Gold Mining Areas at Modderfontein are also improving in the matter of development, ore reserves at present being about 1,250,000 tons averaging $6.35 per ton. It is to these three mines that the Barnato house is looking for most of the improvement in the immediate future, and no doubt they will more than make up for any marked decline the older mines of the group will show for some time to come.

The Albu group of mining companies also held their annual meetings during the week. The most promising of these is the Meyer & Charlton, which at the present time has the highest recovery value of any mine on the Rand, while working costs are being reduced. Several of the mines in this group continue somewhat under a cloud, notably Cinderella Consolidated, New Goch, and the Rand Collieries, and it looks as though some time will elapse before the necessary capital will be obtained for such undertakings as Cinderella Consolidated, Steyn Estates, and West Rand Consolidated.

The Consolidated Mines Selection group has also held meetings during the week, without, however, having anything particularly cheerful to report. Brakpan, the principal mine of the group, did worse than usual during the year, development assays falling away considerably; but during the first few months of the year quite one-half of the ore developed has proved unprofitable. The Springs mine seems to be opening fairly well, but the ore here is somewhat erratic. A fair proportion of the ore developed proved unprofitable, but there seems every probability of the mine falling little short of the Brakpan, underground conditions being somewhat similar on both properties. The Springs mine is situated nearly in the centre of the Far East part of the Rand, which is expected to do much to restore its prosperity, and to enable the Rand to again report progressive gold outputs. When, however, the Daggafontein, sinking about six miles farther east, reaches the 'reef', about the end of the year, the true value and prospects of the Far East Rand will be better known.

Diamond mining in South Africa has recently suffered financially from the evils of over production, especially since the discovery of diamonds in German Southwest Africa. At one time the diamond mines at Kimberley had practically the whole of the world's diamond markets at their mercy, but recent discoveries of diamond mines in other parts of South

MAP SHOWING DISTRIBUTION OF DIAMONDS IN SOUTH AFRICA.

Africa have put quite a different complexion on the diamond mining industry. The Transvaal, with its Premier mine near Pretoria, can now boast of possessing one of the largest and most important diamond producers in the world, while the increasing production of alluvial diamonds in Africa has somewhat complicated the markets. So great has the diamond production of Africa become, that a conference was to be held in London during June, as mentioned in this journal of June 6. During May, Rand mines treated 2,196,287 tons of ore averaging $6.30 per ton, the lowest average in the last twelve months. Working costs were $4.08 per ton, which was equalled in January, 1910. Total profit for the month of May was £1,011,968.

JOPLIN, MISSOURI

STATE AND NATIONAL GEOLOGISTS CO-OPERATE IN EXPERIMENTAL WORK.—MINING ORES FROM SURFACE DOWN.—NOTES ON THE DISTRICT'S MINES.

H. A. Buehler, state geologist of Missouri, C. A. Wright, connected with the U. S. Bureau of Mines, and other geologists and mining engineers who are connected with both the state and federal departments of mining and geology, have established headquarters in Joplin, and a campaign of experimental work which will cover many months is being planned. Flotation processes will be tried out, this feature of the work being considered of much importance in view of the fact that the recovery of zincblende has never been what would be considered thorough, and therefore anything that will tend to bring about a more perfect recovery will be heralded as a great boon to the local industry. The study of the geology of the district, the character of the ores, the details of mining and milling, will be given due consideration, and interesting reports on the work thus undertaken will be looked for with much enthusiasm by local operators and others interested in the district. The oil flotation process has been tried at only one place in the district, namely, at the property of the Underwriters Land Co., west of Joplin, where a small plant is being operated by Hays & Co. The result of the experiment is being kept secret. Sludge from the Priscilla mine of the Underwriters company is being handled.

Modern pumping equipment is succeeding in draining the Lone Elm bottoms, in the northwest part of Joplin, where old types of pumps failed, and as a result operators are now getting into ground that has been under water for many years, and are even going far below the old levels worked. Also, some shallow development of importance is being conducted, work at one or two points being done from the surface down in the form of strip pits. This shallow work is being done where the ore is found within four or five feet of the surface. Plans for the construction of a mill to handle the shallow ore, and also to do custom milling from other mines on the lease, are being completed. The lease is held by the Lone Elm Development Co. and includes 330 acres of the Picher Lead Co.'s land and property of the Granby Mining & Smelting Co. About twenty small operators are at work. Two large pumping plants are maintained, the ground being drained to a depth of 120 feet.

Missouri will have a mines and mineral exhibit at the Panama-Pacific Exposition which will cost between $6000 and $7000, and detailed plans for the arrangement of the various displays have been completed by Otto Ruhl, of Joplin, and forwarded to John L. McNutt, of Aurora, chairman of the state commission having the Missouri exhibit in charge. A floor space of 50 by 100 ft. has been allotted for the Missouri display, and this will be used in a manner which will bring forth the mining industry of this state in an attractive manner. By a series of progressive displays, the visitor will see the prospecting, mining, milling, and smelting methods from the time the churn-drill begins to operate until the finished metal is produced. A complete concentrating plant of 25-ton daily capacity will be in steady operation. Concentrate will be produced from this mill just as it is from the larger plants of this district. The exhibit will also take in the disseminated lead industry of the southeastern part of the state, and the iron, copper, and coal mining of different portions of the state.

The Pocahontas Lead & Zinc Co.'s mill in the Thoms Station district, once a heavy producer, has been converted into a tailing mill by Bendelari & Funk; tables have been installed and various changes made in the equipment of the mill by which the plant will be in shape to handle the tailing. The shafts of the Company's mine are still sealed, although it is more than likely that the disastrous fire which broke out in the heavily timbered portions of the ground has long since subsided. It is said this famous old producer may not be reopened, as the land-owner, Miss Margaret Murphy, has refused to permit the pillars of the mine to be withdrawn. The pillars are rich in ore. This mine, in barely two years' operation, is reported to have netted Miss Murphy nearly $85,000 in royalties. She received a royalty of 10% of ore sales.

Improvements at the Wingfield mine, on a 50-acre lease of the Bowman, Scott & Ware land, north of Webb City, will mean increased production from this property, which already is handling 1000 tons of ore per day and which ranks as one of the heaviest producers of blende concentrate in the district. The mine is operated by Charles T. Orr and associates. The same company operates the Bertha A. mine, on the adjoining property owned by the Newell-Morse company. An old shaft at the Bertha A is being placed in commission again, and the output from this mine also will be increased.

At the beginning of July, zinc blende was weak at $37 to $40 per ton, basis of 60% metallic zinc, compared with $41 to $44 basis for the corresponding period of 1913. Calamine is strong at $22 to $23 per ton, basis of 40% metallic zinc, or about $1 stronger than for the corresponding week of 1913. Lead ore is dull at $46, basis of 80% metallic lead, compared with $52.50 for the corresponding week of 1913.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ARIZONA

Cochise County

Various mine contests were held at Bisbee on July 4, with the following results: Nipper drilling contest: first prize of $250 won by Robert Lyons, Andy Hooks, and Harry Lyons, who drilled 49 in. in 15 min., followed by Lawrence Ligon, Louis Oites, and Mitchell Bogice, winning the second prize of $125 with 32 in. This team had trouble with their steel breaking and lost considerable time. In the stope machine-drilling contest the first prize of $75 was won by Albert Peterson, who drilled 72⅞ in. The second prize of $50 was won by A. D. Fenwick, drilling 72⅜ in. In the timbering contest the first prize of $100 was won by Johnson and Butbrae in 13 min., 57 sec.; also most points for having set level, plumb, and square, also for placing blocks and wedges. The second prize of $50 was won by Jacobson and Martin in 17 min., 40 sec.; also second best on points. There were four entries. In the first-aid contest the first prize of $75 was won by the Czar team, Pat Nanna, captain. The second prize of $40 was won by the Gardner team, Francis Webster, captain. There were three entries. There was a difference of only one point between these teams and the judges had considerable trouble in reaching a decision. In the mine-rescue contest the first prize of $75 was won by the Calumet & Arizona team, Walter Haile, captain, and the second prize of $40 by the Copper Queen team, Thomas Stetson, captain.

Gila County

(Special Correspondence.)—Underground work at the Miami mine in June totaled 2910 ft., while 106,312 tons of ore was milled.——Lining of the Inspiration main shaft is the most important work at the mine. Underground bins have yet to be cut out. That at 600 ft. will have a capacity of 3000 tons.——Slag foundations are being poured for two of the reverberatory furnaces of the International company. Concrete amounting to 400 cu. yd. is being poured for the blowing engines' foundation.——Work on the Magma concentrator at Superior is well ahead. Electric power from Roosevelt has been available for some time. It is probable that a long aerial tram will be constructed from the mine to the smelter being erected at Miami.

Miami, July 10.

Competitive tests are being made at the Inspiration between Minerals Separation and Callow flotation plants. Results have not been made public. A. M. Cobb has been elected the first mayor of Miami.——The new Aldrich electric pump is working at 1800 ft. in the Old Dominion mine. This and the Arizona Commercial mine are to be connected on the 1200-ft. level. The basic converter has been at work for a year without relining, producing 32,000,000 lb. of copper.

Mohave County

During June the Tom Reed 20-stamp mill and cyanide plant produced gold worth $106,000. Rich ore is being mined from the 500-ft. level of the mine.——Good ore is being opened at 400 ft. in the Nevada-Arizona mine.——A mill is being erected at the old Fay mine.——The Schuylkill mine has been leased to California and Oregon men.

CALIFORNIA

The State Mining Bureau has distributed copies of *Bulletin* No. 67, 'Minerals of California,' by Arthur S. Eakle, consisting of 226 pages and an index. This work is just off the press, and should be in the hands of all California mining men. A list in 1866 included 75 minerals, another in 1884 included about 150, while the present work includes over 300, with many sub-species and varieties. A bibliography on California minerals is included. The book is divided into the following chapters: Native Elements; Sulphides, Arsenides, Selenides, Tellurides, and Sulpho-salts; Haloids; Oxides of Hydrogen, Silicon, and Semi-metals; Oxides of the Metals; Carbonates; Anhydrous Silicates; Hydrous Silicates and Titano-Silicates; Phosphates, Vanadates, etc.; and Sulphates and Hydrocarbons. Chapter XII covers minerals arranged according to the elements, and mineral distribution by counties. With *Bulletin* 585, 'Useful Minerals of the United States,' recently published by the U. S. Geological Survey, mining men have two very useful books.

The report of the statistician of the Industrial Accident Commission of the State of California for the first six months of 1914 has just been published. It shows some startling figures relative to the heavy toll of industry in terms of human lives and bodily injuries. A total of over 26,000 accidents has been reported to the Commission during the half-year ended July 30. Of these, 25,475 resulted in temporary disability, approximately 600 caused permanent disability, while 223 resulted in death. During June alone over 7500 accidents were reported, 10 of which were death cases, while 184 caused permanent disability.

Nevada County

The Red Ledge mine has been bonded to a New York syndicate, headed by W. F. Meeks, for about $150,000.

San Bernardino County

Sixteen suits by Colton orange-growers against the California Portland Cement Co. have been settled for $116,831. By agreement, the Company purchased 135 acres of land adjoining its property for $92,450, an average of $685 per acre. This will permanently end all suits. The Company's plant has a capacity of 5000 bbl. of cement per day, and it is proposed to increase this to 9000 bbl. at an expenditure of $1,000,000.

Sierra County

There are 35 men working at the Croesus or Plumbago mine, and high-grade ore is being extracted.——The Independence shaft is down about 300 ft.——Some good shoots of ore have been opened in the Kate Hardy mine.——Work is to be started by M. W. Davis and associates on two placer locations on Oregon creek. A gravel channel is capped by lava, but good yields are expected.

Tuolumne County

A prize of $200 for drilling at Sonora was won by W. Pedro and Fred Marcus, who put in a hole 37 in. in 15 minutes, followed by J. Page and F. Bartlett with 34⅞ in; J. and T. Lumsden with 32⅛ in., and G. Zackovich and J. Burbank with 31 inches.

COLORADO

Clear Creek County

A large station has been cut at the 860-ft. point in the main raise of the Capital mine. A good deal of water is flowing from this ground. An adit has been driven 610 ft. to meet this raise. Lessees are busy in the various sections of the mine. The Westinghouse mine locomotive, working in the main adit, gives no trouble.——Eighteen inches of

lead-copper ore has been opened in the Onondaga mine. —— Retimbering is being done in the Colorado Central. —— Ore has been shipped from the Santiago. —— The Sutton Steele & Steele dry concentration process may be installed in the Linn mill by C. E. Pugh. —— Denver people are said to be trying to jump the Ramsdale claims on Bard creek.

SAN JUAN COUNTY

The Buffalo Boy mine at Silverton is again being sampled. —— Lessees at the Ledge mine are preparing to unwater the workings. —— Under foreclosure proceedings, the Gold Prince

IN THE SILVERTON DISTRICT, COLORADO.

mine, mill, and tramway were recently sold to the Federal Trust Co. of Boston.——The San Antonio Mining Co. is being reorganized.——Twenty men are working at the Hamlet mine. ——Mines in the district produced 420 tons of smelting ore and 18,720 tons of concentrate during June.

TELLER COUNTY (CRIPPLE CREEK)

Twelve men are laying track, cutting a ditch, and doing other preparatory work at the Roosevelt drainage tunnel. Connection was made from the heading of the tunnel, 2600 ft. beyond the El Paso company's main shaft. The air was fair.——Trouble on the Short Line from Cripple Creek to Colorado Springs is hampering ore shipments.——The Last Dollar mine is again being operated.——Rain interfered with July 4 sports to some extent. In the drilling contest, Carroll and Gay carried off the first prize of $100, in double-hand work, drilling a hole 32 in. deep in Gunnison granite in the alloted time of 15 minutes. Hart and Adams, who drilled first, received second prize, drilling 27⅜ in., while Lund and Gustafson were third with 25 in. In the single-hand drilling contest John P. Hinds carried off first prize of $50, drilling 16⅛ in., William Fabry was second with 12½ in., and F. C. O'Neal was third, only putting his hole down 8 inches.

IDAHO

SHOSHONE COUNTY

Drilling contests at Wallace on July 4 resulted as follows: Four teams drilled, and St. Germain and Rossman of the Eugene R. Day ranch at Osburn won with 44 in. Morrison and Walters of the Lancaster mine were second with 42 in. Stokes brothers of Osburn third with 30½ in. and Porter and Kinzella, of Butte, fourth with 29⅝ in. —— At Wardner the contest was won by St. Germain and Rossman, who defeated five other teams, drilling 37⅝ in. in 15 minutes. The second prize of $100 was carried off by Morrison and Walters of Wallace, while Spridell and Furze took third place. The mucking contest was won by Herman and Johanson, and the log-sawing contest was won by Jess Dragon and Charles Anderson of the North Fork.

MICHIGAN

HOUGHTON COUNTY

The cost of maintaining the militia in the copper country during the strike last winter amounted to $405,000, it was announced on July 10.

MONTANA

About thirty mining districts in southwestern Montana are described in a report just issued by the U. S. Geological Survey as *Bulletin* 574, 'The Mining Districts of the Dillon Quadrangle, Montana, and Adjacent Areas,' by A. N. Winchell. The area described was of great importance in the early development of Montana, for it was the discovery of gold in the streams of this region that led to the influx of population and the eventual settlement of the state. The Dillon quadrangle comprises about 3200 square miles; the Butte copper-mining district is immediately north of it, and indeed two of the Butte smelters are within it. The projected Butte, Wisdom & Pacific railroad, upon which construction is soon to commence, will tap certain of the districts described in Mr. Winchell's report, notably the Elkhorn and Vipond districts in Beaverhead county.

The metalliferous mineral resources of the Dillon quadrangle and adjacent areas include gold, silver, copper, and lead, and smaller quantities of zinc, iron, manganese, and tungsten, and their distribution, mode of occurrence, geologic features, and origin are discussed in Mr. Winchell's report. The metallic ore deposits of the region occur in about thirty more or less well defined districts, and these are described individually. The report forecasts the future of the mining industry in the region, suggesting the probability that placer deposits were not destroyed but simply buried by the flows of basalt. If they are not too deeply covered by volcanic ash and lava flows, it is possible that they may in the future supply the material for extensive mining operations.

NEVADA

According to F. M. Manson, general manager of the Western Ore Purchasing Co., mining conditions throughout Nevada are exceptionally good, and greater activity is looked for. The Goldfield district leads others in ore shipments to the Company's plants. The Seven Troughs district is developing well. When the Nevada Short Line, or Codd railway, to Rochester is finished, large shipments should be made from that district. The Bullion, Haystack, and Pine Creek districts are quite promising.

The itinerary of Bureau of Mines Billings mine-rescue car No. 5 is as follows: July 13 to 18, Goldfield Consolidated, Jumbo Extension, and Florence mines; July 20 to 25, Tonopah Mining, Montana Tonopah, Belmont, West End, Tonopah Extension, and North Star mines; July 27 to August 1, Round Mountain mine; August 3 to 8, Pittsburg Silver Peak mine at Blair; August 10 to 15, Nevada Wonder mine at Wonder; August 17 to 22, Nevada Hills mine at Fairview; and August 24 to 29, demonstrations to university mining students and railway employees at Reno and Sparks.

ESMERALDA COUNTY

Great interest was shown in the double and single-handed

rock drilling contests held at Goldfield on July 4. In the doubles, Schram and Olson won first prize ($600), drilling 56⅞ in.; McCann and Collins, second ($200), 56⅞ in.; Impola and Hokken, third (two suits of clothes), 54⅛ in. In the single handed contests, Paul Malli won first prize ($150), drilling 33½ in.; Pete Vanola, second ($50), 30½ in.; and Steven Mitrovitch, third (one suit of clothes), 28⅝ inches.

HUMBOLDT COUNTY

(Special Correspondence.)—Directors of the Rochester Mines Co. have extended leases of the Rochester Hills Mining Co. and Big Four Mining Co. one year, to December 7, 1915. The Four J's Mining Co., which adjoins the Rochester Hills, expires in July 1915. The Rochester Hills has cut a new vein in the Cawsten adit level, a vertical depth of 400 ft., which is believed to be the 'back vein' and has never been developed. The depth on the dip of the vein is 520 ft. The discovery was made in a cross-cut 40 ft. east of the shaft, where the vein is reported by the management to be 12 ft. wide. Five feet is worth $24 to $32 per ton, the balance of the vein being good milling ore.——A. A. Codd, president of the Nevada Short Line railroad, which is being constructed up Rochester cañon to the mine, states that track-laying will commence July 20, and that the road will be completed to the town of Rochester by Labor Day, when a big celebration is planned.——It is said that John F. Cowan, president and manager of the Rochester Mines Co., has financed a custom mill for Rochester ores, which may be built at Nenzel, the terminus of the Nevada Short Line on the Southern Pacific, where a reliable supply of water may be had. A Nevada syndicate, which is said to have secured power rights of the Lahontan dam from the U. S. Reclamation Service, is endeavoring to secure a contract to furnish electric power for the proposed plant.——The Rochester Hills and Big Four leases continue to ship 75 tons of ore per day. The Nevada Packard is shipping three to four cars per month, with an occasional car from other leases in the district. A feeling of optimism pervades the camp.

Rochester, July 9.

In June there was 1400 tons of ore worth $35,000 shipped from Rochester. The average value of ore produced in 18 months was about $25 per ton.

LINCOLN COUNTY

On account of the success of the chlorination process at Park City, Utah, a local syndicate is planning to use the process to treat the low-grade lead-silver-zinc ores of Pioche. Old dumps contain a good deal of lead-silver-gold ore.

NYE COUNTY

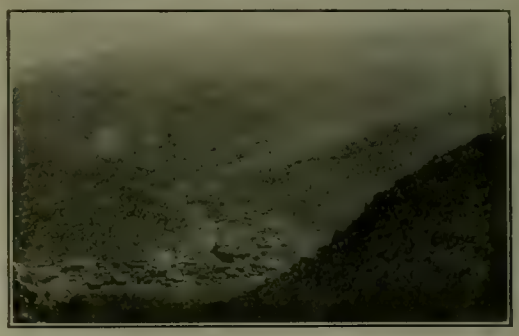
An excellent brochure, 'Tonopah: Past, Present, and Future,' has been published by Charles A. Stoneham & Co. of New York. It consists of 16 pages with good illustrations of mines and mills, and also claim maps in silver tint. The history of the camp is described, and all necessary details are given to enable mining men to understand the properties being developed and producing silver.——During the week ended July 4, the mines produced 9252 tons of ore worth $254,620. In the quarter ended May 31, 1914, the Belmont company's revenue was $829,962, of which $454,351 was profit. The available resources amount to $1,447,761. The West End Consolidated Co. has filed an answer to the Jim Butler Tonopah Mining Co. in the latter's suit concerning wrongful extraction of ore. During May the Extension made a profit of $19,090. There have been labor troubles during the past week at Tonopah, and it appears that the I. W. W. is about to make itself a nuisance as elsewhere of late. Extensive development is being started at the Jim Butler claims. The Montana mill is treating 150 tons per day.

STOREY COUNTY

The U. S. Bureau of Mines rescue car No. 5 arrived at Virginia City from Ely on July 6, in charge of E. Steidle and G. W. Riggs. On July 8 and 9 there was instruction on the 1000 and 2500-ft. levels of the C. & C. shaft with oxygen helmets, also in injuries of all kinds. As a result of this visit, two efficient teams have been developed here. The car left for Goldfield on July 11.

WHITE PINE COUNTY

A mine-rescue and first-aid contest was held at Ely on July 4 under the joint auspices of the American Red Cross and the U. S. Bureau of Mines. The rescue contest of $50 was won by a team from the Nevada Consolidated company's Veteran mine, captain J. C. Metcalf, with H. P. Carten, E. L. Vetter, W. J. Murphy, and Patrick Friel. The problem used in this event was as follows: Fire in miniature mine. Rescue team explores imaginary smoke area, rescuing miner overcome by gas and smoke; every safety precaution as practised by the U. S. Bureau of Mines being observed. In the first-aid contest of $75, the Copper Flat team won, captain C. H. Kay, with A. P. Buffington, R. F. Workman, W. R. Workman, and John Minnock. There were also Greek and Japanese teams from McGill, who were trained in army tactics in their respective countries. The Japanese team is probably the only Japanese first-aid team in America. Problems



ELY, NEVADA.

used in the drill were as follows. One-man events: (1) Miner loading round of holes; puts off shot; he is overcome by powder smoke; rescue patient and restore breathing; burned about face and chin. (2) Man found under fall of roof, suffering from following injuries: fracture of sixth, seventh, and eighth ribs on left side, fracture of left kneecap. (3) Miner starting hole with piston drill; helper struck in left eye by flying chips; cut eye, severe bleeding; falls back, spraining left wrist. (4) Man working in smelter severely burned on right side and right forearm by explosion of matte pot. (5) Brakeman on slag train slips on rail, engine runs over left leg, cutting it off 4 in. above knee; man severely shocked. (6) Demonstrate four methods of one-man carry, including assistance to walk. In the two-man events were to be shown three methods of two-man carry.

According to *Safety First*, the Nevada Consolidated company's monthly bulletin, there were no accidents at either the Veteran mine or concentrator, but at Copper Flat there were 15 disabling accidents. The large concrete central hospital at East Ely is described and illustrated in this bulletin.

OREGON

JACKSON COUNTY

(Special Correspondence.)—The Purkeypile mine, in the Gold Hill district, has been bonded by southern Oregon men. A stamp-mill and other equipment has been ordered from San Francisco. The mine's output to date is over $75,000. Gold Hill mines are fairly active, judging by gold receipts at the local bank.

Gold Hill, July 10.

UTAH

Beaver County

Sixty tons of gold ore, averaging $1000 per ton, is being mined from No. 1 and 2 levels of the Sheep Rock mine in the Newton district. The Beaver Gold Mines Corporation owns this property and a number of claims adjoining.

Juab County

First-class ore amounting to 3656 cars or 182,800 tons and worth $4,570,000, was shipped from the Tintic district during the first half of 1914. The shippers were as follows in carloads: Centennial-Eureka, 632; Mammoth, 605; Chief Consolidated, 186; Iron Blossom, 162; Eagle & Blue Bell, 325; Grand Central, 289; Gemini, 286; Victoria, 119; Gold Chain, 89; Beck Tunnel, 56; May Day, 55; Colorado, 49; Bullion Beck, 29; Dragon Consolidated, 28; Uncle Sam, 26; Scranton, 25; Opohonga, 15; Sharp, 11; Lower Mammoth, 8; Godiva, 9; Carisa lease, 12; Eureka Hill, 3; Yankee, 5; Tintic Standard, 1; Swansea Consolidated, 1; United Ore Sampler, 2; United Tintic, 4; Black Jack, 5; Ridge & Valley, 2; Victor lease, 3; Salvador lease, 1; E. L. Davis lease, 1; Leaver lease, 1; East Tintic Development, 2; Cliff, 1; Sunbeam, 3; Minnie Moore, 4; Showers, 4; and Tesora, 1 car.

Small shoots of rich gold-silver-copper ore are found at 700, 800, and 900 ft. in the Grand Central mine, and two cars of this ore are shipped each month. About 100 tons in June returned the Company $10,000.——Electric equipment is being installed in the Gold Chain mine.

WASHINGTON

Okanogan County

(Special Correspondence.)—Two stamp-mills are now working in the Similkameen part of this county, both under the management of the United Mines, of which J. L. Harper is the leading man. At the Owasco are 10 stamps and Wilfley tables, and a ball-mill is being added to increase the mills' capacity to 60 tons per day. Concentrate sent to the Greenwood smelter assayed $90 per ton. The mill at Night Hawk has 20 stamps and four Wilfley tables, treating ore from the Caaba mine.

Nighthawk, June 20.

WYOMING

The total value of gold, silver, and copper in this state in 1913 was $84,474, an increase of $57,527 over that of 1912, according to the U. S. Geological Survey. There were 15 producing mines, of which six were deep and nine were placer. Silicious ore amounted to 3272 tons, and copper ore 964 tons. The yields were 1170 oz. gold, 957 oz. silver, and 385,239 lb. copper. Placer mines produced $1407. Four deep mines and three placer mines in the Atlantic City district of Fremont county produced $23,276 gold and 115 oz. silver. In Platte county, the Sunrise mine shipped a good tonnage of silver-bearing copper ore; and several cars of copper ore from the Green Hope mine. Wyoming has produced since 1867, $1,191,178 gold, 58,680 oz. silver, and 26,383,318 lb. copper, with a total value of $5,378,908.

CANADA

Alberta

(Special Correspondence.)—There have been several reports of oil and gas finds in the Calgary district, but most of them are unfounded. The Monarch well had a few 'drops' of oil. It is down 400 ft. below that point, with no further development. Work is being done at the Lady Betty well. There are several small anticlines between this place and the United States boundary line which are worth a test, but in the 4500 square miles examined by four engineers, there is no large field of value along the Rocky Mountain front.

Calgary, July 4.

The Limehan area near Oil City has been purchased by a Calgary syndicate for $1,000,000 cash. The oil excitement continues, and there are five exchanges open in Calgary.

British Columbia

Zinc ore production of Kootenai and Boundary mines in June was 655 tons against 301 tons in June 1913. This ore goes to the United States. The Lucky Jim produced no ore last month, while the Rambler-Cariboo, Van Roi, and Standard shipped 82, 32, and 541 tons, respectively.

A good deal of work is being done in the Rocher de Boule district, according to *The Chalcopyrite* of Skeena Crossing. The Montana Continental Development Co., and the Hudson Bay Mining Co. have extensive developments planned and under way. An aerial tram is nearly completed by the former concern. A long shoot of ore has been exposed by trenching at the Fiddle Creek claims owned by Lew Knauss. An adit has opened gold-silver-lead-copper ore worth $39.60, the gold content being about $28 per ton. A 45-ft. adit driven in the Brunswick claims, has opened chalcopyrite, containing silver. Good specimens of bornite were recently brought in from Driftwood river.

A new copper furnace has been blown-in at the Trail smelter, making a total of four for the copper-gold ore of the Rossland district. The tonnage now required from the mines is about 1000 per day, against 600 to 700 tons formerly. In June, the Rossland mines produced 22,811 tons of ore.

Ontario

Mineral returns published by the Bureau of Mines for the first quarter of 1914 are as follows:

	Quantity.	1914.	1913.
Gold, fine ounces	61,032	$1,202,502	$1,030,910
Silver, ounces	6,519,860	3,549,556	4,040,450
Copper, tons	4,135	591,988	436,328
Nickel, tons	6,641	1,446,012	1,309,870
Iron ore, tons	4,536	12,928	25,695
Pig iron, tons	184,086	2,503,450	2,506,175
Cobalt, tons	33	8,898	.....
Cobalt and nickel oxides	248,001	168,965	120,500
Total	.....	$9,484,299	$9,469,938

Silver production of Cobalt showed a decrease of 680,198 ounces.

The Buffalo mill treated 6307 tons of ore in May, averaging 18.66 oz. silver per ton. There was 93,326 oz. recovered, and 173,747 oz. was paid for during the month.

Draining Cobalt lake will not commence until October, when all preliminary work will be finished. In five weeks or so further excavation will be made to lower the water about 6½ ft. The pumps and motors are now on the site.—— The mill at the Temiskaming and Hudson Bay mine has been shut down. The mine became a steady producer in 1907. Dividends paid since 1905 amounted to $1,940,250, equal to 25,000% on the capital of 7460 shares.——At 100 ft. in the Cochrane mine, 3 to 5 in. of 2000-oz. ore has been opened. A 10-ft. raise is still in ore.——Development in slate at No. 4, and in conglomerate at No. 5 level of the Penn-Canadian has opened good ore.——The Dome mill treated 16,180 tons of ore yielding $62,109 in May.——The Nipissing high and low-grade mills treated 202 and 6672 tons of ore respectively in June, and the refinery shipped 619,316 oz. silver. No. 64 vein was cut at 900 ft., where it is from 4 to 7 ft. wide, but low grade.

MEXICO

Sonora

A Mexican pumpman, working at the Sierra de Cobre mine, near Cananea, was stabbed to death last week. The whole camp is now idle, only pumps at the Capote mine being at work. Colonel Calles is in command of about 800 troops.

PERSONAL

PHILIP ARGALL was in the San Juan this week.

J. W. GREGORY has gone to Australia and China.

CHARLES JANIN is expected in New York July 20.

A. S. HOWE has returned from Arizona and gone to New York.

R. E. CRANSTON has gone to Cripple Creek from New York on professional business.

WALTER N. VANCE has resigned as topographer in the United States Geological Survey.

FREDERICK G. COTTRELL has been appointed chief chemist of the United States Bureau of Mines.

E. N. BARBOT DE MARNY, of St. Petersburg, Russia, was in San Francisco on his way to Alaska.

J. D. HUBBARD, SEELEY W. MUDD, and W. Y. WESTERVELT were among San Francisco visitors Wednesday.

E. K. SOPER has returned to Minneapolis from northern Manitoba, where he has been making examinations.

COLIN FRASER, formerly on the staff of the geological survey of New Zealand, is inspecting the Mt. Morgan mine, Queensland.

J. O. HUDSON, senior inspector of mines at Kalgoorlie, Western Australia, has been appointed chief inspector of mines for Tasmania.

H. M. KINGSBURY has left the Conrey Placer Mining Co., at Ruby, Montana, to accept a position with the Kyshtim Corporation at its mines in Russia. Mr. Kingsbury left New York for London July 7.

WARREN D. SMITH has resigned as chief of the division of mines, Bureau of Science, Manila, P. I., to become head of the geological department, University of Oregon. Mr. Smith will spend the summer at Madison, Wisconsin.

GEORGE B. CHURCH has resigned his position as head of the engineering department for the Goldfield Consolidated Mines Co., after a service of more than seven years, and has accepted a similar position with the Dome Mines Company.

D. C. JACKLING returned to Salt Lake City on July 12 from Juneau and a brief stay at Butte. Mr. Jackling will be in Salt Lake City for two weeks and will then go to Chicago and again to Alaska and back to Salt Lake City by the end of August.

W. L. SAUNDERS, A. R. LEDOUX, GEORGE F. KUNZ, JOHN HAYS HAMMOND, J. F. KEMP, W. R. INGALLS, B. B. LAWRENCE, BRADLEY STOUGHTON, and E. GYBBON SPILSBURY joined in giving a luncheon at the Downtown Club in New York, July 2, to C. F. RAND, in recognition of the presentation to him of the Order of Isabella by the King of Spain.

In the Department of Geology of Northwestern University, the following appointments have been made, to take effect on September 1, 1914: JOSEPH E. POGUE, of the United States Geological Survey, to be associate professor of geology and mineralogy; WILLIAM H. HAAS, of the University of Chicago, to be instructor in geology and geography; HENRY R. ALDRICH, of the Massachusetts Institute of Technology, to be instructor in mining and metallurgy; and JOHN R. BALL, of Northwestern University, to be assistant in geology.

THE U. S. Civil Service Commission announces an open competitive examination for assistant engineer of mine tests. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in this position in the Bureau of Mines, at Pittsburgh, Pennsylvania, at a salary ranging from $1800 to $2400 per year. An educational training equivalent to that required for the degree of bachelor of mining engineering from a college or university of recognized standing; at least three years' subsequent experience in testing structural materials and in computations; and two years' field work in mining, since graduation from college, are prerequisites for consideration for this position.

GEORGE D. WHITCOMB, president of the mining machinery firm that carried his name, and who died at Glendora, California, two weeks ago, was one of the pioneers in his line. He began in the coal mines, and, being of an inventive turn of mind, developed the Whitcomb pick mining machine. This led him into manufacturing, first of the pick machine itself, and later of gasoline locomotives and other machines for mine use. He built up a large business with a plant at Rochelle, Illinois. Though over 80 years of age at the time of his death and resident in another state, he retained his keen interest in the business. The active management has been for some years in the hands of his son.

SOCIETY MEETINGS

AUGUST	
American Institute of Mining Engineers, Salt Lake City	10-14
British Association, Adelaide, South Australia	8
Canadian Mining Institute, Rocky Mountain branch, Banff.	
Lake Superior Mining Institute, Ishpeming, Michigan	31 to Sept. 3
SEPTEMBER	
American Chemical Society, Montreal	15-18
American Institute of Electrical Engineers	not fixed
Colorado Scientific Society, Denver	3
Illuminating Engineering Society, Cleveland	21-25
OCTOBER	
American Institute of Electrical Engineers	9
American Iron and Steel Institute	23-24
Colorado Scientific Society, Denver	3
NOVEMBER	
American Institute of Electrical Engineers	13
Colorado Scientific Society, Denver	7
DECEMBER	
American Institute of Electrical Engineers	11
American Museum of Safety	11-20
American Society of Mechanical Engineers	7-8

SCHOOLS AND SOCIETIES

LEHIGH UNIVERSITY summer school in mine surveying was held this year at Hazleton, Pennsylvania. Sixteen men took part in the work, which consisted of surveying a portion of the Wharton coal seam.

The SOUTH DAKOTA SCHOOL OF MINES, at Rapid City, has issued its *Annual Catalog*. The school year starts on September 16. There are 12 instructors in the faculty. In its 110 pages, this publication gives all details of the school and courses given.

The second INTERNATIONAL SAFETY EXPOSITION will be held in New York City, December 12 to 19 at the Grand Central Palace, under the direction of the American Museum of Safety. The purpose of the exposition is to show how the health and safety of the worker is being looked after in the various American industries, manufacturing, trades, railroading, building, business, and engineering, as well as the methods which have been adopted for the welfare and education of employees.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Stocks and Bonds

SAN FRANCISCO STOCKS AND BONDS

(San Francisco Stock and Bond Exchange.)

July 15

BONDS

Listed.	Bid	Ask	Unlisted.	Bid	Ask
Associated Oil 6s	$ -	98½	Natomas Consol	4	12
Natomas Con	21	--	Pac. Port. Cement 6s	100	—
Unlisted.			Santa Cruz Cement 6s	—	87½
General Petroleum 6s	34½	40	Union Oil	86½	87½

STOCKS

Listed.	Bid	Ask	Listed.	Bid	Ask
Amalgamated Oil	81	83½	West Coast, pfd	101	107
Associated Oil	38½	--	Unlisted.		
Du Pont, pfd	80	84	General Petroleum	3	—
Giant	79½	--	Noble Electric Steel	50c	65c
Pac. Cst. Borax, com.	60	—	Pac. Port. Cement	60	94
Sterling O. & D.	—	1½	Riverside Cement	—	63
Union Oil	65	—	Santa Cruz Cement	39	—
			Stand. Port. Cement	—	19

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

July 16.

Atlanta	$ .14	Montana-Tonopah	$ .55
Belcher	.40	Nevada Hills	.30
Belmont	6.15	North Star	.24
Con. Virginia	.14	Ophir	.16
Florence	.36	Pittsburg Silver Peak	.25
Goldfield Con	1.40	Round Mountain	.39
Goldfield Oro	.09	Sierra Nevada	.06
Halifax	.40	Tonopah Extension	2.15
Jim Butler	1.00	Tonopah Merger	.34
Jumbo Extension	.18	Tonopah of Nevada	7.00
MacNamara	.01	Union	.12
Mexican	.45	Victor	.30
Midway	.19	West End	.65
Mizpah Extension	.22	Yellow Jacket	.40

CALIFORNIA STOCKS

(Latest Quotations.)

	Bid.	Ask		Bid.	Ask.
Argonaut	...	$6.25	Kennedy	$8.00	....
Brunswick Con.	1.50	....	Mountain King	...	0.50
Bunker Hill	1.90	....	South Eureka	1.37	....
Central Eureka	0.12	0.14			

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

July 16.

	Bid	Ask		Bid	Ask
Allouez	$ 38½	39½	Nevada Con	$ 13½	13¾
Ariz. Commercial	4½	4¾	North Butte	24½	24¾
Butte & Superior	36	36¾	Old Dominion	49	50
Calumet & Arizona	64½	64¾	Osceola	76	78
Calumet & Hecla	400	410	Quincy	55	57
Copper Range	35¾	36	Shannon	6	5¼
East Butte	9¾	10	Superior & Boston	1¾	2
Franklin	4¼	4½	Tamarack	34	35
Granby	78	78½	U. S. Smelting, com	31½	35
Greene Cananea	31	31½	Utah Con	1¼	1¾
Isle Royale	18½	19½	Verde	75	80
Mass Copper	4¾	4¼	Winona	2¾	3
Mohawk	44	45	Wolverine	38½	39

NEW YORK STOCK EXCHANGE

(By courtesy of J. C. Wilson, Mills Building.)

July 16.

	Bid	Ask		Bid	Ask
Amalgamated	$ 69¾	69¾	Miami	$ 22¾	22¾
Anaconda	30¾	31	Nevada Con	13½	13¾
A. S. & R., com	65¼	66¼	Quicksilver, com	1	1½
Calif. Pet., com	21¾	22	Ray Con	20¾	21
Chino	40¼	40¾	Tenn. Copper	32¾	33
Guggenheim Ex	53¼	53¾	U. S. Steel, pfd	109¼	109¾
Inspiration	19	19¾	U. S. Steel, com	60¼	60¾
Mexican Pet., com	64	64½	Utah Copper	56¾	56¾

NEW YORK CURB QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

July 16

	Bid	Ask		Bid	Ask
Alaska Gold	26⅞	27⅛	Mason Valley	...	1
Braden Copper	7⅝	7⅞	McKinley-Dar	54c	62c
B. C. Copper	1⅝	1⅞	Mines Co. Am.	2⅞	3⅛
Con. Cop. Mines	1⅝	1½	Nipissing	5⅝	5⅞
Davis-Daly	½	⅝	Ohio Copper	⅛	⅜
First National	1⅜	2	Stand. Oil of Cal.	320	322
Hollinger	18½	19½	Tri-Bullion	⅛	⅜
Iron Blossom	1⅛	1½	Tuolumne	⅛	½
Kerr Lake	5⅜	6	United Cop. com	⅛	⅜
La Rose	⅞	1	Yukon Gold	2⅛	2⅜

LONDON QUOTATIONS

(By cable through the courtesy of Hollister, Lyon & Walton, New York.)

July 16.

	£	s.	d.		£	s.	d.
Alaska Mexican	1	8	9	Mexican Eagle, com	0	16	9
Alaska Treadwell	7	10	0	Mexico Mines	4	17	6
Alaska United	3	9	0	Messina	1	12	0
Arizona	1	5	0	Oroville	0	10	9
Camp Bird	0	8	3	Pacific Oilfields	0	1	3
Cobalt Townsite	1	11	9	Rio Tinto	68	15	0
El Oro	0	13	3	Santa Gertrudis	0	12	6
Esperanza	0	15	0	Tanganyika	1	18	3
Granville	0	9	6	Tomboy	1	1	3
Kern River Oilfields	0	7	6				

Metal Prices

LOCAL METAL PRICES

San Francisco, July 16.

Antimony	9 — 9¾c
Electrolytic copper	15 — 15¼c
Pig Lead	4.15— 5.10
Quicksilver (flask)	$37.50
Tin	39 —40½c
Spelter	6½— 6¾c

Zinc dust, 100 kg. zinc-lined cases, 7½ to 8c. per pound

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, July 16.—All metals are quiet and weak. What copper gained last week, it lost this week, prices being just the reverse. While there is a good turn-over of shares on the Stock Exchange, investors and others are holding back. In St. Louis, lead and spelter are dull at 3.75 and 4.80c, respectively. Bar silver is weak in London at 25¼d. (50.5 cents) per ounce.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date		Average week ending	
July 9	56.12	June 3	56.52
" 10	55.75	" 10	56.48
" 11	55.87	" 17	56.56
" 12 Sunday		" 24	56.24
" 13	55.75	July 1	56.58
" 14	55.25	" 8	56.12
" 15	54.87	" 15	55.60

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63 01	57.58	July	58 70	....
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58 21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask

or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
June 18	38.50	July 2	38.50
" 25	38.50	" 9	37.50
		" 16	37.50

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	....
Feb.	41.00	39.70	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	39.33	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
July 9	13.60	June 3	13.86
" 10	13.55	" 10	13.75
" 11	13.50	" 17	13.65
" 12 Sunday		" 24	13.55
" 13	13.45	July 1	13.28
" 14	13.40	" 8	13.44
" 15	13.35	" 15	13.47

Monthly averages.

	1913.	1914.		1913.	1914
Jan.	16.54	14.21	July	14.21	....
Feb.	14.93	14.46	Aug.	15.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
July 9	3.90	June 3	3.90
" 10	3.90	" 10	3.90
" 11	3.90	" 17	3.90
" 12 Sunday		" 24	3.90
" 13	3.90	July 1	3.90
" 14	3.90	" 8	3.90
" 15	3.90	" 15	3.90

Monthly averages.

	1913.	1914.		1913.	1914
Jan.	4.28	4.11	July	4.35	....
Feb.	4.33	4.02	Aug.	4.60	....
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date		Average week ending	
July 9	4.75	June 3	4.90
" 10	4.75	" 10	4.88
" 11	4.75	" 17	4.85
" 12 Sunday		" 24	4.85
" 13	4.75	July 1	4.75
" 14	4.75	" 8	4.75
" 15	4.75	" 15	4.75

Monthly averages.

	1913.	1914		1913.	1914
Jan.	6.88	5.14	July	5.11	....
Feb.	6.13	5.22	Aug.	5.51	....
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1913.	1914		1913.	1914.
Jan.	50.45	37.85	July	40.70	....
Feb.	49.07	39.76	Aug.	41.75	....
Mch.	46.95	38.10	Sept.	42.45	....
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

REPORT of the Mine Inspector for the territory of Alaska, to the Secretary of the Interior, for the fiscal year ended June 30, 1913. P. 10. This was mentioned in this journal of June 6, 1914.

Abrasive materials consumed in the United States in 1913 were worth $4,582,949, an increase of $665,056 over 1912.

ARON HIRSCH & SOHN'S ANNUAL COPPER REPORT

This is the twenty-second annual issue of this Halberstadt, Germany, firm's 'Statistical Compilations About Copper,' and has been forwarded by L. Vogelstein & Co., its representative in New York. Production of the world in 1913 was 993,200 long tons, compared with 1,005,740 tons in 1912, from the following countries:

Country.	Long tons— 1912.	1913.	Proportion of total, %.
United States	550,030	546,300	55.00
Japan	65,000	72,000	7.25
Spain and Portugal	58,000	53,000	5.34
Mexico	72,400	52,000	5.24
Australia	45,500	46,500	4.68
Chile	37,000	39,400	3.97
Canada	33,500	34,000	3.42
Russia	33,000	33,800	3.40
Germany	30,500	30,500	3.08
Peru	27,400	25,700	2.59
Sweden and Norway	13,600	14,000	1.41
South Africa	7,000	9,000	0.91
*Katanga	2,500	7,200	0.72
*German Southwest Africa	6,000	6,500	0.65
*Servia	6,000	6,000	0.60
Austria-Hungary	3,960	4,100	0.41
Bolivia	2,000	3,500	0.35
Italy	2,350	2,200	0.22
Turkey (estimated)	500	500	0.05
Newfoundland	1,000	.....	.....
†Miscellaneous (estimated)	8,500	7,000	0.71
Total	1,005,740	993,200	....

*Hitherto included in miscellaneous.

†Including Cuba, Venezuela, Argentina, North Africa, and Bulgaria.

The consuming countries are as follows:

Country.	1912. Long tons.	1913. Long tons.
Germany	243,173	256,566
France	106,753	107,283
England	147,551	147,434
Austra-Hungary	50,590	41,021
Russia	38,818	39,475
Italy	34,378	30,891
Belgium and Holland	13,000	13,000
Scandinavia	7,500*	8,500*
Rest of Europe	2,500*	3,000*
Total Europe	644,263	647,170
North America	365,922	342,528
Rest of America	3,000*	3,000*
Total America	368,922	345,528
China	4,000*	5,000*
Japan and rest of Asia	27,000*	32,000*
Africa and Australia	1,000*	1,700*
Total world consumption	1,045,185	1,031,398

*Estimated. Australia uses 1000 tons of its refined copper, and imported copper manufactures (no brass included) of 4906 tons in 1913 from England.

Stocks of metal at the beginning of 1913 were 55,000 tons in America and 43,101 tons in the rest of the world; and at the end of 1913, 40,822 tons in America and 29,519 tons in the rest of the world. The Hamburg Metal Exchange handled 239,250 tons compared with 252,000 tons in 1912, and 100,000 tons in 1911. The German electrical industry absorbed about 47% of that country's total Russian production included 17,280 tons from the Urals, 5651 tons from Siberia, 10,008 tons from the Caucasus, and 1375 tons from chemical works.

Monthly Copper Production

ANACONDA COPPER MINING CO., Butte, Montana. $108,112,500 in $25 shares, controlled through Amalgamated Copper Co. which owns 3,185,240 shares (Rockefeller, Rogers, H. H. Rogers, F. Cole, J. D. Ryan, and Standard Oil interests). 16,000 ton concentrator and smelter at Anaconda, 5000 ton concentrator and smelter at Great Falls, Mont., also 70-ton electrolytic refining plant at Great Falls. Production figures include copper from all companies which ship custom ore to Anaconda smelters. Total in 1913, 230,301,644 lb. copper, 64,898 oz. gold and 10,321,296 oz. silver.

Month	Pounds.	Month	Pounds
February	21,300,000	May	23,400,000
March	23,800,000	June	23,300,000
April	22,900,000		

ARIZONA COPPER CO., LTD., Morenci, Arizona. £703,894, of which £379,974 is in 5s ordinary shares, £500,000 in 5% debentures; controlled by Edinburgh investors; mill at Morenci is being enlarged to 3000-ton capacity and a new 1200-ton smelter near Clifton has just been started.

Month.	Pounds	Month	Pounds
March	3,286,000	May	3,092,000
April	3,570,000	June	3,742,000

BRADEN COPPER CO., La Junta, Chile. $2,332,030 in $10 shares and $4,000,000 in 6% convertible bonds; entire stock held by Braden Copper Mines Co.; $14,000,000 in $5 shares; $4,000,000 in 6% convertible bonds, $3,000,000 7% bonds controlled by Guggenheim interests; two mills at La Junta, 3000-ton capacity smelter at Racagua.

Month.	Pounds.	Month	Pounds
February	2,362,000	May	2,480,000
March	1,801,000	June	662,000
April	2,720,000		

BRITISH COLUMBIA COPPER CO., LTD., Greenwood, B. C. $2,958,545 in $5 shares; owns 63% of the stock of the New Dominion Copper Co; controlled by Newman Erb; 600-ton sampling plant and 2500-ton smelter.

Month.	Pounds.	Month.	Pounds
February	572,571	March	682,867

CALUMET & ARIZONA MINING CO., Warren, Arizona. $6,285,710 in $10 shares; has absorbed the Superior & Pittsburg Copper Co. by stock exchange; controlled by Hoatson and other Lake Superior interests; 3000-ton smelter at Douglas. Total in 1913, 52,987,383 lb., 880,915 oz. silver, 18,989 oz. gold. Monthly returns include the Shattuck-Arizona.

Month.	Pounds.	Month.	Pounds.
February	5,948,900	May	5,480,000
March	5,870,000	June	5,862,300
April	5,450,000		

CALUMET & HECLA MINING CO., Calumet, Michigan. $2,500,000 in $25 shares; controls the Ahmeek, Allouez, Centennial, Isle Royale, La Salle, Osceola, Tamarack, and Superior copper mining companies, as well as a number that are non-productive; controlled by Agassiz and Shaw interests; 2 mills on Lake Linden, capacity 15,000 tons; smelter Hubbell, Mich.; electrolytic refinery and smelter at Buffalo, N. Y.; figures include output of subsidiaries. Total in 1913, from Calumet & Hecla alone, 45,016,890 pounds.

Month.	Pounds.	Month.	Pounds.
May	9,299,507	June	10,472,124

CANANEA CONSOLIDATED COPPER CO. S. A., Cananea, Sonora, Mexico. Capital ₱20,000 in shares of ₱100; entire stock owned by Greene Consolidated Copper Co.; $10,000,000 in $10 shares; 945,320 shares are held by Greene Cananea Copper Co.; $50,000,000 in $100 shares, which is controlled by Thos. F. Cole and J. D. Ryan; 30,800 shares held by the Amalgamated Copper Co.; 2 mills and smelter at Cananea, 3000-ton capacity. Total in 1913, 37,050,574 pounds. Output does not include copper from custom ores.

Month.	Pounds.	Month.	Pounds.
February	2,282,000	April	2,044,000
March	3,510,000	May	1,487,000

CERRO de PASCO MINING CO., Cerro de Pasco, Peru. $10,000,000; entire stock held by Cerro de Pasco Copper Co.; $60,000,000 in $1 shares which is owned by Cerro de Pasco Investment Co., which is controlled by J. B. Haggin, and Morgan estate; 3000-ton smelter at La Fundicion; monthly production figures not given out; output in 1912 was 45,000,000 lb. copper.

CHINO COPPER CO., Santa Rita, New Mexico. 4,302,700 in $5 shares; 121,200 shares are held by Guggenheim Exploration Co.; controlled by Sherwood Aldrich and C. M. MacNeill; 5000-ton mill at Hurley, N. M.; concentrate smelted at El Paso.

Month.	Pounds.	Month	Pounds
February	5,769,948	April	6,109,888
March	5,399,814	May	5,666,881

CONSOLIDATED COPPERMINES CO., Ely, Nevada. $8,000,000 in $5 shares; $2,000,000 in 7% convertible bonds; is a recent merger of the Chrome, Butte & Ely, Chainman, and Copper mines, properties controlled by Isaac L. Cole, Wm. B. Thompson, Charles F. Baird, and Jas. Hobbs; in reduction plant not yet built; production so far derived solely from Chrome, ore treated at Nevada Con. smelter.

Month.	Pounds	Month	Pounds
January 1914	148,411	April	471,769
March	287,080	May	442,838

COPPER QUEEN CONSOLIDATED MINING CO., Bisbee, Arizona. $2,000,000 in $10 shares; owns 100,000 shares of Greene Cananea; almost all its stock is held by Phelps Dodge & Co. Inc., $44,995,000 in $100 shares. 4000-ton smelting plant at Douglas, Ariz. Total in 1913, 85,789,630 pounds.

Month.	Pounds.	Month.	Pounds
February	6,448,770	May	7,897,070
March	7,122,719	June	7,184,928
April	6,922,390		

COPPER RANGE CONSOLIDATED MINING CO., Painesdale, Michigan. $39,371,000, in $100 shares, owns 99,659 shares of Baltic M. Co., 99,699 shares Copper Range M. Co., 99,345 shares of Tri-mountain M. Co., half interest in Champion Copper Co., 16,392 shares of Copper Range R. R. Co., and $870,000 in Copper Range R. R. bonds; controlled by Wm. A. Paine; production is derived from the Baltic, Champion, and Tri-mountain companies, each of which mills its ore; concentrate is smelted by Michigan Smelting Co., Houghton, which is owned by mining companies. Total in 1913, 24,852,026 pounds. Reports only 'mineral' containing 60 to 70% copper.

Month.	Pounds.	Month.	Pounds.
February	3,518,000	May	5,908,000
March	3,834,000	June	6,232,000
April	4,428,000		

CORDOBA COPPER CO., LTD., Cordoba, Seville, Spain. £182,891 in 5s shares. 200-ton concentrator, Murex plant for re-treating middling, 200-ton smelting plant.

Month.	Pounds.
May	990,000

DETROIT COPPER MINING CO., Morenci, Ariz. $1,000,000 in $25 shares; owned by Phelps, Dodge & Co.; 1300-ton mill and 350-ton smelter. Total in 1913, 22,352,299 pounds.

Month.	Pounds.	Month.	Pounds.
February	1,814,214	May	2,105,534
March	1,973,725	June	2,129,100
April	1,790,926		

EAST BUTTE COPPER MINING CO., Butte, Mont. 4,110,000 in $10 shares; owns 83% of the stock and all bonds of the Pittsmont Copper Co., which holds 90% of the stock and all bonds of Pittsburgh & Montana Copper Co.; controlled by Wm. A. Paine; 350-ton mill and 1000-ton custom smelter. Total in 1913, 14,401,108 pounds.

Month.	Pounds.	Month.	Pounds.
February	1,182,063	April	1,178,080
March	1,530,717	May	1,179,762

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD., Phoenix and Hidden Creek, British Columbia. $14,998,500 in $100 shares; $1,497,200 in 6% convertible bonds; controlled by General Chemical Co. interests; 4400-ton smelter at Grand Forks and 2000-ton smelter at Anyox. Total in 1913, 21,511,747 pounds.

Month.	Pounds.	Month.	Pounds.
February	1,661,212	April	1,692,102
March	1,775,852	May	1,669,334

GREAT COBAR, LIMITED, Cobar, New South Wales. £1,000,000 in 200,000 shares of £5 each; also 6% first-mortgage debentures. Operates gold, copper, and coal mines, coke works, flotation concentration plant, blast-furnaces, and a refining plant. During past fiscal year treated 361,566 tons for 13,016,640 lb. copper, 27,136 oz. gold, and 127,542 oz. silver.

Month.	Pounds.	Month.	Pounds.
February	898,240	March	896,000

HAMPDEN CLONCURRY COPPER MINES, LIMITED, Cloncurry, Queensland. £400,000 in shares of £1 each; 350,000 issued. During past fiscal year treated 24,744 tons for 5,815,040 lb. copper, 818 oz. gold, and 24,457 oz. silver.

Month.	Pounds.	Month.	Pounds.
March	1,332,800	May	1,473,920
April	1,126,720		

KYSHTIM CORPORATION, LTD., Kyshtim, Perm, Russia. £1,002,800 in £1 shares, £650,000 in 6% debentures, convertible at £2 10s. 1000-ton smelting plant at Karabash, also electrolytic plant to treat all copper produced. Blister production:

Month.	Pounds.	Month.	Pounds.
Mar. 13 to April 11	1,666,500	April 12 to May 17	1,783,280

MASON VALLEY MINES CO., Yerington, Nev. $770,000 in $5 shares; $1,000,000 in 6% convertible bonds; controlled by W. B. Thompson; 1000-ton smelter at Thompson, Nev., also smelts ore of Nevada-Douglas Copper Co. and custom ore; smelter production. Total in 1913, 14,694,000 pounds.

Month.	Pounds.	Month.	Pounds.
February	1,254,000	May	916,000
March	992,000	June	1,068,000
April	862,000		

MESSINA (TRANSVAAL) DEVELOPMENT CO., LTD., Messina, Transvaal. £165,451 in 5s. shares. Controlled by Leslie and H. C. Hoover. 250-ton mill and small smelter; ships concentrate to Europe.

Month.	Pounds.
May	920,000

MIAMI COPPER CO., Miami, Ariz. 746,935 $5 shares issued; $22,000 in 6% bonds convertible at $17 outstanding; controlled by General Development Co. (Lewisohn interests), 3000-ton mill at Miami; concentrate smelted at Cananea. Total in 1913, 33,944,795 pounds.

Month.	Pounds.	Month.	Pounds.
February	3,193,300	May	3,347,000
March	3,361,100	June	3,124,759
April	3,227,600		

MOCTEZUMA COPPER CO., Nacozari, Sonora, Mexico. $2,000,000; entire stock owned by Phelps, Dodge & Co.; 2000-ton mill; concentrate smelted by Copper Queen. Total in 1913, 36,694,013 pounds.

Month.	Pounds.	Month.	Pounds.
February	2,642,543	May	2,834,616
March	2,882,884	June	3,330,807
April	2,654,976		

MOHAWK MINING CO., Mohawk, Mich. $2,500,000 in $25 shares; controlled by Stanton interests; 3000-ton mill, Traverse bay; concentrate smelted by Michigan Smelting Co. Total in 1913, 8,016,000 pounds.

Month.	Pounds.	Month.	Pounds.
March	790,000	May	688,000
April	749,000	June	971,000

MOUNT LYELL MINING & RAILWAY CO., LTD., Queenstown, Tasmania. 1,300,000 shares of £1 each. Operates an extensive copper property, two railways, blast-furnaces, converters, and three superphosphate works in Australia. During past fiscal half-year treated 165,594 tons for 7,705,600 lb. copper, 231,000 oz. silver, and 4500 oz. gold.

Month.	Pounds.	Month.	Pounds.
Feb. 18 to Mar. 18	1,243,200	May 11	1,214,080
Mar. 19 to Apr. 15	1,042,400		

MOUNT MORGAN GOLD MINING CO., LIMITED. Operates a large gold and copper mine near Rockhampton, Queensland, a pyrite mine, iron and limestone quarries, a coal mine, concentrating plant being built, blast-furnace plant, and controls an electrolytic refinery at Port Kembla, New South Wales. During past half-year treated 152,016 tons for 9,741,960 lb. copper and 54,992 oz. gold.

Month.	Pounds.	Month.	Pounds.
Mar. 8 to April 5	1,447,040	May 3 to May 31	1,594,880

NEVADA CONSOLIDATED COPPER CO., Ely, Nevada, $9,997,285 in $5 shares; has absorbed the Cumberland-Ely Copper Co.; controlled by American Smelters Securities Co. through the Utah Copper Co., which owns half of the Nevada Con. stock; the Nevada company owns the Steptoe Valley Mining & Smelting Co., $10,000,000; 16,000-ton mill and 1500-ton smelter at McGill, Nevada. Total in 1913, 64,972,829 pounds.

Month.	Pounds.	Month.	Pounds.
February	4,583,243	April	4,880,043
March	5,218,227	May	4,959,589

OLD DOMINION CO., Globe, Ariz. $7,333,825 in $25 shares. Controlled by Phelps, Dodge & Co. Owns 155,353 of 162,000 $25 shares of Old Dominion Copper Mining & Smelting Co., and all the $2,300,000 stock of the United Globe Mines; 300-ton mill, 2400-ton smelter. Production figures include custom ore smelted. Total in 1913, 30,810,000 pounds.

Month.	Pounds.	Month.	Pounds.
February	2,066,000	May	3,303,000
March	2,997,000	June	2,937,000
April	2,779,000		

OSCEOLA CONSOLIDATED MINING CO., Osceola, Mich. $2,403,750 in $25 shares; owned by Calumet & Hecla; 2 mills, 4000-ton capacity, at Torch Lake. Total in 1913, 11,325,010 pounds.

Month.	Pounds.	Month.	Pounds.
May	1,411,205	June	1,784,615

PHELPS, DODGE & CO., Inc. $44,995,000 in $100 shares; controlled by C. H. Dodge, James Douglas, and others; owns the Copper Queen, Moctezuma, Detroit, and Burro Mountain copper companies, Stag Canon Fuel Co.; indirectly controls Old Dominion, United Globe, and Commercial Copper Mining Co.; members of the firm control the El Paso & Southwestern railway, and have large interests in the Rock Island and Great Northern railways. Production figures include all properties under its control and copper derived from custom ore, the latter ranging from 750,000 to 1,000,000 lb. per month. Total in 1913, 154,454,444 pounds.

Month.	Pounds.	Month.	Pounds.
February	11,444,123	May	13,228,353
March	12,493,651	June	13,113,626
April	12,008,625		

QUINCY MINING CO., Hancock, Mich. $2,750,000 in $25 shares; controlled by W. R. Todd; 4500-ton mill at Mason; 340-ton smelter at Ripley. Reports only pounds of 'mineral,' containing 60 to 70% copper.

Month.	Pounds.	Month.	Pounds.
April	1,232,000	June	1,588,000
May	1,400,000		

RAY CONSOLIDATED COPPER CO., Ray, Ariz. $15,875,000 in $10 shares; controlled by Sherwood Aldrich and C. M. MacNeill; 8000-ton mill at Hayden, Ariz.; concentrate smelted in A. S. & R. smelter adjoining. Total in 1913, 53,745,934 pounds.

Month.	Pounds.	Month.	Pounds.
February	5,600,000	April	6,277,693
March	6,220,617	May	6,495,719

SHANNON COPPER CO., Metcalf, Ariz. $3,000,000 in $10 shares; controlled by N. L. Amster; 500-ton mill and 1000-ton smelter at Clifton. Total in 1913, 13,640,000 pounds.

Month.	Pounds.	Month.	Pounds.
February	904,000	May	1,056,000
March	1,082,000	June	1,056,000
April	1,012,000		

SHATTUCK ARIZONA COPPER CO., Bisbee, Ariz. $3,500,000 in $10 shares; controlled by Duluth investors, ore smelted at Calumet & Arizona smelter. Total in 1913, 13,219,756 pounds.

Month.	Pounds.	Month.	Pounds.
March	1,136,458	May	1,353,043
April	1,386,594	June	1,226,987

SPASSKY COPPER MINE, LTD., Spassky Zavod, Akmolinsk (Kirghiz Steppes), Siberia. £989,815 in £1 shares. Controlled by F. H. Hamilton and Arthur Fell. 100-ton smelting plant near Karagandy, 74 miles from Yuspensski group of mines. Atbasar group is 300 miles distant. Blister output.

Month.	Pounds.	Month.	Pounds.
April 13 to May 13	905,000	May 13 to June 13	907,200

TAMARACK MINING CO., Calumet, Mich. $1,500,000 in $25 shares; owned by Calumet & Hecla; 2 mills, 3500-ton capacity, at Torch Lake. Total in 1913, 4,142,000 pounds.

Month.	Pounds.	Month.	Pounds.
May	149,835	June	424,895

TENNESSEE COPPER CO., Copperhill, Tenn. $5,000,000 in $25 shares; $1,000,000 in first mortgage 6% gold bonds; controlled by Jas. Phillips, Jr., and associates. Total in 1913, 13,493,140 pounds.

Month.	Pounds.	Month.	Pounds.
February	1,232,812	April	1,370,800
March	1,262,184	May	1,336,950

UNITED STATES SMELTING, REFINING & MINING CO. $24,313,700 in $50 7% cumulative preferred shares; and $17,553,700 common $50 shares; copper production chiefly derived from its subsidiary, the Mammoth Copper Mining Co., Kennett, California.

Month.	Pounds.	Month.	Pounds.
February	1,629,902	May	1,750,000
March	1,814,200	June	1,725,000
April	1,850,000		

UNITED VERDE COPPER CO., Jerome, Ariz. $3,000,000 in $10 shares; owned by W. A. Clark; 1000 to 1200-ton smelter at Clarkdale; monthly figures not given out, estimated at about 3,000,000 lb. Total in 1913, 37,750,000 pounds.

UTAH COPPER CO., Bingham, Utah. $15,826,000 in $10 shares; owns half of Nevada Consolidated; controlled by A. S. & R. Co., Sherwood Aldrich, C. M. MacNeill, and W. B. Thompson; 2 mills, 20,000-ton capacity, at Garfield; concentrate smelted at Garfield plant of A. S. & R. Co. Total in 1913, 113,942,834 pounds.

Month.	Pounds.	Month.	Pounds.
February	9,492,898	April	13,132,463
March	12,704,200	May	13,616,993

WOLVERINE COPPER MINING CO., Kearsarge, Mich. $1,500,000 in $25 shares; owns $80,000 interest in Michigan Smelting Co.; controlled by J. R. Stanton; mill on Traverse bay treated 388,500 tons during last fiscal year. Total in 1913, 5,700,000 lb. Yields are 'mineral' containing 60 to 70% copper.

Month.	Pounds.	Month.	Pounds.
March	628,000	May	830,000
April	762,000	June	944,000

MINING DECISIONS

PERSONAL INJURY—MINE OWNERS LIABLE

A shaft boss at a mine undertook an independent contract with the mine owners to sink a shaft 300 ft deeper. He was, however, retained on the company's payroll and his men employed on that particular piece of work were paid through the company's office. One of his men was injured and brought suit against the company. Held, that on the above statement of facts, the jury's finding that the contractor was still an employee of the company and the company liable for the injury, would not be disturbed.

Watson *v.* Hecla Mining Co. (Washington), 140 Pacific, 317. April 29, 1914.

GRUBSTAKE CONTRACT—"PROCEEDS" DEFINED

In a grubstake contract entered into in 1898, providing for a division "of all the proceeds derived from said venture," that wages earned should be treated as proceeds, and that the contract should continue so long as defendant was in Alaska, the word "proceeds" meant net proceeds, so that where the net result of the venture was that the defendant in 1903 finally returned sick and penniless plaintiff could not recover.

Troutman *v.* Polhill (Washington), 140 Pacific, 719. April 29, 1914.

MINERAL LOCATION—REQUIREMENTS SATISFIED

A locator abandoned a portion of his claim in order to relocate another claim including the abandoned portion of the first one. He wrote his location notice on a piece of white paper, placed it on a stick, and partly covered it by a rock to prevent it from being blown away. Held, that the abandoned portion of the first claim was unlocated mineral land, open to relocation, and that the posting of the location notice in the manner indicated was a sufficient compliance with the laws of Colorado to validate the claim.

Emerson *v.* Akin (Colorado), 140 Pacific, 481. April 13, 1914.

RIGHT-OF-WAY—EFFECT OF ABANDONMENT

A person having the right to go upon another's land 'to bore and develop said land for oil and gas with the necessary, usual, and convenient rights' therefor, has a right to build a road over the land, when necessary to haul machinery and material to the place selected for drilling a well; but is liable for injury to the land resulting from the road construction if he subsequently abandons the contemplated exploration before drilling the well.

Coffindaffer *v.* Hope Natural Gas Co. (West Virginia), 81 Southeastern, 966. May 21, 1914.

MINER'S LIEN—VALIDITY UPHELD

The Nevada statute gives a right of lien to both contractors and laborers for materials furnished and work done on mining property. Held, that a joinder of a claim of lien under a contract of employment by the day with one under a contract of employment for a specified amount of work at an agreed price per foot, the work being continuous and of the same character under both contracts, would not invalidate the lien. Nor need all the parties to the contract, where under its provisions they were to be paid severally, join in the lien claim. Each may file a claim for the amount due him. Lien statutes are remedial laws and should be liberally construed.

Ferro *v.* Bargo Mining & Mill Co. (Nevada), 140 Pacific, 527. April 28, 1914.

RECENT PUBLICATIONS

MINERALS OF CALIFORNIA. By Arthur S. Eakle. *Bulletin* No. 67. California State Mining Bureau. P. 226, index. San Francisco, 1914. This work is described in 'The Mining Summary' of this issue.

THE PLANT WORLD. Volume 17, No. 3, March, 1914. P. 24. Contains the following articles: 'The Effect of Dust from Cement Mills on the Setting of Fruit,' by Paul J. Anderson, and 'Agriculture in the Nile Valley,' by Godfrey Sykes. Editorial office, Tucson, Arizona.

United States Bureau of Mines publications, Washington, 1914:

WEATHERING OF THE PITTSBURGH COAL BED AT THE EXPERIMENTAL MINE NEAR BRUCETON, PENNSYLVANIA. By Horace C. Porter and A. C. Fieldner. Technical paper 35. P. 35. Illustrated.

RELATIVE EFFECTS OF CARBON MONOXIDE ON SMALL ANIMALS. By George A. Burrell, Frank M. Seibert, and I. W. Robertson. Technical paper 62. P. 23.

INTERNATIONAL CONFERENCE OF MINE-EXPERIMENT STATIONS. Held at Pittsburgh, September 14-21, 1912. Compiled by George S. Rice. Bulletin 82. P. 99, index. This contains a great deal of interesting information on the work of the Bureau on this subject, also short articles by George S. Rice, J. K. Clement, L. M. Jones, Horace C. Porter, A. C. Fieldner, Reinhardt Thiessen, G. A. Burrell, J. W. Paul, H. H. Clark, O. P. Hood, C. G. Storm, and Clarence Hall.

Reprints from *Transactions* of the Geological Society of South Africa, 1913-1914:

THE BUSHMAN'S RIVER CRETACEOUS ROCKS. By E. H. L. Schwarz. P. 3.

THE GRANITE DYKES OF THE 3520-FT. LEVEL, KIMBERLEY MINE. By E. H. L. Schwarz. P. 23. 5 plates.

United States Geological Survey publications, Washington, 1914:

Advance chapters from 'Mineral Resources of the United States, 1913':

PRODUCTION OF FELDSPAR. By Frank J. Katz. P. 7.

PRODUCTION OF FULLER'S EARTH. By Jefferson Middleton. P. 7.

THE CEMENT INDUSTRY. By Ernest F. Burchard. P. 27.

POTASH SALTS. Compiled by W. C. Phalen. P. 23.

PRODUCTION OF SILICA (QUARTZ). By Frank J. Katz. P. 6.

PRODUCTION OF TALC AND SOAPSTONE. By J. S. Diller. P. 11.

GOLD, SILVER, COPPER, AND LEAD IN SOUTH DAKOTA AND WYOMING. Mines report. By Charles W. Henderson. P. 15.

Contributions to *Economic Geology*, 1913:

GRAND GULCH MINING REGION, MOHAVE COUNTY, ARIZONA. By James M. Hill. Bulletin 580-D. P. 20. Ill. Describes the peculiar deposits of this district, which were published in the *Press* of July 11.

A NEW GYPSUM DEPOSIT IN IOWA. By George F. Kay. Bulletin 580-E. P. 6. Illustrated.

OIL SHALE OF NORTHWESTERN COLORADO AND NORTHEASTERN UTAH. By E. G. Woodruff and David T. Day. Bulletin 581-A. P. 21. Map.

Shorter contributions to *General Geology*, 1914-C:

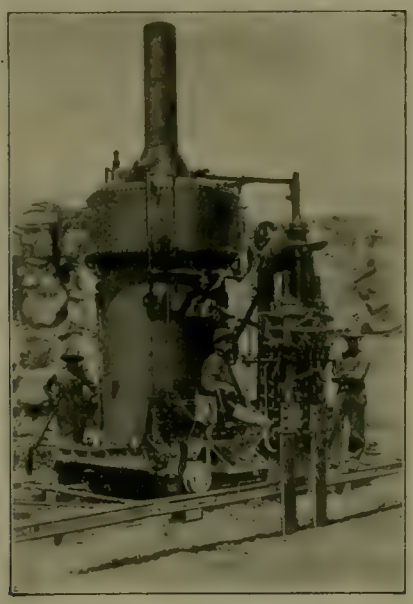
DIKE ROCKS OF THE APISHAPA QUADRANGLE, COLORADO. By Whitman Cross. Professional Paper 90-C. P. 31. 3 plates and relief map.

COMPOSITION OF CRINOID SKELETONS. By F. W. Clarke and W. C. Wheeler. P. 5.

New Machines and Devices

Channeling Machines

In certain types of large excavations the channeling machine is indispensable and the popularity and field for this machine is growing as it has been found adaptable to uses other than quarrying. In excavations for cannals, locks, wheel pits, railroad cuts, the straight smooth solid wall cut by the channeler has advantages of economy and mechanical importance which render these machines as essential a part of a contractors equipment as the rock-drill or air-compressor. The channeling machine cuts exactly to the surveyed line of the work. This is difficult if not impossible, when a wall is made by drilling and blasting. In the latter case too much rock is removed at some points and the vacancy must be filled by concrete or other expensive means. A further economy which may be considered is the fact that the channeled cut affords the powder used, in blasting rock inside of the line, an additional free face upon which to act. This of course reduces the amount of powder necessary. The wall left by the channeler remains as solid as the rock strata themselves, since it is not weakened or shattered by explosives. Retaining walls to prevent rock falls or slips are also obviated by the use of this machine. The channeled walls are less affected by weather than roughly hewn, blasted sides. Channeling is also desirable when it is necessary to excavate close to the foundations of existing structures, since the ground outside of the cut is not disturbed by explosives. A recent publication entitled 'Sullivan Stone Channelers' and Bulletin 68-A issued by the Sullivan Machinery Company, of Chicago, discusses in detail the various types of machines manufactured and the wide range of uses to which they are adapted. The accompanying halftone is that of a Sullivan duplex channeler, with 8-in. cylinders, which is claimed to be the fastest cutting and most powerful channeling machine ever built.



DUPLEX CHANNELER.

Variable Volume Air-Compressor

The 3-cylinder variable volume air-compressor manufactured by the Bury Compressor Co. of Erie, Pa., represents a departure from the usual compressor design. The operation is automatic and entirely independent from any working part and in no way limits the speed of the compressor. The air supply is controlled through separate and independent variable volume unloading by-pass valves attached to each end of the two low-pressure cylinders and two similar valves on each end of the one high-pressure cylinder.

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Commercial Paragraphs

The July number of 'Leschen's Hercules,' published by the A. Leschen & Sons Rope Company, of St. Louis, Mo., contains a short discourse on the use of Hercules rope on Alaska gold dredges.

The Sullivan Machinery Co., Chicago, Illinois, has recently opened a branch office at Juneau, Alaska, which will be managed by Burt B. Brewster. The new Juneau agency has quarters in the New Brunswick building on Front street of that city.

The Denver Engineering Works Co., Denver, Colo., has recently issued Bulletin No. 1068, which is descriptive of the tube-mills manufactured by this Company. The bulletin is fully illustrated and describes the many details of construction of this type of machine.

The Chicago Pneumatic Tool Co., Chicago, Ill., has recently issued Bulletin No. 34-N., which is devoted to a description of Class 'N' steam and power-driven enclosed compressors. This type of machine has been designed for both stationary and portable use and the various sizes together with details of construction are discussed in this bulletin.

'Core Drilling by Contract' is the subject of an attractive little booklet recently issued by the Sullivan Machinery Company. The purpose of the booklet as stated in the preface is to remind engineers, mining companies, and capitalists of the facilities which the Company offers for undertaking mineral prospecting and test boring contracts of all kinds with the Sullivan Diamond core drills.

The June number of 'American Vanadium Facts,' published by the American Vanadium Company, of Pittsburgh, is devoted largely to the use of vanadium in heavy locomotives. In a series of tests which are published in this number it will be noticed that the specified minimum elastic limit for heat-treated chrome-vanadium steel is 50% higher and the minimum tensile strength 17½% higher than for heat-treated carbon steel; while the elongation in 2-in. is about the same in each case and the reduction of area from 20 to 28% higher for the vanadium steel.

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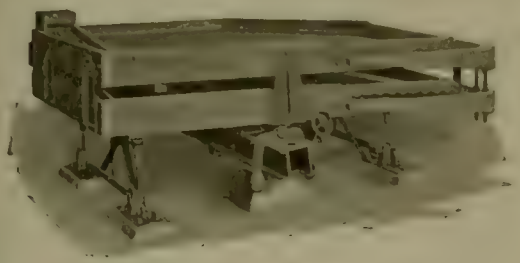

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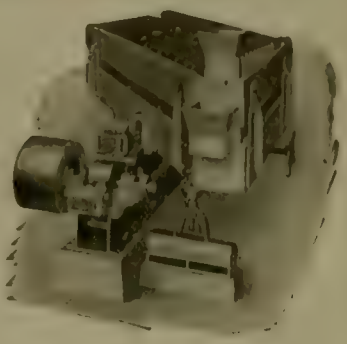

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LESSONS FROM LEADVILLE

Leadville's obituary was written years ago, but Leadville refuses to die; and it has been well said that the first requisite to a successful funeral is a willing corpse. Gold, silver, lead, zinc, iron, manganese—each of these has been mined, and each has contributed to the stream of wealth that has flowed down to the plains from Tennessee pass. Leadville has been a mine of many metals, but it has also been a mine of knowledge, and its name is inextricably interwoven with the history of the study of ore deposits. Emmons' classic work served a great purpose. Emmons made mistakes. His belief that the underlying Paleozoic beds would not pay a profit on their exploration has been proved wrong by many shafts, and his ideas as to the origin of the ore-bearing solutions were materially in error; but Emmons demonstrated that the ore-bodies were metasomatic replacements when all the world thought of ores as fissure fillings, and Emmons' structural studies were extremely useful. Aside from that, by personal contact as well as by printed word, he taught an active generation of mining engineers to respect and use geologic knowledge. His younger associates and successors of the Geological Survey have not been altogether happy in their subsequent treatment of Leadville. A perhaps natural, but undue, disinclination to criticize the weak points in the work of a well loved pioneer has been the cause, but at any rate it has fallen to engineers outside the service to show the relations of the Leadville deposits to the deep-seated and fundamental geologic agencies operating in the region. It is a pleasure to have served as the medium for publication of part of this work, and in Mr. Argall's discussion of the siderite deposits we believe that geologists will recognize a real contribution. The question where the manganese came from has been asked by many; it remained for him to point out that the source lay in bodies of siderite produced by contact metamorphism of the limestone, and that the character of the siderite linked it with vein deposits in many parts of the world. It is easy to confuse siderite with dolomite, both in crystals and massive beds, and again it is demonstrated that knowledge of many deposits in many lands is necessary if one would know accurately the rock that is below his own feet. The value of broad training and careful persistent note taking can hardly be over emphasized.

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EDITORIAL

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SMELTING has been resumed at Chihuahua, the American Smelting & Refining Company having reopened its plant. This is a concrete evidence of faith in better conditions in Mexico, by people who know the country well.

IN these days when loans are being extended rather than paid and it has become a habit to issue new bonds to take up old ones, it is a pleasure to record the action of the American Locomotive Company in taking up from treasury funds $1,000,000 of its serial notes not due till October 1, following redemption of a similar amount in April.

HUME has written that "a government may endure for several ages though the balance of power and the balance of property do not coincide." That nature's balance cannot be disturbed without disastrous results is evidenced by a recent report from India that the campaign being waged against tigers has resulted in such an enormous increase in wild pigs that the crops have been greatly depleted. If the crop returns fail, this may well, in turn, affect the silver market.

THE political adviser of the new Chinese republic, Mr. George Morrison, in a recent interview in London states that there are plenty of evidences of stability in Chinese public life and finances at the present. Revolutionary activity and the operations of bandits are confined to a small area, and the £15,000,000 which was horded in the banks of the treaty ports is returning to circulation. This optimistic view of one so intimate with Chinese affairs is encouraging in light of the many rumors of incipient revolution and political unrest.

THAT flotation can be profitably applied to the treatment of the low-grade porphyry deposits appears to be the opinion of those who are engaged in this metallurgical problem. It is probable that flotation will be adopted as an auxiliary method of treatment, but not entirely to replace the present method of concentration at the Utah Copper Company's mills, according to a recent statement of managing director Mr. D. C. Jackling. The importance of the subject is apparent when it is understood that the $20,000,000 output of this Company represents an extraction of only about 70 per cent of the copper content of the Utah ores and with the flotation process it is expected to save from 85 to 95 per cent of the copper.

CONSOLIDATION of the United Mine Workers and the Western Federation of Miners is being given serious attention by these organizations at the biennial convention of the Western Federation at Denver. It is to be noted that in a report by Mr. Charles H. Moyer opposition is offered to the proposed amendment to the constitution of the Federation whereby any member who has held office for two consecutive terms is ineligible for reëlection. Although this attempt to oust the present officers of the Western Federation may not prove successful, it is evidence of a growing feeling of dissatisfaction among the better element of the organization and would indicate that the revolt at Butte was but the crystallization of this sentiment in one locality.

A MOST interesting program is promised those who attend the Salt Lake meeting of the American Institute of Mining Engineers to be held from August 10 to 14 inclusive. The program includes many features of both a technical and social nature, among which are visits to Bingham cañon, the Magna and Arthur mills, and the Garfield, Murray, Midvale, and Tooele smelters. Excursions to Park City, the Tintic mining district, and Cottonwood cañon have also been arranged. Technical sessions will be held on the evenings of August 10, 11, 12, and the morning of the 13th. At these sessions a wide variety of subjects will be discussed, particular attention being given to the metallurgy of copper, lead, and zinc. Mining methods and practice will also be treated in papers dealing with some of the problems of modern mining. The technical sessions will be held at the Hotel Utah and a most successful meeting is anticipated.

CONCESSIONS in the Arequipa borax fields will be asked for by the Borax Consolidated, Ltd., at the next session of the Peruvian congress which convenes on July 28. In that the support of the Peruvian government has been pledged and the measure was approved by the Chamber of Deputies at its last session, it is very probable that the privileges asked for will be granted. The present holdings of the Company represent an original investment of £150,000 for the property rights, and it is estimated that an additional investment of £200,000 will be required to equip the fields for production. As the working of these deposits will require a force of several thousand men and economic conditions in the Department of Arequipa have been depressed for a long

time, it is hoped locally that the concession will be granted. Under its terms the Company is to construct a railway or tramway from the borax and salt mines of Moquegua to the city of Arequipa; furnaces with an annual capacity of 40,000 tons of borax and lime are to be erected; only Peruvian workmen will be employed at the works; and the Company will spend £200.000 on the works for which this concession treats. Congress will be asked not to levy duty on the exportation of borax from the port of Mollendo for 18 years, and the municipalities not to tax borax for this period. All machinery and supplies for this work are to be admitted free of duty.

TONOPAH has been recently the scene of operation by agitators of the I. W. W. organization. One man lost his life, a boarding house was looted, and destruction of property and other acts of violence were openly preached. There is a general feeling that the peace officers failed in their duty, but the situation has its bright side in the prompt action of organized labor in the district in repudiating the trouble makers. When a systematic effort is being made, as now, to provoke open defiance of the law, a grave situation is created. The first impulse is to stand the agitators up and shoot them, but so simple a solution is not likely to be final. We have no panacea to urge, but we do feel keenly that American institutions have sufficient stability to withstand the attack now being made and that a way out can and will be found.

PETROLEUM producers should be keenly interested in events at Washington these days, as a determined effort is being made to find a solution of the various legal difficulties that have grown out of the different land withdrawals, the pipe-line legislation, and the Southern Pacific litigation. It was supposed some weeks ago that a *modus operandi* had been found whereby operators on land in dispute with the Government might have the option of accepting a lease or by depositing with the court an agreed portion of the receipts, be free to produce and sell pending settlement of the legal points involved. Bills covering these points have been framed and were expected to go through without opposition. Dispatches of this week indicate a hitch in the program. Funds, too, for the petroleum division of the Bureau of Mines that we discussed July 4, are in jeopardy, and it will take prompt and emphatic action of the oil men if money is to be available for doing the work outlined. This is particularly important, since, however much we may differ as to the propriety of the Government occupying so large a field in petroleum matters, there can be no disagreement as to the need of its action being informed. Oil men are not afraid of legislation or court decisions that are based upon real knowledge of the industry; it is half knowledge in high places that is dangerous, and in their own protection the oil men should help Mr. Williams and his associates to get the new division on a sound basis.

NATOMAS FINANCES AGAIN

Our criticism of the plan of reorganization of Natomas Consolidated has provoked comment from many sources. It, and the general discussion of the matter, has served the excellent purpose of bringing out additional information, so that bondholders and others may more intelligently decide upon a course of action. While a revised list of current liabilities and quick assets, compiled by Mr. Emery Oliver, general manager for the Company, was made public July 10, the general figures already presented remain substantially unchallenged. Mr. Oliver's figures do, however, permit the matter to be viewed from a different angle. He lists the outstanding underlying bonds, consisting of the unretired bonds of Natoma Development Company, Natoma Land & Milling Company, and the Clarke & Cox Farms Company as amounting to $843,000. He further states that the total amount, with interest, now owing for lands purchased but not wholly paid for, is $489,024. From an accompanying opinion by Messrs. Pillsbury, Madison & Sutro, it is learned that the floating debt, exclusive of the amount due the Natomas Syndicate, is now $815,000, and the claim of the latter, prior to return of a block of reclamation bonds, was $1,213,000. The last transfer mentioned may be disregarded, since under the proposed reorganization it would be, in effect, canceled. Adding these various obligations, it appears that Natomas owes $3,363,024—provision for which sum must be made before the so-called first mortgage bondholders can hope to realize upon their investment. The reclamation bonds, now amounting to something over a million dollars, are purposely omitted in the above calculations, since they either are now in the treasury of the Company or would be returned to it in event of the debts above outlined being paid. In addition, however, to the $3,363,000, provision must needs be made for completing the reclamation work and for interest charges. There is equity back of all these debts and, what is at least quite as much to the point, the creditors, in the main, have such security in the form of liens, cash, or underlying bonds as put them in a strategic position. Settlement must be made with them, or the bondholders will lose the property. The debts must, and ought to be paid. The question is the purely practical one of how they may be best met.

Not all the money needs be paid at once. For example, but $100,000 of the Natoma Development Company bonds falls due this year. Mr. Oliver lists obligations to the amount of $1,332,226, including $554,361 for the minimum of reclamation work, that must be met by January 1, 1915. He also estimates $803,000 as the income for the remaining months of the year. These are hard facts that must be met by any plan for reorganization and in urging caution on the part of bondholders, we have had no intention of suggesting repudiation of any debt.

Repudiation is one thing, however, and the price paid for money borrowed is another. Under the plan pro-

posed Natomas Syndicate will pay $2,700,000 for notes worth $3,000,000. From this the Syndicate will, directly or by underwriting, care for a floating debt of $815,000 and its own debt of $1,214,000 so that the new money contributed will amount to $670,000. The payment of the floating debt will, however, release cash now held in banks, so that, as Messrs. Pillsbury, Madison & Sutro say, $1,000,000 cash will be available for use. Furthermore, since payment of current accounts will naturally extend local credits, the effective sum will be even larger. Interest and sinking fund to retire the 6 per cent notes in the five years will add an annual charge for that time, though interest on the first mortgage bonds will be allowed to accumulate. The plan may well, as its friends hope, clear away the present difficulties and eventually bring the bondholders more than the present value of their bonds. At the same time, it is true that, disregarding the new stock, which is of problematic value, the bondholders are sealed down to 60 per cent of their holdings and wait for their interest, while Natomas Syndicate will get full value for its advances, plus 6 per cent interest, and a commission on the money advanced. In case the notes are not paid within the five years, the Syndicate will also receive $4,500,000 out of the new issue of $16,500,000 bonds. The practical question is whether this is the best bargain that can now be made.

It must be remembered that Natomas Syndicate, and other of the creditors, have in their possession underlying securities which in any scramble would protect them and take the whole property. Whether such securities should have been pledged is beside the question. They were—and to raise money with which to pay interest to bondholders. If there was benefit from the transaction the latter secured it. It is also worth remembering that an appeal to the courts and a receivership would probably depreciate the property so greatly, since the reclamation work is incomplete and there are so many interests to be reconciled, that no one would be the gainer. Whatever else may be done, we hope that the present sensible and economical policy of amicable readjustment with expenditure upon works rather than lawsuits, will be followed. In fact, we believe the bondholders will best serve their own interests by joining with the reorganization committee, and working substantially along the lines proposed.

When we wrote of the subject a month ago we had in mind the possibility of a group of the bondholders offering an alternative proposal or working together to secure modification of the terms of the Natomas Syndicate. No adequate proposal of this sort has been made, and under the circumstances we would strongly urge all bondholders to accept the situation and come in on the plan offered. Any terms are better than a prolonged contest in the courts, and quick action is necessary. The management must stop the reclamation work unless the project be financed within the next few weeks, and if the half-finished levees be exposed to the probable floods of the winter much of the value of the work already done will be lost. Even if the work were resumed a year later, the mere loss of time, because of interest charges, would have added $10 or more to the cost per acre of the land. From this point of view the commission paid Natomas Syndicate is less important than the protection of the work.

It is to be remembered that the bondholders have never had a perfect first lien on the property. The underlying bonds of the constituent concerns and the reclamation bonds have precedence. The latter, it is true, were in the treasury of the Company until pledged as security for loans and later sold to the Natomas Syndicate. The plan of reorganization proposes that they be returned, and we would respectfully suggest that they should not be allowed to be again pledged. Otherwise, if the notes are not paid, the end of the period will find the old bondholders with about two-thirds of the outstanding bonds, 40 per cent of the preferred stock only, practically none of the common, the unpaid notes, and the best of the gold land dredged. It is true this is a matter of management, and the new board that is proposed is one of the best guarantees possible that everything will be done to make things go well. It is none the less a vital matter to the bondholders and should receive attention.

One other matter we may venture to suggest. If any reliance is to be placed upon the estimates available, the gold reserve in the dredging ground has a present cash value considerably in excess of all the debts of the Company, and, if the dredging lands could be sold for their cash value or nearly it, all debts could be wiped out and a surplus would be available for reclamation work at least equal to, and probably greater than, that provided by the reorganization plan. In the end the bondholders must save their capital and take their profit, if any, from the sale of the reclaimed land, and, while the new Natomas may be able to conduct gold-dredging as economically as any other concern, it must in the meantime pay more for money. In other words, future profits are worth less and present cash is worth more to Natomas than to others prepared to dredge. We believe that, properly presented, there would be lively bidding for the dredging lands, but for the directors to propose to sell the property most immediately valuable would subject them to criticism. An outsider, such as ourselves, may properly offer the suggestion. It would be entirely possible to reserve the right to do this if found practicable. Natomas bondholders can hardly expect to have their cake and eat it, too. It is a choice of evils they must face. Let them do it frankly. We have no quarrel with Natomas Syndicate or the present committee. They are making an effort, deserving of success, to avoid a receivership. They should have the coöperation of the bondholders, and if the latter will not face debts that must be paid, they can hardly expect to escape loss.

Siderite and Sulphides in Leadville Ore Deposits—II

By PHILIP ARGALL

The derivation of vein siderite at Leadville may be from the slaty and thin bedded Silurian limestones or from the porphyries, but without doubt it is derived from the rocks traversed by the mineralized solutions that in their passage through the fissured rocks formed the vein and replacement deposits. It is significant that some of the gray porphyries on mine dumps are in a few years covered with a heavy film of black oxide derived from their manganese content; proving that some Leadville porphyry contains manganese in appreciable quantity, that oxidizes somewhat readily under atmospheric conditions. Emmons, in his Leadville monograph,[1] gives two analyses of comparatively fresh gray porphyry containing 0.0677% manganese, equal to one and one-third pounds per ton of rock.

Spurr and Garrey, in their discussion of the gangue minerals of the Georgetown quadrangle,[2] claim that siderite may be derived from original pyrite, "as is probably the case in one instance noted in the Harrisburg mine, where a post-mineral fissure had been opened in

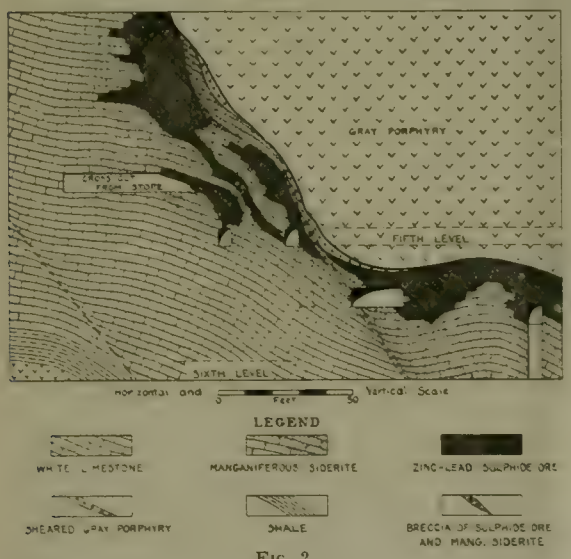


FIG. 2.

pyritic altered rock and had become lined with siderite that was evidently due to lateral secretion." They also state that when siderite occurs as a primary mineral or as the last formed mineral, it is usually mingled with other carbonates; especially that of manganese. Siderite is thus contemporaneous with primary pyrite and "its iron, like that of the pyrite, has probably been derived from the rocks traversed by the mineralizing solutions. This conclusion applies also to the manganese in the brown carbonates." Elsewhere these authors state that siderite or ankerite in the Colorado Central mine, represents "the crystallization along the walls of cavities of the carbonates abundantly formed by alteration of the biotite and feldspar of the wall rock."

The latter hypothesis is entirely inadequate to account for the Leadville replacements, nor can I conceive of iron sulphide being converted into carbonates on a scale commensurate with the Leadville deposits. In various places in the Tucson mine the beds of siderite are of such wide extent as to suggest sedimentary deposition. Observing a drift closely following the strike of the beds in such locality, samples were taken at intervals of 20 ft. along one particular bed and assayed with the following result:

Sample.	From fissure, ft.	Iron.	Manganese.	CaO.	Insoluble.
		%	%	%	%
A	40	24.3	16.2	1.8	16.6
B	60	5.2	3.1	19.6	25.2
C	80	3.4	1.2	24.1	13.2

A second place was chosen where ore was mined along a 'flat' in the foot-wall country of a fissure where, on reaching the limits of pay-ore, a cross-cut had been extended through the siderite into the unreplaced limestone following the bedding. Samples here gave the following results:

Sample.	Ft.		Iron.	Manganese.	CaO.	Insoluble.
			%	%	%	%
A	10	from ore	26.6	18.9	0.6	29.6
B	20	from ore	19.4	21.0	0.7	19.2
C	30	from ore	16.7	20.1	1.2	25.0
D	40	from face of cut top ...	4.2	3.2	19.6	20.0
E	40	from ore-floor of cross-cut	3.6	2.8	23.0	18.0

These samples conclusively showed that practically complete siderite replacement of the limestone extended 30 ft. beyond the termination of the zinc-lead ore (see Fig. 2, cross-cut from stope) extending as a 'flat' from the fissure, and then gradually faded out in 10 ft., as shown in samples *D* and *E*. In fact, the change in the cross-cut is so gradual and imperceptible that no person with the unaided eye could determine in the mine the limestone from the siderite; or say between the rock represented by samples *C* and *D*. Consequently the siderite has, perhaps, been mistaken for white limestone, both by the miners and by the visiting scientists. To the former siderite was waste or gangue containing neither precious metals, zinc, nor lead in paying quantities, so he had no use for it. These tests, together with other observations, prove to my satisfaction that the siderite beds and included orebodies are replacement deposits; and, inasmuch as the physical conditions—that is, the adjacent porphyry mass, the contact-

[1] U. S. Geol. Surv., 1886, p. 332.
[2] U. S. Geol. Surv., Prof. Paper 63 (1908), p. 153.

metamorphic minerals in the limestone, and the presence of siderite in the intrusive gray porphyry sheet itself—suggest that the ores were derived from magmatic solutions and vapors emanating directly from the intrusive mass of gray porphyry, I am led to the conclusion that this is a contact-metamorphic deposit of great significance in the study of the genesis of Leadville ores.

In his last contribution to the geology of Leadville, S. F. Emmons, writing of the ultimate source of the metals, states:[3] "The questions still at issue are:

"1. Whether the sulphide ores were originally deposited as a precipitate exclusively from meteoric or from magmatic waters, or in part from both.

"2. Whether the magmatic waters, if they were the transporting agents, reached the present locus of the depths directly from below, or whether they came up along the general channels that carried the magma of the intrusive rocks, and, where this magma had spread out in sheets between the sedimentary strata, whether they followed in general the contacts between intrusives and sedimentaries or penetrated the mass of the latter along cracks and joints before depositing their load.

"3. Whether the deposits, or any part of them, were formed by contact metamorphism—that is, by waters emanating directly from the cooling intrusive bodies, squeezed out, as it were, from the solidifying igneous mass into the adjoining sedimentary beds."

I believe that the section, Fig. 2, answers the first and last questions in favor of magmatic waters and of contact metamorphism. It also throws much light on question No. 2. The gray porphyry shown in Fig. 2 is the eastern edge of the huge sheet exceeding 200 ft. in thickness extending over the greater part of the Tucson claim. The folding and fissuring is coincident with the porphyry intrusion, but the slight fissuring shown in this illustration had, I believe, little to do with the ore deposition, though movement has occurred along the fissure nearest the porphyry since the formation of the replacement deposit and some ore breccia was developed along its plane. In support of the contact-metamorphic theory of deposition for the orebody illustrated by Fig. 2, I call attention:

1. To the silicification of the limestone by means of what I take to be emanations from the intrusive porphyry. I have previously noted the silicious nature of the siderite, averaging in samples *A*, *B*, and *C* 24.6% insoluble. Taking these samples as representing siderite, and *D* and *E* the silicified limestone, the following comparison may be made:

	Iron.	Manganese.	CaO.	Insoluble.
	%	%	%	%
Siderite	20.9	20.0	0.8	24.6
Limestone	3.9	3.0	21.3	19.0

Inasmuch as wollastonite had been noted in other portions of the deposit, lime silicates were suspected here, and two slides were prepared which revealed nothing but quartz in the limestone at 80 ft. from the porphyry, where the temperature was evidently not high enough to form lime silicates.

2. To the massive siderite itself, which I consider a metamorphic mineral deposited simultaneously with the mixed sulphides, including pyrite and pyrrhotite, also specular hematite and magnetite.

3. To the chloritic material adjoining the porphyry which may be derived in part from the decomposition of pyroxene.

4. To magnetite bands (one 12 in. thick) associated with hematite, considerable of which is of the specular variety, and to pyrite bands, in part pyrrhotite, alternating with siderite and zinc-lead sulphides.

Finally, the minerals appear to be derived from the same source and deposited about the same time, the zinc-lead sulphides forming in masses near the porphyry, the massive siderite next, and the silicification of the limestone extending as the outer border of metamorphism. The siderite, and to lesser extent the silicified limestone, contains much sulphide material in scattered crystals throughout the zones indicated; that is to say, distinct crystals of galena, sphalerite, and pyrite, apparently segregated from the siderite mass.

On these facts I base my conclusion that the section Fig. 2 illustrates a contact-metamorphic ore deposit.

The Tucson Fault-Fissure

The siderite deposited in the Tucson fault-fissure and replacements therefrom may have had a deep-seated origin, or the iron and manganese may have been derived from the Silurian limestones, but inasmuch as the development of this fissure vein is not by any means extensive, the ultimate source of its siderite may eventually be traced to the porphyries.

It is noteworthy that the siderite veins briefly described in this paper occur in the older sedimentaries:

Perran iron lode	in clay slates	Lower Devonian
Brendon Hills	in clay slates	Middle Devonian
Stahlberg Musen	in clay slates	Lower Devonian
Slocan mine	in clay slates	Pre-Cambrian
Coeur d'Alene	quartzite	Pre-Cambrian
Leadville	quartzite and limestone	Cambrian and Silurian

Composition of Leadville Siderite

The following analyses were made on selected specimens from the Tucson mine, fairly free from sulphides, but containing minute specks of galena, pyrite, and zinc-blende. For part chemical analysis of siderite from other Leadville localities, see preceding table:

	A.*	B.*		A.*	B.*
	%	%		%	%
Iron	23.07	21.80	Lead	1.50	0.60
Manganese	20.70	21.10	Zinc	0.30	0.30
CaO	0.30	0.40	Gold, oz.	0.04	0.04
Insoluble	19.60	21.20	Silver, oz.	0.08	0.00
MgO	1.40	2.40			

*P. T. Gallaher, analyst.

[3] 'The Downtown District of Leadville, Colorado,' *Bull.* 320, U. S. Geol. Surv., 1907, p. 72.

The small quantity of lead, zinc, and silver present in the siderite is accounted for by the scattered crystals of galena and blende impossible to separate. The gold is as high in the siderite as in the sulphide ore, and to account for it is difficult; apart from this metal, the siderite is apparently free from combined zinc, lead, and silver, and may be considered a true gangue.

Structure

Probably the best development of siderite in Leadville today can be seen in the Tucson mine; at any rate, it is the occurrence with which I am most familiar, inasmuch as I recently examined the mine.

The Tucson has three important structural characteristics: (1) steeply folded beds approaching a thrust, reverse, fault of about 200 ft. throw, which brought the Cambrian quartzite of the hanging country above the white limestone of the foot; (2) an immense sheet of gray porphyry exceeding 200 ft. in thickness intruded below the parting quartzite; (3) the development of shearing in the foot and hanging wall country paralleling the fault and the deposition of ore therein. These structural peculiarities greatly complicated mining development. The shaft passed twice through the white limestone and Cambrian quartzite and first struck rich ore in the foot-wall quartzite on the 9th level, close to the granite. This ore has since been followed upward along the quartzite bedding planes for a distance of 600 ft. from the granite quartzite contact. Through these structural peculiarities the mine has been worked from the bottom up. The 9th and 10th levels are today under water, while the 5th and 4th levels are only now being developed.

The Tucson fault has been followed from 40 ft. below the granite-Cambrian contact to 60 ft. into the 'blue limestone' a vertical height of 600 ft. measured in the foot-wall formation. On its strike the fault has been traced a length of 1500 ft. No record of the fault is found on the old maps of the 'first contact' workings, the 'white porphyry'-'blue limestone' contact exhausted of carbonate ore and abandoned over 20 years ago, so it is highly probable that the Tucson fault flattened out into a bedded fault in the 'blue limestone' and became dissipated in the bedding planes below the 'first contact' horizon.

The age of the Tucson fault is not easily determined, for the reason that present development has not been sufficient to fully prove up all the geologic conditions; particularly in the hanging wall country and in the 'blue limestone' horizon, while the steeply folded beds and the intrusive sheet of gray porphyry adds to the complication. The fault and attendant shearing appear to have been coincident with the porphyry intrusion and earlier than the ore deposition in the Cambrian and Silurian horizon. The quartzite ores are certainly subsequent to the faulting as are also the siderite replacement deposits and accompanying zinc-lead ores. The fault in places becomes a typical fissure vein filled with alternating bands of leaded zinc ore and siderite. The normal faulting in Leadville took place after the formation of the sulphide replacement deposits of the blue limestone-white porphyry ('first contact') horizon. The Tucson fault, if I read the evidence correctly, preceded the ore deposition in at least the lower sedimentaries and is older than the normal Leadville faulting, such as the 'Iron fault' for example.

Ore Deposits

The quartzite ore deposits are found along the shearing planes as lining in solution cavities, along some bedding planes, and on the bottom and to a less extent on the roof and sides of irregular horizontal solution cavities or 'water courses.' The richest ore in the Tucson mine was found between the 9th and 10th levels; as well as the largest solution cavities, exhibiting the most intense action on the quartzite. Some of the crusted ore near the bottom of cavities on this horizon assayed 14 oz. gold per ton, 4000 oz. silver, and 45% lead; antimony and bismuth minerals are also present.[4]

The photographs reproduced as Fig. 3 and Fig. 4 illustrate the peculiar deposition.

Fig. 3 shows an ore occurrence in Cambrian quartzite above the 8th level. The ore can be clearly seen partly filling an oval solution cavity (water-course) between tight shearing planes in the quartzite. One such is marked by the pick and the other indicated by the drill-hole at the top of the picture. The ore is a mixed sulphide covered with fine crystals of siderite. This figure is offered as an example of a typical high-grade deposit of what I shall call the 'Red Cliff type', for the reason that at Red Cliff similar channels or water courses, following tight shearing planes or cracks in the quartzite and in places spread out along bedding planes, have been worked for many years, often at great profit. The Eagle river at Red Cliff has cut through the sedimentaries and deep into the granite, exposing many veins and some replacement deposits in the precipitous cliffs, which latter carry oxidized ores to considerable depth into Battle mountain, along the dip of the quartzite beds. Some of the quartzite ore channels produced magnificent specimens of crystalline gold and much gold and silver ore of high value.[5] It is evident these channels, incipient fissures, and bedding planes, favorable to the passage of mineralizing solutions, were in part filled with rich ores, the oxidation of which in moist condition or in stagnant pools produced the crystalline gold noted above. The Leadville ore illustrated in Fig. 4 assayed: gold, 0.38 oz.; silver, 610.8 oz.; lead, 37.2%; copper, 0.7%; zinc, 24.6%; iron, 6.8%; insoluble, 4.6%. Such ore should, on oxidation under like conditions, produce metals and minerals similar to those of Red Cliff; hence these rich quartzite ores are common to both mining districts and elsewhere in Colorado, though but recently recognized in Leadville. The primary quartzite ore in the Tucson is much richer than that found in the limestone; furthermore, it decreases in gold and silver content and increases in copper (chalcopyrite) as followed upward along and through the beds. The deposit sometimes fades out on one bedding plane, rising through a fissure or solution cavity and continuing on a higher plane, being often enriched by incipient fissures. The cause of the varying richness of the ores in quartzite and in limestone and

[4] Argall, G. O., *Eng. & Min. Jour.*, Jan. 29, 1910, p. 264.

[5] Argall, Philip, *Trans.* Amer. Inst. Min. Eng., Vol. 22 (1893), pp. 759-760.

between the upper and lower beds in the Cambrian quartzite itself, is somewhat puzzling. I can only ascribe it to lack of a precipitating medium in the quartzite, rather than a change in the composition of the mineralizing solution. Be that as it may, the conditions may be tentatively stated as follows: The ascending hot solutions dissolved quartzite readily in the bottom beds, at the same time depositing sparingly in the solution cavities, partly as replacement and partly as crusted deposits, sulphides of iron, lead, copper, and zinc with much gold and silver and a little bismuth and antimonial minerals, which are comparatively rare in Leadville; then, as the solutions in their upward passages through the quartzite took up more silica their solvent action became less, the resulting cavities and quartzite replacements smaller, and the sulphide deposition heavier, resulting in filling the smaller cavities and cracks completely, chalcopyrite predominating in places; at the same time the content of precious metals in the ore fell off very considerably. So far as the precious metals are concerned, it appears not unlike a case of fractional precipitation. A typical shipment of ore from the present working faces in the quartzite is as follows: gold, 0.11 oz.; silver, 164.4 oz.; lead, 7.5%; copper, 1.15%; zinc, 7.5%; iron, 8.4%; insoluble, 57.6%. Inasmuch as there is over 50% silica present, because of the fine dissemination of the ore through the quartzite, it is manifest that the pure ore is at least double the value stated.

Fig. 4 shows a small fissure, *F*, in glassy quartzite, bifurcating near the middle of the picture and the branch fissures apparently closing up toward the bottom of the drift. The ore is less than two inches wide, though worth over $150 per ton. The fissure shown here runs east and west. Those in Fig. 3 parallel the fault and are the real mineralizing fissures for the bedded deposits in the Cambrian. Vugs and solution cavities at this horizon contain siderite crystals in the partly dissolved quartzite throughout the ore, and as a vigorous growth of crystals forming the final mineral deposition often covered with sericite mud which represents the softened matrix of the quartz grains. Present development has revealed but one rather narrow channel of quartzite ore in the Tucson mine.

FIG. 3.

FIG. 4.

Limestone Ores.—The largest siderite veins and replacements in the Tucson mine occur in the 'white limestone' beds at some distance from the main Tucson fault or fissure vein, and, so far as present developments show, in the folded and sheared foot-wall country. Mr. Calkins' remarks on the Coeur d'Alene deposits apply here: "Although siderite has a much wider distribution than the ores, yet it is more abundant where the rocks have been folded and fissured." To this I add, to cover Leadville occurrence, *adjacent to porphyry intrusions.* Very often one wall of a fissure deposit is found to be gray porphyry, while practically the whole siderite development in the limestone to date occurs

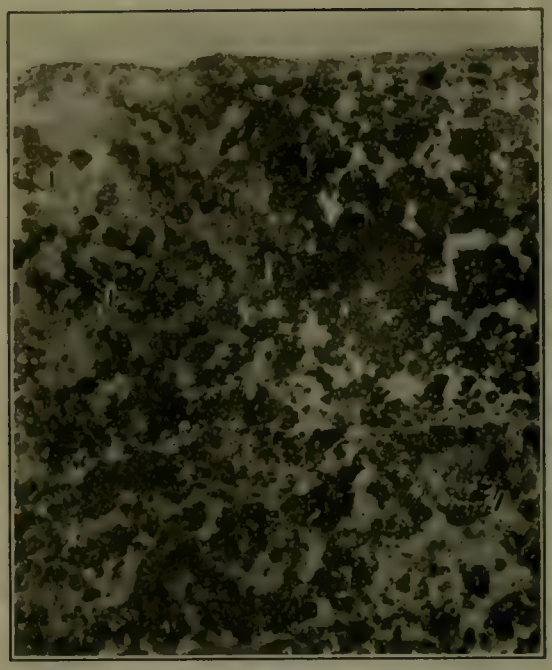


FIG. 5.

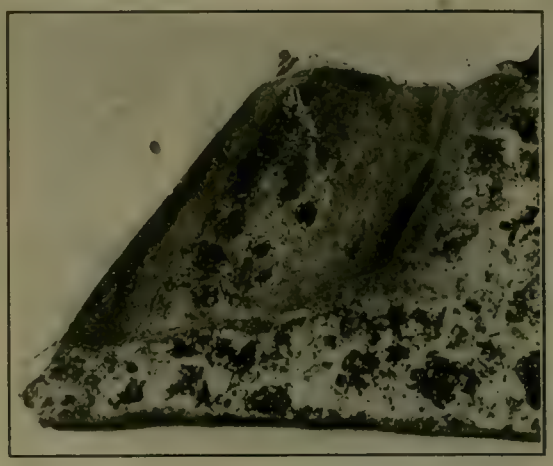


FIG. 6.

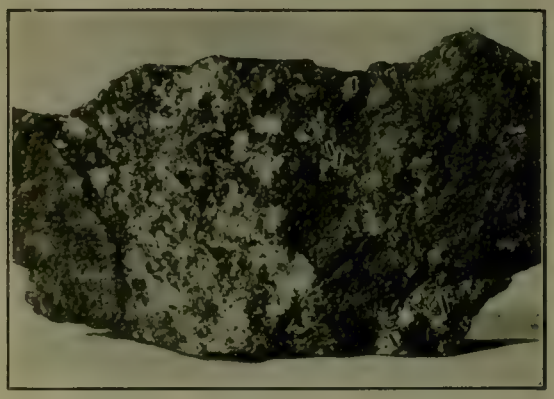


FIG. 7.

below the great sheet of intrusive gray porphyry previously mentioned. Occasionally the zinc-lead ores form on a porphyry wall, but more often a band of solid siderite adjoins the porphyry. Again, it may be slaty limestone crushed, contorted, and partly chloritic. As a rule, the zinc-lead ore occurs free from gangue or other contamination, not even intermixed with siderite. Such ore is broken down separately, the waste sorted out at surface, and the ore shipped for pigment manufacture. This zinc-lead ore, an intimate mixture of zincblende, galena, and pyrite in lesses quantity, low in silver, and of fine steel-like fracture, is not common in Leadville. It is of the variety first called 'blue stone'

FIG. 8.

ore in Parys Mountain mine, Anglesea, Wales, and later found in some quantity in the Ovoca mines, Ireland.[6] A similar ore occurs as a quartzite replacement in the Sullivan mine near Cranbrook, British Columbia.[7]

The Tucson zinc-lead ore is of somewhat coarser grain than the 'blue stones' referred to, yet I have not noticed coarse crystalline galena in any of the Tucson siderite repacement ores in the Silurian limestone, while invariably coarse crystalline galena is the more common form in the blue limestone 'first contact' replacement deposits. It is noteworthy that while in the orebody the zincblende and galena minerals are intimately mixed, yet in the massive siderite they occur as disseminated crystals of apparently pure minerals.

Toward the edges of the zinc-lead replacement deposits both pyrite and siderite sometimes occur as shown in Fig. 5; the dark mineral is zinc-lead; the dull white, siderite; the scattered clear white pyrite (1), which is somewhat abundant near top left-hand corner. The specimen is from 5th level, Tucson mine, enlarged two diameters. The fissure shows evidence of reopening and of considerable movement, breccia is common, and striæ and slickensides are abundant, as is also slaty limestone developing chloritic minerals and but partly replaced.

Fig. 6 is a typical example of brecciated ore. The main piece shows at the bottom and right zinc-lead ore in siderite gangue. The piece at the left, molded into position by pressure, is slaty limestone, highly siliceous and partly replaced. The black is zinc-lead ore surrounded by siderite. The bright white near the top at the left-hand corner (1) is pyrite. Separating this rock from the larger is a seam of chloritic shale, which also forms the outer, left-hand edge of the specimen. Magnetite is common. A little hematite and specularite is also found in close relation with siderite.

Fig. 9.

Fig. 10.

Fig. 7 is a very instructive specimen. A small veinlet of siderite (white) is shown in a gangue of magnetite. The left side is magnetite and sandy hematite, while the right is chiefly magnetite through which fine pyrite is scattered. The white spots at the right of the siderite veinlet (1) are pyrite. A similar specimen cut and polished showed under the microscope an independent and apparently simultaneous growth of siderite and magnetite; also some specular hematite. The outline of the minerals is clear and the edges free from alteration.

Fig. 8 illustrates an occurrence of massive siderite in the white limestone, the same being the contact-metamorphic deposit shown in section in Fig. 2. The view was taken on the 5th level, P drift. The black, lower right-hand corner, is zinc-lead ore; the rest is massive siderite with a streak of low-grade ore running through it. The geology of this contact-

[6]Argall, P., *Sci. Proc.* Royal Dublin Soc., 1879, p. 225.
[7]Argall, P., 'Report of Zinc Commission,' cited, p. 230.

metamorphic replacement of white limestone is clearly shown in Fig. 2, a cross-section made by Frank A. Aicher, surveyor for the Iron Silver Mining Co. The section follows the stoping quite closely, the faces mostly representing the limit of profitable ore rather than that of zinc-lead replacement, the irregular outline of which could not be clearly shown on the small scale adopted. The orebodies are practically enclosed in vein siderite which gradually merges into the limestone, fading away at about 80 ft. from the porphyry. The siderite carries about 18% silica, and silicification of the limestone extends for over 100 ft. from the porphyry intrusion, indicating a highly silicious emanation of moderate temperature.

The source of the 'black iron' of Leadville, or rather of its manganese content, has long been a subject of discussion. I have elsewhere traced the source to the siderite bordering the orebodies.[8] When it is considered that the great mass of siderite underlying the zinc-lead ore shown in Fig. 2 will assay about 22% iron and 18% manganese, the source of the oxidized 'black iron' of Leadville is placed beyond reasonable doubt. The siderite replacement deposits in bedded form or extending out from fissures as 'flats' are extensive in the Tucson mine, sometimes carrying pay-ore, over 60 ft. from the fault fissure and siderite replacement of limestone to 100 feet.

Fig. 9 is a view in a stope 100 ft. above the 5th level. It clearly shows the arrangement of the ores. A peculiarity of these siderite replacements in the white limestone is the presence of chalcedony and whitish chert bands in the ore. Flints have apparently been dissolved and redeposited or partly dissolved and included in amorphous quartz. In Fig. 9 the chalcedony bands follow the original bedding; *c* is chalcedony, *o* zinc-lead ore, *s* siderite.

Fig. 10 shows a pillar left in an old working ('Highline' stope) about midway between the 4th and 5th levels. The chalcedony *c* is segregated. The roof is a bed of siderite, *s*, freely sprinkled with galena and blende in distinct crystals of high assay value. The pay ore *o* is mixed zinc-lead previously described. A candle is shown on a small chalcedony lens of great purity. A seem of pyrite *p* is marked by the pick and extends to the lowest visible bedding plane. I consider Fig. 9 and 10 splendid examples of limestone replacement, showing alternating beds (Fig. 10) of pyrite, of siderite slightly ore bearing, of zinc-lead ore with included chalcedony lenses, and a smooth bedding plane for the roof. The pay-ore is small but ample to illustrate the manner of deposition.

FIG. 11.

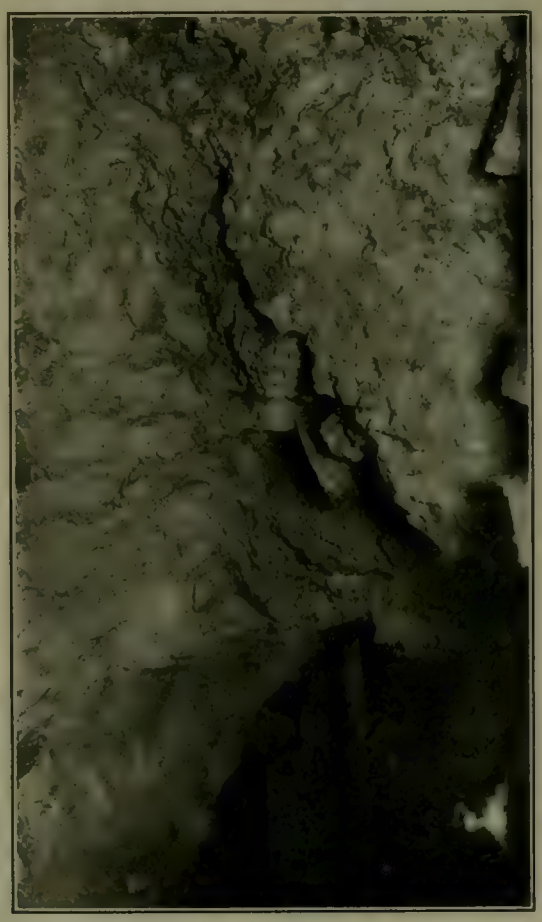


FIG. 12.

Fig. 11 is the face of a drift in a siderite replacement. The beds here are massive and quite hard. From the top of pick to the roof is solid steel-grained zinc-lead ore. From the same point to the floor, is massive fine-grained siderite, oxidized on faces and stained yellow. The white patches represent crystalline siderite enclosing zinc-lead ore (black). This drift is just entering the pay-ore after penetrating siderite beds for about 50 ft. The Tucson fault is about 50 ft. to the right.

[8] *The Mining Magazine*, April 1914, p. 287.

Fig. 12 from the 4th level Tucson shows a brecciated vein mostly crushed zinc lead ore cemented by siderite. This brecciated ore occurs in the blue limestone 15 ft. above the part ing quartzite and on the 'foot wall' side of the Tucson fault, or fissure vein, the hanging is a sheeted zone of shaly limestone seamed with fault clay containing breccia and pebbles of hard limestone and quartzite with occasional pieces of zinc-lead ore and much decomposed porphyry.

From about 30 ft. below the 4th level to 50 ft. above (the present extent of these stopes) the Tucson fault is a typical fissure vein, exhibiting alternating bands of zinc lead ore and siderite as replacement of the foot wall limestones, both the white and the blue formation. Fault clay forms the hanging wall with a sheeted zone of clay seams, shaly limestone, and decomposed porphyry extending 10 to 30 ft. into the hanging wall country. In places the vein is brecciated, Fig. 12 showing movement after ore was deposited. The fault is still moving. At other points thin beds of hanging wall limestone have been drawn into the fault zone, folded, crushed, and replaced, wholly or in part, with zinc-lead ore and again folded or fractured by further movement and pressure.

The Tucson fault fissure is not continuously mineralized. It is barren where taley clays predominate as filling, and is usually quite dry in such places. The ore occurs in shoots, not yet well defined, because of limited development. Lastly, fine-grained zinc-lead ore occurs everywhere in the vein and in the adjacent foot-wall country deposits, but in several localities below the 5th level large deposits of copper ore occurred in and near the fault fissure, but no copper has been found to extend much above the 5th level.

Conclusions

1. Siderite replacement deposits in Leadville are of wide extent and of great significance in the future development of the district.

2. Siderite in Leadville primary deposits is of high manganese content, a true vein siderite, the principal source of manganese for the oxidized ores ('black iron') long a subject of geologic speculation and fruitful of discussions.

3. Siderite replacements are closely associated with intrusive gray porphyries, faults, and folded and sheared limestone. Siderite was one of the first minerals deposited in the fissures. It was also the last, and was present during the whole vein-forming period.

4. Siderite and sulphides are closely related, and doubtless of similar origin, being derived chiefly from intrusive porphyry emanations and deposited together in massive contact-metamorphic replacements. Siderite and sulphides have also been introduced through deep-seated fissures such as the Tucson fault, and may have been, in smaller part, derived from the Silurian sedimentaries through minor fissuring.

5. The Tucson fault preceded ore deposition in the Cambrian and Silurian formation and is older than the normal faults of Leadville.

6. The Tucson fault is coincident with the gray porphyry intrusion of Iron Hill.

Coal production of Colorado in 1913 was 9,232,510 short tons, worth $14,035,090, a decrease of 1,745,314 tons and $2,310,246 compared with 1912. This drop in output was due to the strike which has caused so much loss of life, discussion, and investigation.

Carbide Lamps and Explosives

Gas and dust was the cause of explosion which resulted in the death of Frank Hora at the Wheeling Creek mine of the Lorain Coal & Dock Co. on January 27, 1914. It was at first supposed that the residue from carbide lamps had caused the explosion; some of this residue was found in break-through 5, about 150 ft. from the centre of the explosion. As a preliminary, pending the investigation, a temporary order was issued forbidding the miners of Wheeling Creek mine to use carbide lamps. The local union passed a resolution demanding a thorough investigation, and refused to go to work unless allowed to continue using carbide lamps. In the meantime, chief mine inspector Davies, deputy inspector Gaffney, together with safety commissioner of mines, J. M. Roan, of the State of Ohio, aided by other deputies, officials and engineers were making a searching investigation. It was soon demonstrated that as the residue left by the carbide lamps is merely slaked lime it could therefore not be considered as a cause, and it was proved conclusively that even had there been fresh carbide in the break-through, it could not have had anything to do with the explosion, as the break-through was dry. Carbide will not give off sufficient gas, when exposed to the air, to cause an explosive mixture or an ignitable mixture unless brought in contact with actual water. The moisture in the air is not sufficient to make enough acetylene to ignite. There can never be an accumulation of gas produced from carbide by moist air, for the obvious reason that in order to produce gas, any air which has given up its moisture to produce acetylene must move on, and the acetylene goes with it. An investigation of the place where the carbide residue was found showed that as a matter of fact, this residue was shut off from the butt entry in which the explosion occurred by a substantial brattice, the residue being found within 3 ft. of the adjoining butt entry in break-through 5, and as before stated with a brattice between it and the butt entry in which the explosion occurred. The order prohibiting the use of acetylene was rescinded. J. W. Paul, of the U. S. Bureau of Mines, supplemented the investigation.

Fluorspar production of the United States in 1913 was 115,580 tons averaging $6.37 per ton, a small decrease compared with 1912. About 80% of the domestic output of fluorspar is consumed as a flux in basic open-hearth steel furnaces. It is used also as a flux in blast furnaces, iron foundries, and silver, copper, and lead smelters; in the manufacture of fluorides of iron and manganese for steel fluxing; in the manufacture of glass, enameled, and sanitary ware and of hydrofluoric acid; in the production of aluminum; and for many other purposes, according to the U. S. Geological Survey.

Manganese ore production of the United States in 1913 was 4048 tons. Imports were 345,090 tons.

FIG. 1. DISTILLATION FURNACE BUILDINGS, NATIONAL ZINC COMPANY.

The National Zinc Company, Bartlesville

By E. H. LESLIE

The smelter site of The National Zinc Co. is about 100 yd. to the east of the Bartlesville Zinc company's plant. Topographically the site of the National company is almost identical with the Bartlesville plant, being a level tract of land with a few slight depressions which are being used as dumping ground for retort residue. This Company is controlled and operated by Beer, Sondheimer & Co. and is the most modern of the Bartlesville group. The halftone, Fig. 1, and the sketch, Fig. 2, published through the courtesy of W. H. Gill, superintendent of the smelter, show in a general way the arrangement of the various buildings and character of the construction.

The zinc concentrates, which are being treated at this plant, are derived largely from the mills of Joplin, Colorado, Utah, and Butte. The concentrates are delivered at the plant in standard freight cars and unloaded by hand into storage bins at the ore house. There are 61 storage bins at the smelter with a capacity of 15,000 tons of concentrate. The concentrate is removed from the bins in buggies and taken to the dryers where it is dumped into the boot of an elevator and thus to the feed hoppers of the dryers. The dryer equipment consists of four 30-ton circular dryers of the same type as those used at the Bartlesville plant, the concentrate being fed at the centre of the furnace, is forced across the hearth by the four revolving rabble arms and discharged at the periphery. The power for the dryers is furnished by a 30-hp. Western Electric motor operating on a 220-volt, 115-ampere circuit. The dried concentrate is crushed by the usual Blake crusher and rolls, the material from the crusher going to a ¼-in. trommel screen and the oversize being re-crushed in a set of rolls. The dried product is elevated and conducted by bucket elevators to the feed bins of the roasting furnaces.

The roasting equipment consists of one 20-ton double hearth furnace, two 25-ton, and one 30-ton Zellweger furnaces. A brief description of the Zellweger furnace was presented in a previous issue.* The power for the furnaces is furnished by individual Hawthorne and Western Electric motors, a 40-hp. motor being used on the double hearth furnace and 30-hp. motors on the 30 and two 25-ton furnaces. The rabble mechanism is automatically controlled by a hydraulic starting and stopping device whereby one passage of the rabbles through the furnace is made about every six minutes. The feed to the furnaces is automatically dropped upon the hearth through a hopper at the bottom of the feed bins, the discharge being effected by a cam and tappet arrangement which is operated by a small motor. The 30-ton furnace is 156 ft. long while the hearth is about 16 ft. wide.

Roasted Sulphide

The roasted sulphide as discharged from the furnace contains from ½ to 1% sulphur in clean blende. This product is discharged from the furnace into hoppers and elevated by bucket elevators to brick storage bins. The roasted ore is drawn from these bins into tubs which are suspended from an over-head Sprague electric hoist and in this manner are carried to the mixing room.

The fuel used consists of coal from the Pittsburg, Kansas, field, Arkansas semi-anthracite, and coke. The fuel is delivered to the storage bins directly from the railroad cars. In the mixing room the various tubs of roasted ore, carbonate, and fuel pass over weighing scales and are dumped into the hopper of a concrete mixer. The furnace charge thus prepared in the mixer

*"Zinc Smelting at Bartlesville, Oklahoma," by E. H. Leslie, *Mining and Scientific Press*, July 11, 1914.

is dumped from the mixer into the furnace charge cars which set in a pit in front of the mixer. The charge cars are then picked up by a 12-ton capacity Sprague electric overhead hoist and carried to furnace where it is charged directly by hand into the retorts of five blocks of furnaces. In the two other blocks of furnaces which go to make up the battery of furnaces at this plant, the mixed charge is elevated at the furnaces into suspended steel storage bins from which it is drawn into the hoppers of the Saeger charging machines.

The National Zinc Co. distillation furnace, shown in Fig. 3 and 4, is of the same general type as that employed throughout the natural-gas smelting region. The furnace is four rows high and comprises 19 sections of 16 retorts each. There is thus 304 retorts per furnace or 608 retorts to the block, making the total for the smelter 4256 retorts. The length of the furnace outside of the end walls is 102 ft. 10 in. while the height from the floor to the front skewback is 6 ft. 2 in. The pitch of the retorts is 4 in. The cylindrical retorts used are $50\frac{1}{2}$ by $8\frac{1}{2}$ in. inside measurement. Blow boxes or burners through which the air and gas enter the furnace are fitted to each half-section with the exception of the last four which have but one blow box to a section. The use of two blow boxes to a section has come to be looked upon as better practice than the single blow box which is used at the older plants. By thus increasing the number of fuel admissions a more uniform heat is obtained. The furnace blocks are supplied with air by individual fan blowers by which means the maximum pressure of about 2 in. of water is maintained. A sketch showing the general arrangement and construction of the furnace is shown in Fig. 3. The fuel consumption covering everything is about 1,000,000 cu. ft. of gas per block every 24 hours.

The Saeger Machine

One of the most interesting features in the operation of these furnaces is found in the employment of the Saeger machine, a front view of which is shown in Fig. 5, for the charging of retorts on two blocks of furnaces. While mechanical charging of retorts has found favor in Europe the introduction of the Saeger machine is an innovation in American practice. The pioneer work in that country which has been conducted with the Saeger machine at the National smelter gives promise of a wider field for its use in the operation of American zinc smelters. While the conditions for the most efficient use of this machine are not found in the American arrangement of furnace blocks, it is nevertheless in successful operation at this plant and is proving a valuable adjunct to smelter operation.

An idea as to the arrangement and construction of the charging machine is obtained from the accompanying side elevation sketch (Fig. 6) and the halftone, Fig. 5. It will be seen that the machine is mounted on a truck of 11-ft. gage and consists of a hopper bin with a capacity sufficient for charging one-half of one side of a block of furnaces. The bin is supported by a

Fig. 2. National Zinc Company, Bartlesville smelter in the background.

structural steel column and bracing. The charge passes by gravity through a feeding device in the bottom of the bin and is conducted through individual pipe conduits to the eight spiral feeding devices which are so positioned as to enter and charge the eight retorts of one-half of a section of the furnace simultaneously. The machine. The operator is protected from the heat of the furnace by the iron shield seen in the illustration. In actual charging operations the charging spouts are inserted into the 8 retorts of one-half of a section of the furnace for a distance of about 44 in. or to within 5 or 6 in. of the back of the retort when the charge is forced

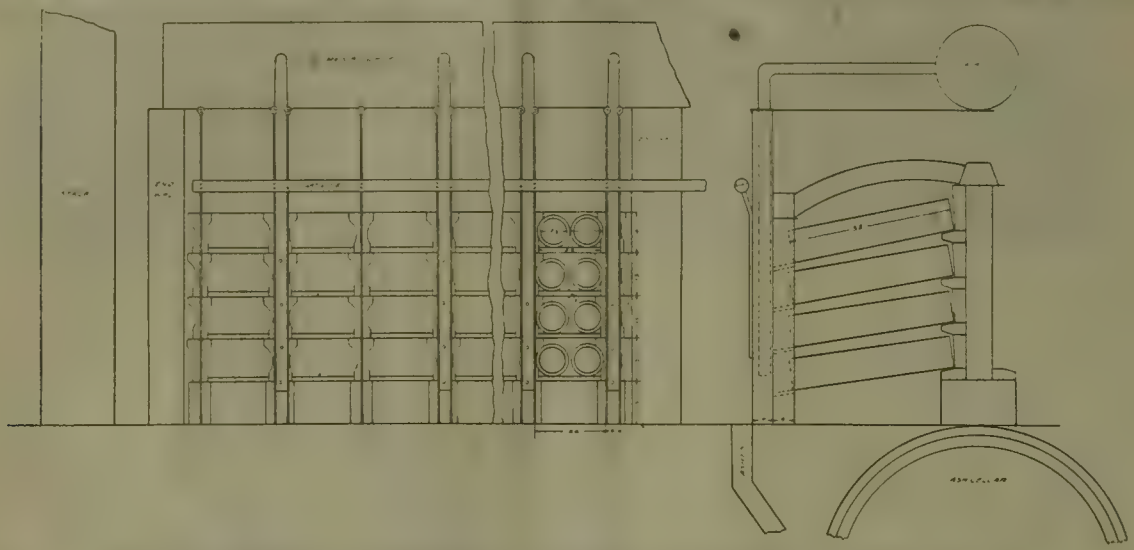


FIG. 3. SIDE ELEVATION AND CROSS-SECTION THROUGH DISTILLATION FURNACE AT NATIONAL ZINC PLANT.

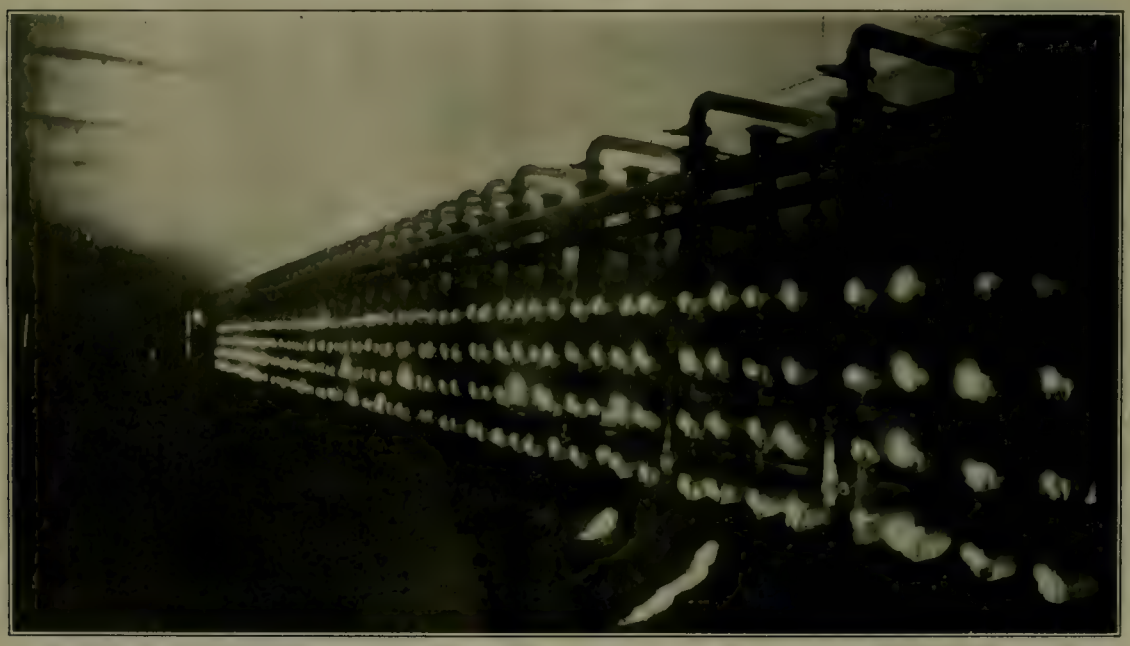


FIG. 4. NATIONAL DISTILLATION FURNACE IN OPERATION.

charging mechanism is mounted on a movable platform which moves at right angles to the trucks of the machine. This platform, with the chain drive for moving it is seen in Fig. 5. The movement is controlled by the operator who stands on an elevated platform, seen at the left of the half-tone, which platform is a part of the by the spiral feed through the spouts into the retorts. As the retorts become filled the spouts are gradually withdrawn from the retorts and when the spouts emerge from the retorts an automatic cut-off stops the feeding device. The compactness and uniformity of the charge is regulated by the operator keeping the load on the

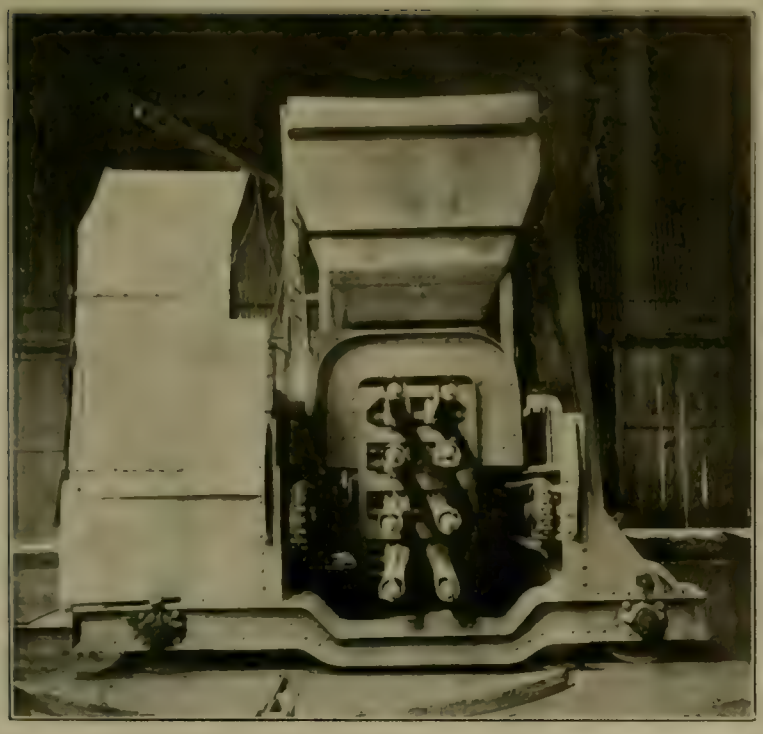


FIG. 5. FRONT VIEW OF SAEGER CHARGING MACHINE.

feed motor at a predetermined constant. When one-half of a section is charged the machine is moved forward and the operation repeated over the whole length of the furnace. Electricity for moving and operating the machine is obtained through a trolley. Since installing this machine several modifications have been made in it which include the placing of a small rod above the charge spouts for the purpose of leaving a hole at the top of the charge for the escape of the first gas that is formed in the retort. A small bucket elevator has also been added at the side of the machine by which any charge which is spilled on the floor during charging operations is returned to the bin of the machine. Blue powder is also handled by this elevator and subsequently charged. The last 4½ sections of each furnace are charged with blue powder. The machine is operated by two motors, one for locomotion and the other for operating the charging machinery. A small 2-hp. motor is used on the bucket elevators.

With the ordinary American arrangement of furnace blocks the charge storage bins which feed the machine must be placed at the end of the furnaces. It is therefore necessary to run the charging machine under the hopper of the feed bin, fill the feed hopper of the machine, move the machine to a turntable which is situated at the end and at the side of the furnace, turn the machine around 90° to bring the feed spouts into the charging position, and then move the machine down the track and in front of the retorts. Since the hopper bin on the machine will only hold sufficient charge for one half of one side of a block, it is necessary after this half has been charged to move the machine back to the turntable, transfer it to the tracks under the storage bin, re-fill the hopper bin on the machine, and again return to the front of the furnace. In European practice this difficulty, which occasions considerable loss of time, is not experienced. The blocks being arranged in series instead of parallel, the charged bins are situated at convenient distances along the front of the furnaces and when it is necessary to re-fill the hopper on the charging machine it is moved underneath one of these bins and little or no delay is occasioned. The turntable is not necessary in European practice and the cycle of operations is continuous. Even with the unfavorable arrangement of furnaces in American practice the machine has been found to possess many redeeming features, in that besides saving six men on the two blocks of furnace, in this instance it permits of the charging of from 1000 to 1500 lb. more concentrate to the side.

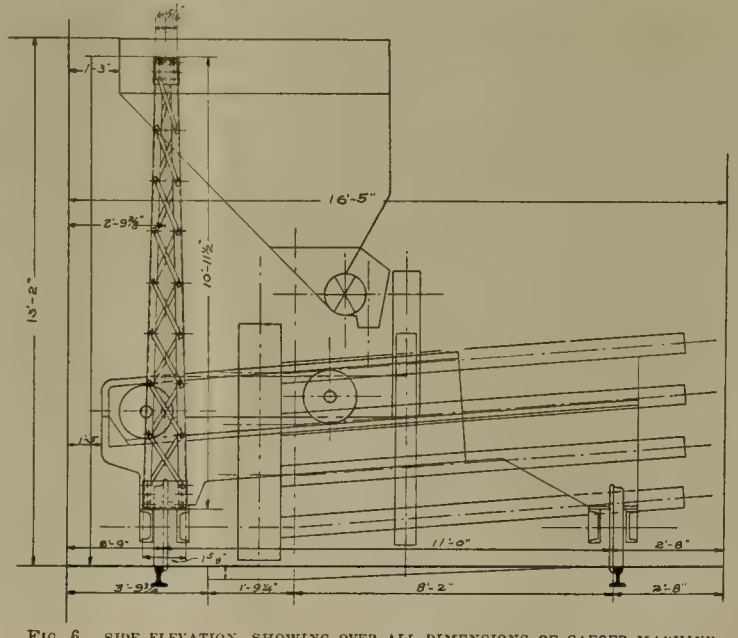


FIG. 6. SIDE ELEVATION, SHOWING OVER ALL DIMENSIONS OF SAEGER MACHINE.

and gives a more uniform charge and better results than hand charging, which is the general practice. By the use of this machine one side of a block of furnaces is charged in one hour.

The drawing of metal is conducted in the usual manner, a draw-car being used which moves over a track in front of the furnaces. The ladle is raised or lowered to position in front of the condensers by means of a hand winch, the operator being protected from the heat of the furnace by a metal shield. The zinc is drawn three times a day; at 3 p. m., 11 p. m., and 4 a. m., cast into slabs and removed to the stock pile, Fig. 7, for shipment. The average charge of roasted ore is about 15,000 lb. to the side of a block or 15 tons to the block, thus giving the plant a capacity of approximately 105 tons per day.

Water is used for discharging the retorts. A hose with nozzle is connected with the water pipe-line directly in front of the furnace with convenient taps to which the hose may be attached. In cleaning the retorts the operator is protected by means of a sheet iron shield which is suspended from a rail along which it can be moved in front of the furnace. Any slag which is not removed by the steam, which is immediately formed when the water enters the retorts, and which sticks to the sides of the retorts, is removed by means of scrapers.

Discharging Machine

In connection with the discharging of retorts, it may be stated in passing that the discharging machine which was imported simultaneously with the Saeger charging machine, was found, after a thorough trial, to be unsuited to American practice and has been discarded. The chief difficulty in the use of the discharging machine was found to be that it shook up the retorts unnecessarily and thus brought about mechanical difficulties in the operation of the furnace. With muffle retorts this machine no doubt would be a success.

The retort furnaces are of the cellar type and the residue as discharged from the retorts falls into a chute at the front of the furnace and is conducted to cars underneath. The cars are subsequently removed to the dumping ground at the rear of the furnace blocks. Some of the residue is used for railroad ballast, some dumped, and that derived from the ore, which carries silver, is either clinkered at the plant of the Bartlesville company† or shipped to the blast-furnace plants. The average life of the retorts is about 30 days, while the condensers last about 10 days.

The pottery is equipped with all the necessary machinery for supplying the plant with retorts and condensers. St. Louis clay, received at the plant in the ordinary freight cars, is dumped at the pottery building where it is given a preliminary weathering. The crushing equipment consists of a 14-in. Blake crusher, the discharge from which is elevated by a bucket elevator and discharged into the hopper of the primary rolls. The discharge from the rolls is conducted to a four-mesh screen, the undersize from which goes direct to the pottery bins, while the oversize is re-crushed in a second set of rolls and is thence returned to the screen.

Making the Retorts

The clay is pugged in a small mill from which it is removed, cut into convenient size for handling, and allowed to season for three or four days. This material is then taken to a second pug-mill and re-pugged, the product thus obtained being ready for the manufacture of retorts. The material used consists of a mixture of 1000 lb. of clay to 1250 lb. of adobe or burnt clay. In the manufacture of retorts the Mehler hydraulic press is used. This press has a capacity of 250 retorts per shift of nine hours. The retort department of the pottery is handled by five men. As the retorts emerge from the press they are taken on carriages to the dry rooms of which there are twelve. These dryers are heated by steam coils placed in both the floor and ceiling of the rooms. By this means a temperature of about 110°F. is maintained. The twelve drying rooms have a capacity of 1100 retorts each. The retorts are kept in the dryers for about 60 days before being used in the furnaces. From the dryers they are taken on cars by a 30-hp. Jeffrey locomotive to the annealing ovens which are situated at the furnace blocks and are here tempered for about 12 hr. before being put into the furnaces.

Fig. 7. Spelter stock piles.

The condensers are made of a composition of one-half clay and one-half crushed old retorts. The material is mixed and pugged in a small pug-mill and subsequently molded in a Vannatti condenser machine. This machine is operated by two men and has a capacity of from 1000 to 1200 condensers per shift. The condensers as taken from the machine are allowed to stand for a day and are then crimped; this operation consisting of shaping the base of the condensers to conform with the retorts. They are then dried for about a week and burnt for use at the furnaces. The burning requires about 26 hr. The kiln used for this purpose has a capacity of 2500 condensers.

The boiler room equipment consists of three 72 by 18-

†"Zinc Smelting at Bartlesville, Oklahoma," by E. H. Leslie. *Mining and Scientific Press*, July 11, 1914.

ft. horizontal return-tube boilers, built by the Frost Manufacturing Co., for a steam pressure of 125 lb. per square inch, which supply steam to the engines operating the electric generators, and one 72 by 18 ft. boiler of the same type built for 100 lb. pressure per square inch, which is used for dry room service. The boiler feed water is supplied at a temperature of 190 F. by a Blake 7½ by 5 by 6-in. pump.

The generator equipment consists of three units arranged as follows: One 18 by 36-in. St. Louis Corliss engine direct connected to a 200-kw., 250-volt, compound-wound direct-current Western Electric generator operating at 120 r.p.m.; one 16 by 19-in. Chase 4-valve engine, direct connected to a 125-kw., 250 volt, compound-wound, direct-current Sprague generator operating at 190 r.p.m., one 15 by 14-in. Skinner engine, direct connected to an 80-kw., 250-volt, compound-wound, direct current Western Electric generator, operating at 300 r.p.m. The switchboard consists of four 24 by 84-in. panels of blue Vermont marble, equipped with circuit breakers and Weston and Keystone instruments.

This plant is the most modern of the Bartlesville group of zinc smelters and the work being done is most commendable, from both a mechanical and metallurgical standpoint. While details as to charges, costs, and exact metallurgical results are not available for publication, the plant is extracting about 85% of the zinc content of the concentrates treated and as long as gas is available in the district and there is a market for spelter, will be operated profitably.

An Impression of the Rand

We give herewith a portion of letter recently received from an Anglo-American mining engineer known to many of our readers and recently on a short visit to Johannesburg:

"The Rand is certainly a great goldfield, and shows no sign of failing as a large factor in the world's supply of gold. There is a tendency, of course, for the original outcrop mines to play out, signs of this fact are demonstrating themselves fairly rapidly; on the other hand, the deep-level mines of the East Rand are showing up very well. Recently the State has had a hand in gold production of its own, and the experiment is being watched with interest.

"There is very little doubt that there are large areas in the East Rand district that remain untouched, but attention has turned that way, and it seems probable that one by one there will be new mines developed, and in the course of a few years the production will move from the Johannesburg district to the East Rand. The Modder 'B', Modder Deep, Brakpan, and Van Ryn Deep all have a life of from 20 to 50 years.

"The predominating factor in the success of the mines is the labor condition, to which is closely allied the political; in fact, it is difficult to talk about one without bringing in the other. The Boers are the real owners of the country as much today as before the war. They are, however, divided into two factions, the old pig-headed type headed by Hertzog, whose only desire is to drive everyone out of the country that wants to do anything except sit on the *stoep* and smoke, the more sane and ambitious faction being led by Botha, who is kept 'on the fence' with the *backveldter* on one side and the mining interests on the other. Then there is the English party, or mining interests, with Merriman as an offshoot with a small coterie which looks after the interests of the colored people other than the kraal 'nigger'. Last, but not least, is the Labor party, which is being led at the present time by disgruntled failures in mine management, such as Cresswell, Poutsma, and others. This is a strange mixture to form into a sane and constant government to work for the best interests of the premier industry of the country.

"Mining has always been the 'bone of contention' in Africa, and it looks as though it will remain so in spite of the fact that a bloody war has been fought over it. It seems to have done little good toward the permanent peace of the country, the only difference being that the flag of another country flies over Government House, and a few Dutchmen have got titles.

"The supply of Kaffir labor is short at the present time by 40,000 boys, in spite of the fact that the last three years have been very dry; indeed, the one word that is on everyone's lips is 'drought'. This condition should have forced the native from the kraals to the mines, and undoubtedly it has, but still the supply of labor is scarce. It is easy to foresee what will happen when the cycle changes and there are several wet seasons favorable to the native's natural agricultural instinct. This same drought condition has also forced many young Dutchmen to the mines, as there is no work on the land.

"White labor is making itself impossible, and forcing itself out of the mines by its own foolhardiness. It is being replaced, selected natives of intelligence being given jobs other than common labor which were formerly held by white men. This is the natural outcome of the tyrranical behavior of the labor leaders.

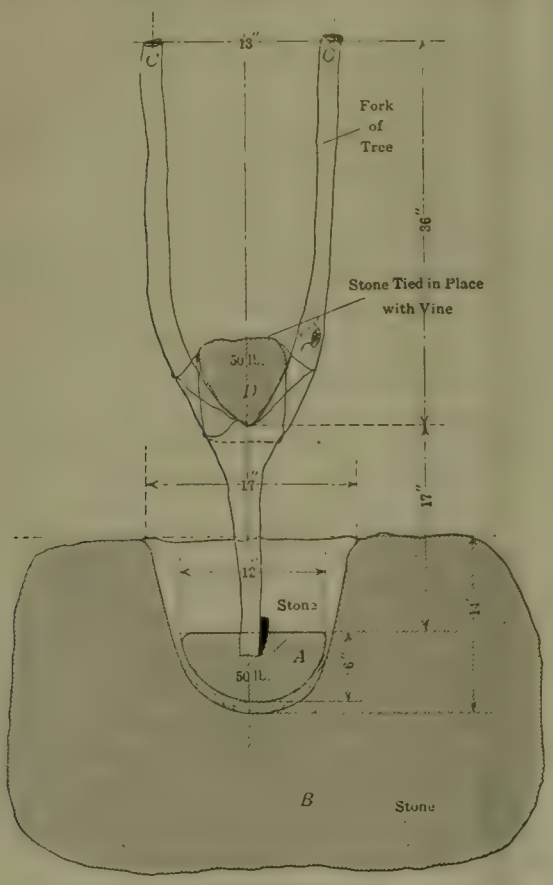
"Merriman is raising the 'color bar' question, and there is little doubt that before long, with or without favorable legislation, the 'tar-brush yellow' or half-breed mechanic of the Cape and Natal will find employment in the mines, replacing the pure white at lower wages and less trouble to the mine-owner, at any rate for the time being.

"While it is necessary for this condition to come about, one has to pause and look ahead a few years for the result of such a policy, and the only conclusion that can be arrived at is that the educated colored man will be supreme in Africa."

A Crude Method of Disposing of Cyanide Slag

By ARTHUR FEUST

In some recent work in Central America I had to solve the problem of disposing of a small quantity of cyanide slag, and the Latin-American *molinette*, shown in the accompanying sketch, was suggested to me by my native foreman. It was finally adopted as the cheapest and most efficient method under the circumstances, freight to San Francisco, California, costing $76 per ton. These molinettes are used by the 'high-graders' to recover the gold from stolen ore. The base or bowl of the



THE MOLINETTE.

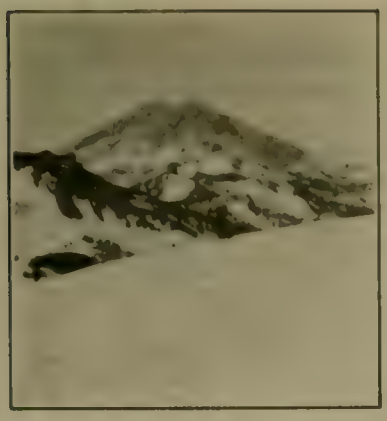
molinette, as shown in the illustration, is made in a hard, close-grained rock which is hollowed out by fire and cooling with water to crack the rock, this being repeated until a sufficient depth has been attained. The rough or projecting parts are then trimmed up with a chisel. A fairly round stone, *A*, is selected for the head, and a hole drilled in its upper side to receive the fork, *C C*, which is wedged into place. To the fork an extra weight, *D*, is fastened by the aid of vines. In order to smooth the bowl, *B*, fine gravel is used with a little water and the molinette is operated for a day or two in this way until it has become polished on the inside.

The molinette is operated as follows: first the slag is broken down to pass a No. 10 screen and, for the size molinette illustrated, five pounds of slag forms a charge. Just enough water to make a thick paste is added, since if excess water is used the operation is delayed, as with a thin pulp in a tube-mill. Quicksilver is added according to the richness of the slag. The operator then puts the head *A* into the bowl on top of the slag, water, and quick, and grasping the ends of the fork *C C* begins to revolve the head, *A*, at the same time giving a rolling or twisting motion so as to smear or brighten small shots of metal. After the slag becomes slimed a trifle, some more water is added, then the slime is washed away and the coarse particles reground until the entire quantity of slag is slimed. When the amount of slimed slag in the bowl becomes small the entire mass is scooped up with a piece of dry gourd into a Russia iron pan and covered with cold water to congeal the warm amalgam. The rest of the slime is then washed off and the remaining amalgam squeezed dry. It is now ready for retorting.

I have had one of these molinettes made for a sum in Nicaragua equivalent to $8. One hundred pounds of slag can be cleaned up in a day, using two men, one to treat the slag and one to work the molinette. The slag in question weighed 600 lb. and the bullion recovered was worth $379.89. The slag discharged was assayed and found to be worth $25.03 gold and $2.78 silver per ton, or a total of $28.41. Bullion thus recovered is free from the metallic iron which is present after regrinding in an amalgamating barrel.

THERE ARE 15 coke-making establishments in Colorado, which operate 3588 ovens, all of the beehive type. Six of the establishments, operating 726 ovens, were idle throughout the year. In addition to these idle plants, 980 ovens were idle at plants that made some coke in 1913, so that the total number of idle ovens was 1706, representing nearly half the coking capacity of the state. No new ovens were under construction at the end of the year. The output of coke in 1913 was 879,461 tons, valued at $2,815,134, according to E. W. Parker, of the U. S. Geological Survey. The decrease as compared with 1912, amounting to 93,480 tons in quantity and $228,860 in value, was due entirely to the labor troubles among the miners, and not to adverse trade conditions. The principal disturbances were in Las Animas county, the leading coal-producing and coke-making county, and resulted in a decrease in coal production of nearly 1,000,000 tons and in the whole of the decrease in the output of coke.

DUTY of the Oroya Links 50-stamp mill at Kalgoorlie in 1913 was 7.9 tons per stamp-day. Ore treatment cost $2.05 per ton, the extraction being 92.25%, and residue average 44c. per ton.



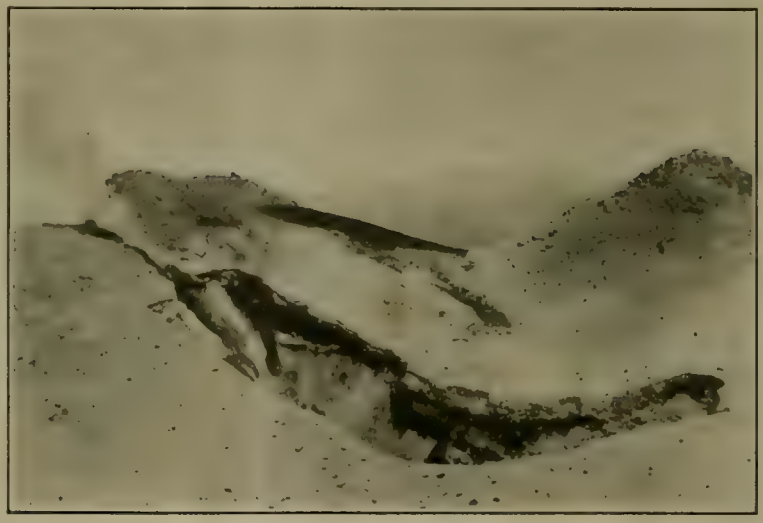
The Eruption of Mount Lassen

By WILLIAM H. STORMS

The recent renewal of volcanic activity at Mt. Lassen, in Shasta county, California, has attracted much attention from scientists, engineers, geologists, summer tourists, and others, many of the more venturesome climbing the steep slope of the ancient volcano and gazing down into the ugly pit near its summit, that now constitutes the so-called crater. Some have contended that it is not a volcano at all—merely a geyser. Having personally visited the mountain, inspected the crater, and examined the material thrown from it, and escaped without damage, I am compelled to say that the recent explosive antics of Mt. Lassen in no sense resemble a geyser. While it is true no fresh lava has, as yet, been ejected by this, the newest volcanic vent in the United States, the demonstration, in my opinion, is distinctly that of a volcano—in embyro, perhaps, but a volcano, nevertheless.

What has recently actually taken place at Mt. Lassen is easily described. In the latter part of May last a moderately heavy shock was felt by the inhabitants of that sparsely settled region. On May 30 the report was published that a forest ranger on duty in the Lassen region had observed a fissure near the summit of Mt. Lassen from which a large volume of steam was being emitted. A day or two later there were reports that a crater had formed from which ashes and lava were being ejected. Several eruptions occurred, some of them of spectacular proportions, and notwithstanding the frequently repeated statements published that it was only a geyser, it became evident to those who could see the mountain, even from a distance of 100 miles, that something very unusual was in progress. On Sunday morning, June 14, the volcano had quieted down so that little, if any, steam was visible from a distance, and a number of faithful watchers who had been patiently waiting for an eruption, had about given it up as a hopeless vigil, when, without any warning whatever, at 9:45 o'clock, a huge black cloud burst from the summit of the mountain, ascending to great height and then spreading out like an immense mushroom. In a few minutes the dust-cloud and the heavier gases began to descend, and these soon enveloped the entire mountain and the surrounding region within a radius of 4 to 5 miles, and dust settled to the southward and southwestward to distances as great as 7 to 10 miles. On the evening of the same day, at 6:30 o'clock, a second but smaller eruption occurred.

The following day I went to Mineral, in Battle Creek meadows, and for several days thereafter explored the region on the south and southwest sides of Mt. Lassen. Finally, on June 20, I with three other men, with saddle-horses and pack animal, rode to within 3000 ft. of the foot of the trail leading up the steep slope of Lassen on the south side. A small cloud of steam was observed at intervals issuing from a fissure amid the rocks, far up the mountain side, and as we learned subsequently, 2000 ft. southeasterly from the main vent. When the sun had melted the snow sufficiently to make walking safe, we started for the crater, 2000 ft. above us and nearly 1½ miles distant. Arriving at the summit, the crater was seen on the opposite slope of an amphitheatre-shaped basin, and about 700 ft. distant. It had greatly increased in size over the dimensions given in the early reports. I found it to be about 650 ft. long, 100 to 150 ft. wide, and 100 ft. or more in depth. While its width is being constantly increased by the caving of the walls of the crater, the depth is being diminished from the same cause. It looks like a big open-cut, or glory-hole, and a miner watching the ground surrounding the vent would say the ground was working. Cracks could be seen on the surface about the crater, extending back from the rim from 100 to 200 ft., and it would seem that this moving mass must eventually all fall into the crater.



THE CRATER OF MOUNT LASSEN.

It was evident that a new fissure had formed extend-

ing from near the summit of the mountain in a southeasterly direction for nearly half a mile—how much farther I do not know, as there was at that time no visible evidence of it on the surface beyond the limits mentioned. This fissure undoubtedly extends to great depth, and is a conduit for steam generated far down below the surface. It may be that a mass of molten rock exists below, which, coming in contact with water, generates the steam which follows the line of least resistance, the open fissure, to the surface. When clogged at the surface, the steam and sulphurous gases accompanying it, being unable to freely escape, accumulate until there is sufficient energy developed to blow out the obstruction. This resulted in the formation of a small pit, described by the forest ranger as being 40 by 25 ft., and only a few feet deep. The crumbling walls of this cavity caving into the pit, once more sealed the vent, when a second blow-out took place, enlarging the hole. Again and again this process was repeated until the two eruptions of Sunday, June 14. By June 21, the day on which I saw the crater, it had been enlarged by these repeated explosions to a hole 650 ft. long and over 100 ft. wide.

When at the summit, Mt. Lassen is seen to be a cluster of four peaks. At the highest point of the southeast peak of the four forming the main summit mass, is situated the observatory of the Forest Service. This building was used as a watch-tower by the forest rangers. The observatory is well ventilated by the holes made by the falling rocks thrown out of the crater. The disposition of the several peaks and their connecting ridges forms an amphitheatre-shaped basin, the sloping floor of which is from 100 to 200 ft. below the surrounding ridges and peaks. The new crater lies along the northerly side of this depression, extending from near the summit of the northwesterly peak in a southeasterly direction to the saddle connecting the northeast and southeast peaks. The new vent cannot be seen from any point outside of this crater-shaped basin, as there is no other mountain near that is sufficiently high to permit one to look into the basin.

It has been reported that flames and molten lava have been seen at the crater. This is untrue, or was up to June 21. There were icicles hanging in festoons along the north rim of the pit on June 21, and the only evidence of heat was where the steam was slowly rising from each end of the rift, the central portion having been filled in by the caving of the walls. Sulphur was being deposited on the rocks adjacent to the steam vent, and sulphurous gases could be detected all over the mountain-side, though this was no doubt in part due to the smell of the damp sand that had been thrown out from the vent.

Lassen peak is of volcanic origin, and so are all of the mountains and hills within many miles of it, many of them being, like Lassen itself, extinct craters. To the westward about 5 miles is a rugged peak known as Brokeoff mountain, that has every appearance of being a portion of the rim of an ancient volcano that must have been very much higher than Mt. Lassen now is. What was probably the central part of this old crater is indicated by the two solfatara called Soupan Springs and Bumpasses Hell. From this vicinity the rocks dip away on all sides as from a central vent. The Cinder Cone is 11 miles a little north of east from Mt. Lassen. It has the distinction of having been the last eruption of volcanic rock to have occurred in the United States. Just when that eruption occurred is not positively known, but is placed at from 100 to 200 years ago. Whether the present disturbance at the summit of the dominant peak of the region will result in a flow of molten lava, I am unable to predict, though such an eruption would be in no way surprising.

The Lassen Peak region is one full of natural beauty. There are grand forests of pine, fir, tamarack, and other trees; bright streams teeming with fish; there are hot and mineral springs; geysers, lakes of boiling mud; sulphur deposits; great faults; fields of basalt, andesite, and tuffs. In short, it is a paradise for the geologist, the hunter, the fisherman, or the scientist in search of a volcano, either old or new. I have but one word of advice to offer: If the mountain is steaming, it is fairly safe to climb up and look at it; if it has ceased to steam, it may be extremely dangerous to approach the crater, for it may explode without a moment's warning, and the region of the crater would then be a most uncomfortable place, for, if not hit by flying rocks, the poisonous vapors and gases would quickly asphyxiate anyone who may be enveloped by them.

Gold Production of Siberia

The eight Russian gold-smelting laboratories produced in 1913, 106,901 lb. troy of 'schlich' gold (crushed gold ore), which yielded 104,155 lb. of pure gold equal to 1,249,860 oz. In 1912, the production of these laboratories amounted to 100,290 lb. of schlich gold, yielding 97,828 lb. pure gold. In 1912 the strike at the Lena goldfields had considerable influence on the output of the district. The increase in 1913 was due entirely to the activity of the Bodaibo laboratory, which produced about 7200 lb. more than in 1912.—*Daily Consular Report.*

GOLD OUTPUT of the Consolidated Mines of New Zealand, at Reefton in the South Island, were as follows in April:

Mine.	Tons.	Yield.	Cost per ton.
Blackwater	4,283	$38,000	$4.80
Progress	3,470	21,000	4.48
Wealth of Nations	2,080	14,000	4.56

A CORRECTION.—In the article upon 'Flotation Tests at Mt. Morgan' by William Motherwell, printed June 27, it should have been stated (page 1046) that all samples had been dried before being tested by the *cyanide* process; also that the grading tests showed the finest grade of ore as well as finest grade of concentrate was richest.

DISCUSSION

Readers of the MINING AND SCIENTIFIC PRESS *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Solution Control in Cyanidation

The Editor:

Sir—I have not hitherto joined in this discussion because, being situated so far away as Central America, I thought my contribution would be stale before it could reach your readers, but since I notice in your issue of March 7 that my name has been brought in I think I ought to offer some comments.

It seems to me, first, that the controversy between Messrs. Allen and Colbath has been needlessly confused owing to that common mistake, a failure to define terms. They both use the expression 'direct titration', and yet each is thinking of a different reaction which gives entirely different results, and both writers are probably right from their own points of view.

I may say that I am in agreement with Mr. Allen in his contention that the silver nitrate titration to yellow opalescence with KI indicator is useless as a measure of the 'free' cyanide content of a working solution containing zinc, because, as he rightly observes, if the protective alkalinity is fairly high, (in my experience from 0.06 to 0.08% in terms of NaOH) the reading so obtained will coincide exactly with that of the so-called total cyanide shown by titration to the same yellow end point after addition of excess of caustic alkali.

On the other hand, I agree with Mr. Colbath in thinking that in defense of a large number of cyanide workers, among whom I number myself, a protest is due against Mr. Allen's unkind assumption that the method he criticises is in universal use, and that up to the time he published his article we have all been accustomed to consider our total cyanide as being the free cyanide content of our working solutions, or at least that we have been hopelessly at sea with regard to what that free cyanide content really was. I admit that the method in question is widely used, and I think with him that it may be responsible for many of the curious experiences we read of from time to time, but it is certainly not universal. My own practice during the 20 years in which I have been connected with the process has invariably been, except in the absence of zinc, or in the presence of much copper, to titrate for free cyanide without KI indicator, using the first faintly visible white opalescence as the end point, and this is the practice of many independent workers of my acquaintance.

Mr. Allen asks, rather incredulously, what is the compound of zinc and silver nitrate responsible for the opalescence. I have no personal data to offer on this point, but it is usually considered to be due to a precipitation of the zinc originally held in the solution as double zinc cyanide. It would presumably be cyanide of zinc, unless ferrocyanide be present in which case it would be zinc ferrocyanide. It is not considered to be silver owing to the fact that it appears long before the formation of the yellow iodide of silver. It becomes visible at a definite stage of the titration, and though Mr. Allen and Mr. Clennell, among others, have not been able to make use of it, it yields results of considerable precision in the vast majority of the cases that have come under my observation. I admit, however, that it needs care and practice to distinguish this end point as it is not nearly so easily seen as the yellow silver iodide reaction. Moreover, for a person passing from one mine or mill to another it is often necessary to practice afresh with, say, a dozen titrations, before precision is attained, owing to differences both in the light and in the composition of the solution. In spite of all this, an ordinary solution man unaccustomed to the method will in a couple of days be able to check his own readings within 0.004% KCN.

Mr. Allen may object that, even granting that there is a definite end point, which he personally has not been able to discover, no one can say that this point indicates free cyanide, or indeed has any significance whatever. Well, I suppose that to each man his own practical experience goes for something, and I have found that the figure so obtained harmonizes very well with my actual results. In support of the theory I may quote Bettel* who states that if the exact end point can be caught the figure so obtained represents the free cyanide plus 7.9% of the potassic zinc cyanide present. His only doubt seems to be whether that end point can be detected, especially in the absence of ferrocyanide. For practical purposes I myself have no doubts on that score. This question has also been carefully discussed by Gerard Williams in a paper published in the *Journal* of the Chem. Metal. and Min. Soc. of S. A. for, I think, March or April 1904, and a similar conclusion arrived at.

Since reading Mr. Allen's article I have made some titrations bearing thereon which will serve to illustrate the points I have raised. I will deal first with the rather positive generalization, "in the presence of zinc compounds there is no definite end point to be observed." I took a sample from the barren solution sump at the mill where I now am and placed it in a well stoppered bottle. I made three titrations on this solution myself and had the cyanide superintendent also to make three,

*Clennell, 'Chemistry of Cyanide Solutions,' page 24.

in every case avoiding looking at the burette, and having a third person to record the readings, neither of us seeing the results until all the tests were finished. 25 c.c. of solution was taken for each, no KI was added, and the end reaction noted was the first faint cloudiness that became visible, resembling a pale blue smoke haze.

The first series was made late in the afternoon when the light was bad and therefore the results are not as uniform as those in the second which was made next morning on the same sample. My figures are marked 'A' and those of the cyanide superintendent 'B'.

First Series

A		B	
1	0.068% KCN	1	0.064% KCN
2	0.072% KCN	2	0.068% KCN
3	0.066% KCN	3	0.068% KCN

Protective alkali 0.06%
(in terms of NaOH)
Total cyanide ..... 0.198% KCN.

Second Series

A		B	
1	0.068% KCN	1	0.066% KCN
2	0.066% KCN	2	0.066% KCN
3	0.066% KCN	3	0.066% KCN

These results surely indicate that the method is capable of great precision, and this is not a solitary instance, equally precise results being obtained at the great majority of the mills I have been called on to visit from time to time.

Perhaps I should explain that in addition to the precautions of absolutely transparent solution and clean flask, the incidence of the light is of supreme importance. I find that the best plan is to have the burette opposite a window and place a black card vertically a few inches behind the flask, holding the latter so that the light will strike it just over the top edge of the card but will leave the solution itself in shadow. The flask used should preferably be not very wide at the bottom, so as to give a good depth of solution. Then, keeping the eye on a level with the flask, watch the behavior of every addition of silver nitrate as it touches the solution, not keeping it in continuous agitation but allowing the blueish white cloud formed by each addition of silver to hang for a second or two before agitating and dissolving. The finish is indicated, as already described, by the first appearance of a blueish tinge dulling the original brilliancy of the solution.

Coming now to the method advocated by Mr. Allen, it is not clear to me whether he titrates to the white or the yellow end reaction. He speaks of a 'distinct opalescence', but that word is, unfortunately, used indiscriminately by writers on this subject to indicate a turbidity without any specification as to color. On first reading his article I took for granted that he was speaking of the yellow silver iodide opalescence, but on turning up the reference in Clennell, I find that the latter expressly states that the end point he recommends is a white flocculent precipitate. I should like to say in passing that unless a titration is to be carried to the yellow end reaction I cannot see the object of adding KI at all, as I have never been able to find that its presence or absence makes the smallest difference when reading either to the first faint white opalescence or to the white flocculent precipitate end point.

I began my experiments by using the yellow end reaction but my first six attempts were so hopelessly erratic that I began to look for the variable factor. The only possible one I could see was the quantity of KI, which I had added in each case from a dropping bottle without regard to amount. I then made a systematic series counting the drops of KI (5% solution) from a burette and increasing the number each time, taking 25 c.c. of cyanide solution for my test.

Third Series

1	using	5	drops of	5%	KI solution	.....	0.100% KCN
2	"	10	"	"	"	.....	0.092% "
3	"	15	"	"	"	.....	0.086% "
4	"	30	"	"	"	.....	0.082% "
5	"	25	"	"	"	.....	0.080% "
6	"	30	"	"	"	.....	0.078% "
7	"	35	"	"	"	.....	0.078% "
8	"	40	"	"	"	.....	0.076% "
9	"	45	"	"	"	.....	0.076% "
10	"	50	"	"	"	.....	0.076% "

Each time I obtained the unmistakable yellow opalescence, but the readings varied considerably. There seems, however, to be a halting place in the series at 40 drops where uniform readings may be secured.

I next turned my attention to the white flocculent precipitate end point recommended by Clennell. I found that the transition from a white opalescence to a white flocculent precipitate was very difficult to distinguish and seemed to be almost as much influenced by the time expended in the operation as by the amount of $AgNO_3$ used. After practising for a while, however, I obtained some fairly concordant results which are here given:

Fourth Series

1	No KI					.....	0.086% KCN
2	No KI					.....	0.076% "
3	10	drops	of	KI		.....	0.070% "
4	20	"	"	"		.....	0.076% "
5	40	"	"	"		.....	0.076% "

The KI does not appear to affect the result in any way, thus confirming my previous experience, but the general tendency is to check No. 8, 9, and 10 of the third series.

It would appear from all these figures that the method is difficult and lacking in precision when the aim is to end at the white flocculent precipitate, but that when carried to the yellow opalescence concordant readings may be obtained provided that sufficient KI be used, the amount suggested by the third series being at least 40 burette drops, or about 2 c.c. of 5% solution for 25 c.c. of cyanide solution to be tested.

The question may be asked, "Why go to so much trouble about a free cyanide determination, which is admittedly only relatively correct, when the total cyanide titration gives more uniform readings, is more easily performed, and should be just as effective when once its

dissolving value has been established for a given set of conditions?" This contention would be all right if it be admitted that the zinc potassium cyanide is equal to free cyanide in dissolving power, but if not, as I think most will agree, then the objection lies in the fact that the ratio of free to total cyanide is not by any means constant in a working solution but varies from day to day with changes in alkalinity and zinc content, so that a total cyanide determination may tell very little about the active property of a solution.

Regarding the regeneration of cyanide by addition of alkali, Mr. Allen seems to be trying to picture a permanent restoration of free cyanide which will persist independently of changes in alkalinity. I believe that those who favor the idea hardly understand it in this sense, but rather as a temporary dissociation between the cyanide and the zinc compound, which persists only so long as conditions remain constant, and if so, 'dissociation' would be a better word than 'regeneration'. If, however, while in this condition it acts on the metals in the same manner as free cyanide it ought surely to be registered as such, for purposes of solution control.

Discussions on the subject seem invariably to be based on the assumption that the alkali added is a caustic, but since lime is almost always used in commercial practice it would seem necessary to study the matter in the light of this reagent. I think it probable that if the conventional equations were considered from the standpoint of the substitution of lime for caustic the conclusion would be somewhat different, and that some part at least of the cyanide indicated in my method of titrating as having been freed from combination might be shown to be permanently regenerated in the true sense.

For instance, on adding a clear solution of calcium hydroxide to one of zinc potassium cyanide a white precipitate is thrown down, which I believe to be insoluble calcium zincate. It forms rather slowly and may take from 5 minutes to half an hour, but once formed it seems to be quite unaffected by additions of free cyanide, indicating that the reaction is not reversible. In this case there would be a very different condition of affairs to that usually assumed, because here the zinc of the double cyanide would be removed out of the sphere of further action and would not be liable to reversal on variation of the conditions.

To what extent this may take place in ordinary practice I cannot say, but I have for a long time accepted it as a probable explanation of the 'mysterious' disappearance of zinc out of working solutions.

Following up this point a little further I took a fresh sample from the barren solution sump and titrated in the various ways. For the determination of free cyanide by the method recommended by Mr. Allen, which I have called 'Clennell's method', I added 50 drops of 5% KI solution and carried addition of $AgNO_3$ to the yellow opalescence. In the following table I mean by 'direct titration' the method I use, as previously explained. 'Clennell's protective alkalinity method' refers to the direct titration for alkali after determining free cyanide, as described in 'Chemistry of Cyanide Solutions,' page 63. This works well under the conditions of previous silver nitrate titration as I have described them, because by stopping addition of nitrate at the earliest possible point the interference of the acid zinc nitrate is avoided.

Fifth Series

Free KCN direct titration.	Free KCN Clennell	KCN total	Protective alkalinity Clennell	Protective alkalinity Green
0.082%	0.094%	0.214%	0.066%	0.05%

A portion of this same solution was then agitated in a stoppered bottle with excess of dry slaked lime for one hour, and then filtered and titrated.

Sixth Series

Free KCN direct titration.	Free KCN Clennell.	KCN total.	Protective alkalinity Clennell.	Protective alkalinity Green
0.164%	0.086%	0.214%	0.194%	0.214%

Now there are several points to be noted in comparing these two series.

1. The free cyanide shown by 'direct titration' is doubled after addition of lime.

2. The free cyanide shown by 'Clennell's method' is less after adding lime than before. This surely would suggest something wrong with the process, because though the figure might not necessarily be greater after adding lime there seems no obvious reason why it should be less.

3. The two methods of computing protective alkalinity, which checked exactly in the case of the original solution, do not check after the alkalinity has been raised.

In No. 3 we have the key to what seems to me the weak spot in the Clennell method for free cyanide advocated by Mr. Allen. Assuming that it is capable theoretically of indicating the true amount, which Clennell himself is inclined to doubt, its correctness is vitally dependent on a true value being found for protective alkali. Does Green's method afford a sufficiently correct value for the purpose? Here again Clennell doubts whether the figure so obtained represents the protective alkali according to the usual definition. In the series shown above there are two different values for alkalinity resulting from two recognized methods of determination. Assuming that neither is absolutely correct, which of the two gives the closer result? No doubt for purposes of solution control the two readings in the sixth series form a sufficiently close check, but when used as a measure for neutralization preparatory to the free cyanide titration the difference is anything but a negligible quantity. For instance, I repeated this determination for free cyanide using the basis of the lower alkali reading and obtained a value for free cyanide of 0.134%. Compare this with the figure 0.086% resulting from the use of the higher alkali reading.

Turning back again to my remarks about a possible regeneration due to lime, if this theory were true one should expect to see evidence of it not only in the direct titration method, where in fact it shows us strongly, but

also in the Clennell method if part of the zinc is really eliminated and filtered out as an insoluble compound. I do not see any such indication when the method is carried out strictly as recommended, but when one takes the alkali reading obtained by the other method, which is just as likely to be correct as Green's, and which, after all, is not so very much lower, he gets a value for free cyanide which shows a considerable rise in strength after addition of lime.

In conclusion, I want to make it clear that though for the sake of brevity I have used the term my method in referring to the one I am advocating, I make no claim to connect my name with it. It is as old as the process itself, and its use is almost as widespread. I may sum up what I consider its advantages as follows:

1. I believe it represents the true free cyanide content of a working solution more nearly than any other, except when copper is present in considerable amount.

2. It is rapid and simple.

3. It is definite and capable of considerable precision with a little practice.

4. It is very widely applicable, and the exceptions are few and far between.

5. It provides a simple and rapid method for determining protective alkalinity, as already described, the same solution used for the free cyanide test being titrated direct with standard acid and phenolphthalein indicator.

Of course the most important question in the whole controversy is not, really, how much of the cyanide is free, from an academical standpoint, but how much is available for doing work. There is considerable diversity of opinion on the subject, and many text books treat total cyanide as if it were synonymous with available cyanide. If by available is meant latent cyanide the term might pass, but I very much doubt whether the potassium zinc cyanide can be called available in the sense of being ready to do work without work of some kind being first expended on it. I have been making a few experiments lately to try to throw some light on this point, and if when they are finished they seem to me of general interest I hope to offer them to you for publication.

Before leaving the subject of Mr. Allen's article I wish to point out a misapprehension he has fallen into in referring to the zinc solution at the Nipissing. He quotes the figure given in my paper for the assay of the precipitated solution (0.8 oz. Ag per ton) as if it were a result obtained on a working scale, but I stated that, although zinc precipitation was planned for the new mill it was never used, and the mill was started with the aluminum precipitation.

The solution in question was merely that obtained from laboratory experiments and was run through a small zinc box to remove the silver before being used over again. This box was worked intermittently, and was not tended very zealously, hence the high tailing assay. I see no reason to suppose that had the zinc process been installed in the new mill the barren solution resulting therefrom would have been any higher in silver content than that now obtained by aluminum precipitation.

E. M. HAMILTON.

Divisadero, Salvador, C. A., April 23.

Early Leaching Experiment

The Editor:

Sir—From 1895 to 1903 I operated a copper ore leaching plant at Warrior, Arizona, which has since been destroyed by fire. In connection with this there was built and operated an up-to-date sulphuric acid leaching plant with a capacity of about 300 tons ore per day. Up to that time I doubt if a more perfect leaching plant has been in operation in the United States. The copper was recovered by scrap iron, contained in a revolving, perforated, heavy plate copper drum 8 in. diameter and 12 ft. long, which revolved in copper sulphate solution in a lead-lined tank. The copper precipitates were smelted and refined in a reverberatory furnace using oil for fuel and producing copper ninety-nine and eighty-five one hundredths fine. At that time I secured two patents on mechanical appliances which upon practical test helped but little to overcome the difficulties. I discovered that when one makes a solution of, say, one to three-tenths of 66°B. sulphuric acid and from seven to nine-tenths water, the best results are obtained. I extracted about 65% of the copper contained in the 7% ore. In practice I came upon the same difficulties that everyone has and that is leaching the tailing free from almost a trace of copper and which is absolutely necessary in the low-grade ores. Laboratory or mechanical tests, even on ten-ton lots, are of no value and only tend to deceive, as failure will come after a large amount of money has been spent trying to handle a large tonnage commercially. I have since overcome these difficulties by a simple and inexpensive plant, which is automatic in operation and reduces the copper in tailing to a trace. I expect to precipitate the copper, contained in sulphate solution by electricity on cathodes regardless of how impure or foul the solutions may be.

Globe, Arizona, May 26. JAMES A. FLEMING.

Siderite and Sulphides in Leadville Ore Deposits

The Editor:

Sir:—Through the omission of the words: "Leadville excepted," in paragraph 2, column 2, page 52 of your issue of July 11, I am made responsible for the statement that the occurrence of siderite at Leadville has been described in the U. S. Geological Survey reports; this statement I believe is incorrect, the only reference I find touching the subject being in the nature of a disclaimer and stating the silicate and carbonate of manganese "are notably absent from the sulphide bodies at Leadville" (*Bull.* 320, 'The Downtown District of Leadville,' 1907, p. 34).

In justice to the Geological Survey and to myself, I ask that you publish this explanation.

Denver, Colorado, July 17. PHILIP ARGALL.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information bearing on the practice of mining, milling, and smelting.

Cost of making gas at the municipal works in Belfast, Ireland, was 24.502c., and the profit 16.218c. per 1000 cubic feet. The output in 1912-13 was 2,480,628,000 cubic feet.

Every steel tower on the Waihi company's new transmission line, 50 miles long from the mine to the hydroelectric plant, is numbered and has a danger notice attached to it. Part of the route is over a range 2500 ft. high.

A rheostat resistance block consisting of manganese oxide, zinc oxide, silicate of soda, and brass filings mixed together in suitable proportions has been patented by Arthur Illingworth Graham, of Wellington, New Zealand.

Brick smokestacks which are cracked or showing signs of weathering, and which it is not convenient to pull down, may be greatly strengthened for many years by pouring about 12 in. of concrete all around the chimney. A frame of light timber is erected to the top of the stack, and concrete elevated by a cage and poured in the forms built around the brickwork, starting from the bottom.

King-posts in a stamp-battery are often thrown out of plumb as a result of the settling of bins to which they are connected, and also as the result of continual vibration. In either case it is preferable to allow them to retain the firm and settled position in which they have placed themselves, rather than to attempt to re-plumb them. The guide-girths and cam-shaft bearings should be shimmed or otherwise altered in order to plumb the stems and level the cam-shaft.

A process for treating sulphide ores of antimony and arsenic for the purpose of extracting these metals, consisting in melting the ore with sodium sulphate, carbon, sulphide of iron and sodium carbonate to form a sulpho-salt and oxide, removing the slag formed during the melting operation, smelting the sulpho-salt and oxide with iron and carbon, and recovering the sulphide of iron and the sulphide of sodium from the slag formed by the reduction process, has been patented by Alexander Trifonoff and Daniel Gardner, St. Petersburg, Russia.

Earth tremors are increasing on the Rand, according to H. E. Wood, who read a short paper on this subject before the Chemical, Metallurgical and Mining Society of South Africa. Since 1908 there have been the following number of tremors each year: 7, 3, 12, 14, 38, 82, and 15 up to March of 1914. The Witwatersrand tremors are semi-artificial in origin, and the ultimate cause of them is to be found in the extraction of large quantities of rock and water from comparatively small depths beneath the surface. The combined effect of mining and water pumping operations is to divide up the ground beneath the surface into small sections, which may be subdivided further by existing faults. These small sections gradually become unstable, owing to the withdrawal of their supports, and suddenly slip by small amounts into positions of greater stability. This slipping communicates a slight jar to the surrounding ground, and the effect is radiated as a single wave of small amplitude. There is no evidence to show that this happens only in one particular region of the Witwatersrand, but the localities over which the shocks are felt are found more frequently along the Central and Eastern Rand than along the Western Rand. The existing records do not indicate that the local tremors are more frequent at any particular season of the year, so that it does not appear that their occurrence is facilitated by weather changes, etc. The length of the records is, however, too short to make any definite decision on this point. In the subsequent discussion of the paper, A. C. M. Sim said that earth tremors on the Witwatersrand concern all those who are interested in the industry there, and he had always felt that these earth tremors, which are sometimes attributed to blasting and sometimes reported from the Observatory as earthquakes, are due chiefly to another cause. As is well known, on the Village Main Reef mine there is a line of fissure in the earth, which has caused an extraordinary fault through the three 'reefs' in that mine, and unlike the ordinary faults which occur frequently along the Witwatersrand series. The fissure is very apparent in the Village Main Reef mine, after leaving which it goes right through Lower Doornfontein, and through the Bezuidenhout valley, south of Bedford farm. That means that the whole of the 'Hospital' series are resting on that fissure of the earth's crust, which fissure runs almost diagonally across the reef and up the valley. Therefore, it is obvious, from time to time, as the ground settles, the people who live on the north or northwest of the fissure will feel the shock, and people southeast of it do not feel it to any great extent. Though G. S. Corstorphine makes little mention of this interesting occurrence in his book on the formations and geology of the Transvaal, Mr. Sim stated that the fissure does run through the 'reef' and that is the reason for nearly all of these 'earthquakes' of which so much is heard from time to time in the local papers.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

MOTHER LODE DISTRICT, CALIFORNIA

ACTIVITY ALONG THE LODE.—WORK AT MARIPOSA, BIG OAK FLAT, JACKSONVILLE, JAMESTOWN, BLACK OAK, CARSON HILL, ANGELS CAMP, HODSON, RAILROAD FLAT, WEST POINT, JACKSON, PLYMOUTH, PLACERVILLE, AND GRIZZLY FLAT.

During a recent trip which covered fairly thoroughly the Mother Lode and the nearby districts, from Mariposa to Placerville, encouraging activity was noted. Many of the old mines that have been idle for some time past have been reopened under new management, or by lessees, and the general spirit all through the gold belt is one of optimism. A good feature is that considerable prospecting is going on, and where mines are being reopened it is on a conservative scale. The expensive lessons of elaborate surface equipment for an undeveloped mine have been learned, and the tendency is to develop the equipment along with the mine instead of in advance of it.

Mariposa.—This district is handicapped by the fact that many of the best mineral deposits are on the Mariposa land grant, and the managers of the grant will allow them to be worked only on such terms as are generally considered prohibitive. Some copper deposits have been opened east of town, but so far development has not been carried to a point that shows their actual value. At Colorado, the Colorado mine has started with a few men, and the mill is in operation.

Big Oak Flat.—The Longfellow and the Big Casino mines are working and are running mills at both. The Longfellow is doing company work, and the Big Casino is being operated under a lease, dropping ten stamps. East of Groveland it has been the intention to resume work at the drift-gravel mines of Gold Ship Mining Co., but there is no definite news that work has actually commenced.

Jacksonville.—Work has been resumed at the McCormick group on the river. The main adit is being driven around a bad cave, and will be extended to catch the vein that has been opened in the upper workings. The Shawmut is engaged in development work.

Jamestown.—Negotiations were opened in the spring looking toward the taking over of the Rawhide group by Alexander Chalmers and associates. Mr. Chalmers has been superintendent of the Lightner at Angels Camp for some years past, and there is every assurance that if he gets control of the Rawhide it will be worked actively.

Black Oak.—The Black Oak mill, which is using the cyanide process described in the *Press* in 1912, is a success, and production has been continuous for some time past. The main shaft was recently sunk to the 1770-ft. level, and drifts started both ways from the bottom. North of the Black Oak, the Syndicate, which is controlled by the same interests, has several men sinking the shaft and, to the west, the Draper has been unwatered and is cross-cutting.

Carson Hill.—The South Carolina has started and is running its mill. A leaching plant is being erected near Malones to treat its tailing.

Angels Camp.—The cost of mining the upper levels of the Lightner, where the ground is very heavy and shifting, has proved too high for the grade of ore found, and production has ceased at this mine until the shaft can be sunk further, and new orebodies found on the 1000-ft. level can be developed. This is somewhat offset, however, by the fact that the Johnson, west of town, has been supplied with new equipment and pumped out preparatory to the resumption of operations.

Hodson.—This little camp, two miles west of Copperopolis, will see active mining for the first time since the Royal was closed down some years ago. The litigation and financial troubles of this mine have been disposed of and preparations are under way to resume production. Copperopolis is quiet except for keeping the Calaveras Copper Co.'s mine unwatered, and doing a little precipitation of copper from the mine waters. It is notable, however, that the Company will not talk lease to anyone, and it is rumored that efforts are being made to relieve the financial trouble so as to open the way toward the resumption of operations.

Railroad Flat.—The Comet, north of town, is operating in a small way, efforts at present being confined to sinking the main shaft. The Mohawk, formerly the Keystone, east of town, has been taken over by lessees. The shaft is being cleaned out and retimbered, and some ore is being extracted.

West Point.—After considerable development work a small mill will be built at the Lockwood. Across the river, at Defender, O. E. Lofstad has built a new head-frame, and has ordered hoisting equipment for his claims. Sheridan Barnhart has opened a good vein near the Defender mine.

Jackson.—The long drawn out suit between the Kennedy Extension and the Argonaut has been decided in favor of the latter. The general sentiment is that the decision of Judge Wood was just and that, as the principal litigant is dead, the case will not be appealed. This relieves the uncertainty under which the Argonaut has been working for some time past, and puts it in a position to go ahead on a larger scale, which it is expected will be done.

Plymouth.—The Pacific mine is building a fine equipment. A 30-stamp mill, with Hardinge mills for regrinding, is nearly completed, the head-frame has been enlarged, new hoist installed, and haulage system and completely equipped shops are

being built. This mine should be in operation in the early fall and will be one of the best equipped on the Mother Lode.

Placerville.—Practically nothing is being done here in the mining line except at the Pacific where diamond-drilling is being carried on underground to prove the orebodies before resumption of active operation.

Grizzly Flat.—The Mount Pleasant is the only mine that has been operated here for some time past, and that only in a desultory sort of way. A five-cent assessment has been levied and is coming in quite satisfactorily. It is hoped thereby to obtain sufficient money to clear up outstanding obligations, and put the mine in shape to earn the cost of a new mill. The ore is not amenable to treatment in the mill on the ground, and heavy losses have been the result. It is similar to that found at the Black Oak, and it is desired to erect a cyanide plant modeled on the general lines of the one that has been in successful operation at the latter mine.

No mention has been made of the regular producers which are in operation all along the Mother Lode. The Lightner is the only one to drop out of the list within the past few months. The general awakening of interest in mining and the conservative spirit in which most of the new enterprises are being undertaken gives much encouragement to the belief that this district will see a marked increase in production in the near future.

SAN DIEGO, CALIFORNIA

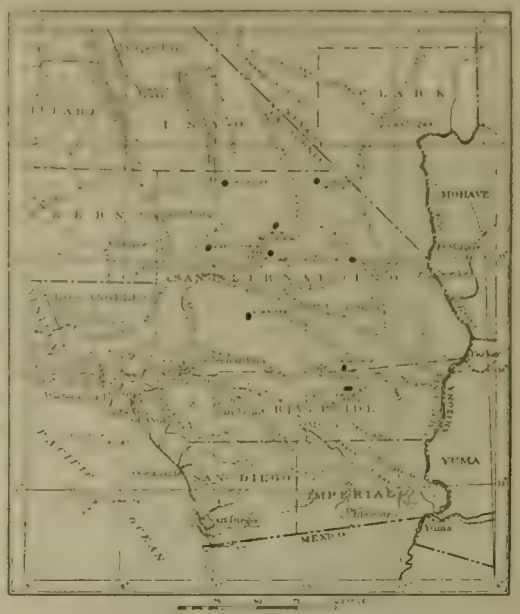
THE OLD JULIAN DISTRICT: GEOLOGY, GEMS, GOLD MINES, AND REASONS FOR MINES SHUTTING DOWN.

The construction of a railroad eastward from San Diego, to connect with the Southern Pacific at or near Yuma, Arizona, is beginning to attract attention to an old and interesting mining district in the Cuyamaca mountains, 60 to 75 miles northeast from the city of San Diego. The district first came into notice following the discovery of rich ore there by a party headed by Mike Julian and the Bailey brothers in the fall of 1869. This district, at first called the Cuyamaca, soon came to be known as the Julian, and a prosperous town of the same name was soon built there. Rich ores were discovered at numerous places in the vicinity of Julian and southeast for several miles, and a second village was built four miles from Julian, known as Banner.

The geological formation for many miles in every direction from Julian is mica-schist and mica-slate, with occasional irregular areas of granite. There are numerous dikes of diorite, norite, diabase, and other basic rocks; but the most important of the dike rocks are the pegmatites, which are not only numerous, but often contain gem minerals, and these have been mined extensively.

The principal gem minerals found are the red and green tourmalines, but topaz, beryl, and other varieties occur.

Gold, however, is the most important commercial product of the region thus far mined there. What the total production has been it is impossible to say, but it amounts to several million dollars. The most noted mines of the earlier days were the Golden Chariot, a few miles from Banner; the Ready Relief, at Banner, which in some respects was a remarkable property; the Washington, Owens, High Peak, and Helvetia, near Julian; the Cable, Cincinnati Belle, Warlock, Kentuck S., Antelope, Ella, and numerous others between Banner and Julian. The largest mine in the region was the Stonewall, about 12 miles south of Julian. This mine was the deepest, about 600 ft., and had the most complete equipment of any of the properties. It was at one time a large producer. Other districts in the region were Mesa Grande, Pine Valley, and Boulder Creek. The ores of the entire country around have a marked similarity, being free-milling quartz which mostly occurs as lenses in the schists and slates, that in the granite having more the usual characteristics of fissure veins. The quartz is often surprisingly rich in gold, but the ore-shoots proving erratic, the miners seldom had either the inclination or the means to carry on systematic development in advance of the extraction of the ore. The usual result has followed this too common policy—numerous idle mines with little incentive for the owners to carry exploration work beyond the face of a pinching shoot of ore. However, the rich ores for which the region has been noted, and the possibility of discovering new and profitable shoots in these old mines, both in greater depth and longitudinally, will probably act as a stimulus to newcomers, who are certain to now invade the old district with the advent of the railroad. It is not in the least unlikely that this region, a famous producer of high-grade ores 30 to 50 years ago, will soon once more contribute substantially to the gold output of California. Some years ago not less than 20 mines were in operation in the Julian and Banner districts under a system of leases, but as the lessees were men of small means the net results were little, if any, better than when the mines were operated by the owners. The causes for failure of many of these mines may be summed up in the following: small scale operations due to lack of capital; expensive transportation and milling charges; a lack of knowledge of the best methods of mining and metallurgy; poverty or extravagance on the part of the operators, usually both, and consequent inability to carry development ahead when the end of an ore-shoot was reached.



MAP OF SOUTHERN CALIFORNIA.

TORONTO, ONTARIO

CANADIAN GOLD FIELDS, LTD.—BAILEY COMPANY'S AFFAIRS.—CHAMBERS-FERLAND PROPERTY.—CANADIAN IRON CORPORATION REORGANIZATION.

The Canadian Gold Fields, Limited, the chief asset of which comprises stock in the Consolidated Mining & Smelting Co., is taking steps to distribute this stock among the shareholders of the holding company, the exchange to be on the basis of one share of Consolidated for every 1500 shares of Gold Field. After this distribution, there will be 270 shares of Consolidated left, which will be sold for cash and the proceeds distributed.

In connection with the liquidation of the Bailey company,

as decided on by the directors a short time ago, official action has been taken by the Standard Stock and Mining Exchange. The Exchange has departed from its ordinary custom and has asked for proxies to contest the action of the directors in liquidating the Bailey company. The president of the Exchange states that he is unable to explain the proceedings for the winding-up of the property, and on inspecting the records finds that Edwin A. Benson, the president, and other promotors issued 4,250,000 shares of $1 par to themselves, leaving only 750,000 shares in the treasury for the financing of the property. In 1909, Benson was the registered holder of 2,155,165 shares, and his interest has steadily declined until the present time he is the registered holder of only 278,190 shares. Other promoters who held large blocks of stock have also been selling in the same way, while the 750,000 shares in the treasury has been held. It is thought that this treasury stock was not sold as it might have come in competition with the promoters' shares, and the result has been that the public now owns practically all the property, without any of the money realized for the sale of shares having gone toward the liquidation of its debts or the financing of its undertakings. If the Exchange receives a sufficient number of proxies before the petition for the winding-up order comes on for hearing, counsel will be engaged to oppose the petition, and to challenge and dispute the validity of the judgment.

It is probable that some definite action will at last be taken regarding the disposal of the Chambers-Ferland property, which has been so strenuously opposed by the minority shareholders during the past few months. The fight is with reference to the proposed by-law for the transfer of the entire stock and assets of the Chambers-Ferland Mining Co., and 150,000 £1 shares in the Aladdin Mining Co. This latter Company already holds a majority interest in the Chambers-Ferland, and the directors are desirous of obtaining the control of the entire property. The minority shareholders, however, claim that the directors are trying to force through a deal prejudicial to their interests. The only assets of the Aladdin company is a lease on the old Silver Queen mine, and a small amount of cash in the treasury. The Silver Queen was originally abandoned as being worked out, and while some small amount of ore has been found, possibilities for the discovery of any considerable bodies of ore are doubtful. On the other hand, the Chambers-Ferland has liquid assets of $150,000, 124 acres of mining property and ground rentals totaling $6000 per year. The mine has been worked for some years, and while it has not paid any dividends, is supposed to be making a certain amount of money. On account of its location, adjoining the Nipissing and La Rose, the undeveloped territory offers considerable promise for the discovery of new orebodies. The minority shareholders claim that the Aladdin Mining Co. wishes to transfer the assets of a working property of considerable promise for stock, in a company having practically no assets, and they intend to take advantage of the new amendment to the Ontario Companies' Act, passed at the last session of the legislature, which covers such cases. One of the directors has also applied for an injunction to restrain the passing of the by-law for the sale of the property. A further meeting of the directors was called for July 1 in London, but so far no information as to what has taken place is available.

At a recent meeting of the bondholders of the Canada Iron Corporation, which went into liquidation a few months ago, the proposed reorganization was formally approved. The measures adopted by the bondholders provide for the cancellation of the existing trust deed, and the acceptance by the first mortgage bondholders of 6% debenture stock, to be known as 'B' stock in a new company, the exchange to be on the basis of par for par. Prior to this security will be an issue of 'A' debenture stock of an authorized amount of £200,000, of which not less than £120,000 and no more than £140,000 will be subscribed for at 95, to provide the necessary cash for working capital. Preferred and common shares will also be issued, the amounts of which will be determined after negotiations with the second bond holders and holders of secured notes and other creditors of the old corporation. The old preference and common stock will be wiped out, but shareholders who subscribe to the 'A' debenture issue will be given a bonus on the new common stock, which may, in the event of the reorganized company proving successful, help to offset their loss.

JUNEAU, ALASKA

EARLY MINING AROUND JUNEAU, AND FUTURE TONNAGE.—WORK AT THE ALASKA JUNEAU, TREADWELL, EBNER, JUALIN, PENN-ALASKA, TREASURE, AND OTHER PROPERTIES.

To the Juneau district is credited the first gold production of the territory of Alaska. According to a statement of Eugene Owens, a mine owner of Sumsum, Alaska, to the U. S. Geological Survey, the Windham Bay placer diggings produced $40,000 in 1870-71. The first real prospecting in what is the Juneau district was done in 1880 by Joe Juneau and Richard Harris, sent from Sitka by N. A. Fuller. They found placer gold and quartz veins, and returning to Sitka with 1000 lb. of ore, started a small rush. The next year saw considerable prospecting in the district. In the fall of 1881, a village at the foot of Mt. Juneau, called Harrisburg, had a population of 100. The name later was changed to Juneau. Placer mining at first occupied all of the attention of the miners, and in some cases hindered the development of quartz properties. On Douglas island, opposite the mainland from Juneau, the Treadwell claim was being developed in 1883 with the aid of a five-stamp mill. Aside from desultory prospecting on quartz veins in Silver Bow basin, near Juneau, the Treadwell represents the first quartz-mining operations in the district. More prospecting was done between 1883 and 1885, and in the ten years to 1895, most of the principal properties in the district were patented. Careful treatment of ores became necessary when the veins were discovered to be of low-gold content. The Treadwell company's first mill had 120 stamps; its present mills containing 540 stamps. Work in progress on the Alaska Gastineau, Alaska Juneau, and Alaska Ebner properties, all on the mainland, leads to estimates of a future daily capacity for the mills of the district of 25,000 tons, to be realized within four years. The present payroll of the mines in the immediate vicinity of Juneau amounts to $350,000.

Cross-cuts are being driven from the main raise which connects with the 6538-ft. adit on the Alaska Juneau holdings. A crew is at work, developing the mine to that stage where additional units of milling equipment may be installed. The vein, where cut by the main adit, has a thickness of 500 ft., with ore assaying $2 per ton. Forty stamps of the first of four 150-stamp units of the proposed milling equipment are in continuous operation on the property. Ten of the stamps are used as a pilot plant, the operation of which will determine largely the method of treatment for the first unit as well as subsequent units. Two hundred tons per day is crushed by the pilot plant. F. W. Bradley, president of the Company, estimates mining costs at the Alaska Juneau at 40c. per ton, compared with 95c. at the Treadwell, and milling costs at 20c. compared to 25c. at the Treadwell. When the installation of the proposed four units is completed, which will be in about four years because of the great amount of development necessary in the mine, the Alaska Juneau will have a capacity of 12,000 tons per day. A statement issued by Mr. Bradley shows that the plans of the Alaska Juneau company will be carried out as originally announced, despite rumors that the work was about to cease. "Everything will progress as originally planned," said Mr. Bradley, "but of course we cannot build any

more mills until there has been considerable more mine development. The contracts have been signed for machinery for the Alaska Juneau and Treadwell companies aggregating a quarter of a million dollars in cost. The Charles C. Moore company, of San Francisco, gets the contract for increasing the capacity of the steam power plant at Treadwell, on the opposite side of Gastineau channel from the Alaska Juneau holdings, from 3000 to 5000 kilowatts. The first unit is to be completed in six months and will increase the plant's capacity to 5000 kilowatts. The second unit will be added next year. Contracts also were signed for an Ingersoll-Rand 10-drill compressor, operated by a General Electric induction motor. Because of the announced policy of this Company to refrain from going into the boarding house or store business, its standing among the residents of Juneau is high. Nearly 2000 men will be employed eventually, and as the mill and entrance to the mine are virtually within the city limits, the townspeople of Juneau will derive the benefit.

The Treadwell mines still are the largest operators in the district. With the completion of the central hoisting plant, with its Nordberg hoisting equipment, plans are being hastened to hoist the ore of the Alaska Treadwell, 700-Ft., and Mexican claims through the central shaft. The first Alaska Mexican ore will be hoisted within two months. The hoist operates 11 hours daily, raising 3500 tons of rock. All ore to the east of the central plant on the Treadwell lode eventually will be hoisted through the 2200-ft. vertical shaft. On the 2100-ft. level of the Alaska Treadwell, 1500 ft. of adit has been driven and driving is now going on. Stoping will start next winter. Plans are being considered by the Treadwell company to increase the capacity of the Nugget Creek power-plant to 12,000 hp. The present and proposed steam equipment will then be used as an auxiliary plant. The new operations in the district have necessitated careful consideration of power plans.

The Ebner property is being developed by the United States Smelting, Refining & Mining Co., which has also taken options on the Hallam and Dora groups, adjoining the original Ebner claims on the northeast. It is current in Juneau that they have optioned from George R. Noble the Boston and Boston King groups, as well as the Epstein, Goldstein, and Wagner-Folsom properties, with a view to consolidating and development on a big scale. The Ebner property is being developed with a long adit from Silver Bow basin as at the Juneau.

A proposed 5000-ft. adit on the Jualin property north of Juneau on June 19 was in 991 ft. The adit is 7 by 8 ft. in the clear. Progress is being made at the rate of 150 ft. per month. The Company is employing 125 men. The monthly payroll amounts to $25,000. Ingersoll-Leyner water type drills are used in the work. The Jualin property is owned by Herbert L. Hoggatt and is under bond to the Alganican Development company, a Belgian syndicate. A small stamp-mill is operated on the claim. A Pelton water wheel furnishes power. A new wharf has just been completed. Material for a wireless station at Jualin is now on the ground.

In the Berners Bay district, many promising properties are undergoing constant development. Among them is the Frank Fremming property, immediately adjoining the Jualin and the Kensington, in which the Alaska Gastineau company has a share. The Greek Boys property at the mouth of Berners river is being opened up. The Eagle River mine is being developed under B. B. Saeding. In Montana basin there is considerable prospecting. H. R. Plate, representing a Canadian syndicate, has taken options on a number of claims in the Auk Bay district and is engaged at present in supervising the development work on the claims.

At Taku inlet, southeast of Juneau, the Penn-Alaska Mining Co. has 21 claims which it is developing. Ground has been stripped for an experimental mill and water rights have been staked. A small power-plant has been installed. The Company also holds four claims lying northeast of the Alaska Gastineau holdings.

The Alaska Treasure Co. has optioned a number of claims on Nevada creek and is planning the development work on the ground. The Jersey City group, consisting of seven claims one-half mile southwest of the Alaska Treadwell glory-hole on Douglas island, and owned by M. J. O'Connor and associates, has been optioned to Walter J. Brocking and Mr. Armstrong, who expect to begin work soon. A shaft has been sunk 75 ft. and drifts run a distance of 80 ft. on a vein of free-milling gold ore 25 ft. wide. The ore averages $4.85 per ton and has been traced for 3000 ft. The work this season has shown up another vein with a width of 600 ft., carrying ore on the surface, where disclosed by stripping operations, which assays 90c. per ton.

MILL AT THE EBNER MINE.

ALASKA JUNEAU 40-STAMP MILL.

NEW YORK

Attitude of Eastern Capital toward Mining Men.—Work in Mexico.—Utah Consolidated.—Butte & Superior.—Elm Orlu Suit.—W. B. Thompson's Rise.—Copper Statistics.

A peculiar situation exists in New York in regard to mining properties. There is a demand for developed or producing properties, but despite some notable examples of mining successes, it is almost impossible to induce the Eastern investor to become interested in anything that has not already shown itself a profit-earner. The exploration company, which has been so much of a progressive factor in English mining interests, has never appealed to American capital to anything like the extent that it should. The field has been so largely left to a few concerns, that today when some Western mining man comes to New York for assistance in developing or to sell claims, he is mystified to find that after visiting one or two offices he will find the details of his property ahead of him in any other quarter that he may present it. It is a most familiar thing to hear them say they had thought New York to be a big city, only to find it apparently smaller than the mining camp they left behind them in so far as the traveling of news is concerned, and the number of people with whom it might be possible to do business. Yet everyone familiar with the situation will say that real mines can be readily sold in New York. At the bottom of this state of affairs lies an undue degree of timidity, both on the part of the public and the engineers to whom they look for guidance. This is the complaint of the laymen, that there is no willingness to take the legitimate chance which is necessarily a part of mining success, that the engineer should not so greatly fear any penalty for favoring development that promises well, and should see that no good possibility or probability gets by his clients, rather than to fear that he may lose prestige by recommending expenditure that may not prove profitable. Numerically, failures must be greater than successes, and it is to meet this condition and cover this hazard that is the office of the exploration company. The centres of accumulated capital in the United States have too few of them; the present number is so small that in New York or Boston the rejection of a property by any one of the half dozen or so possible buyers discredits it more than it should, and a second presentation can only be made at a considerable disadvantage. Under these circumstances it is most natural that these same buyers should realize their control of the market and should, quite without concerted action, eliminate anything like active competition. Mining profits lie largely in successful development, and it is in this development, rather than in operation pure and simple, that the public would like to participate. There lies in this situation a part of the mining field that is not properly occupied. The matter is one of viewpoint or mental attitude, perhaps, more than anything else, but the condition is one concerning which both property owner and investor have some just cause for complaint.

Speaking of complaints, there has been little else heard in that district at the lower end of Manhattan Island known as 'South of Fulton street' during the past week. The pent-up wrath of the public at some of the misdoings in high finance took concrete form in a report of the Interstate Commerce Commission concerning New England's transportation lines, the New York, New Haven & Hartford railroad and its subsidiaries, with the result that the railway shares have been much demoralized, the market drop occupying the centre of the stage to the exclusion of nearly all other features that ordinarily come in for some share of public attention.

The progress made in Mexico ought eventually to have a good effect on the mining interest of the East. The opening of new fields or getting back into old ones with improved prospects would be a considerable help in securing and holding public attention. Affairs like the shutting down of Greene Cananea, where labor conditions became so disturbed as to force the management to prepare for an indefinite period of idleness, do not make for present enthusiasm over Mexican mining operations. Not all American mining progress has come to a complete standstill, however. H. Vincent Wallace, who is directing the operations on the Nueva Luz cross-cut at Guanajuato, has remained continuously on the job and has been making some progress toward the extension of the Valenciana, which it is hoped will be opened at depth. At the Santa Gertrudis property the manager, H. Rose, has remained in charge, and while it has proved impossible to keep the mill going, the mine has been under development. The Grenfell failure in London touched the Sta. Gertrudis, but has not affected it seriously.

It is said the Utah Consolidated management is actively engaged in a search for a mine to take the place of its Bingham property. Mark L. Requa and Roscoe H. Channing have been making some preliminary field surveys in Nevada, without, however, finding anything among those properties looked at sufficiently developed to permit of actual examination.

N. Bruce MacKelvie, of the firm of Hayden, Stone & Co., Kurnal Babbitt, and D. C. Jackling have all been at Butte in conference with W. A. Clark concerning matters in dispute between the Butte & Superior company and the Elm Orlu mine owned by Mr. Clark. Mr. MacKelvie is the president of the Butte & Superior, while Mr. Babbitt is the legal representative of the Hayden-Stone, Shove-Aldrich, Jackling-Penrose, MacNeill interests, which include, with the Butte & Superior, Chino, Ray Consolidated, Alaska Gold, being enough to swamp any organization not headed by such great workers.

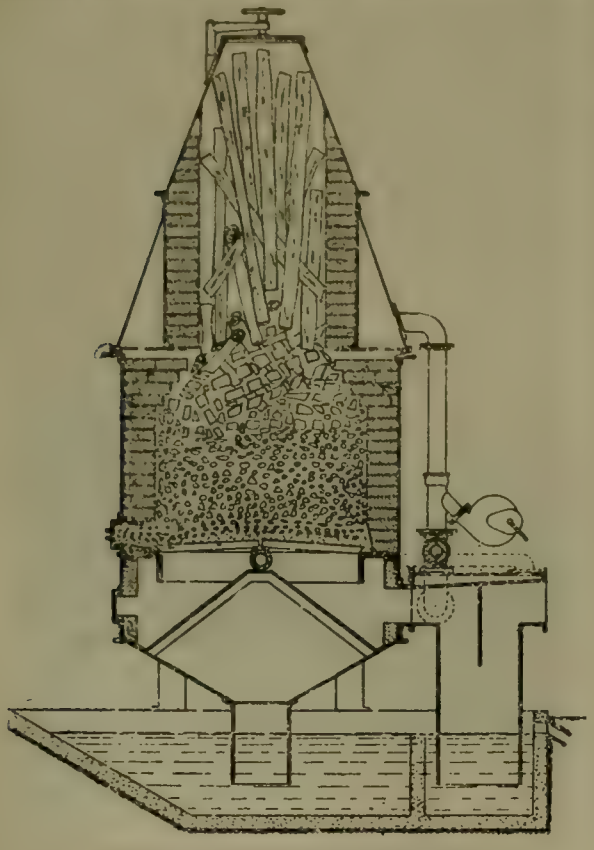
William B. Thompson, whose rise has been so rapid since he came to New York from Butte some years ago, is apparently about to step from a leading place in mining circles to an equally prominent place in the banking world, being the leading candidate for one of the directorships of the Federal Reserve Bank of New York. Mr. Thompson has been the leading spirit in several successful mining enterprises, including the old Cumberland Ely, since merged into Nevada Consolidated, this interest placing Mr. Thompson in the directory of the Utah Consolidated, including also Nipissing, La Rose, and, later, the Mines Company of America, Mason Valley, and Inspiration.

The porphyry properties are now making up figures covering production for the half-year, and so far show increases in tonnages handled, lower costs, and improved results. It is hard to realize or estimate just what the copper mines of this country could do if under pressure of normal demands from consumers. The export trade seems fated in some way to take the best of the copper market's ups and downs. Foreign deliveries for the six months just passed about 13% greater than for the same period last year, the average monthly shipments being 81,700,000 lb., against 72,400,000 lb. in 1913. Domestic deliveries were 55,000,000 lb. monthly as compared with 64,000,000 lb. for the half-year ended June 30, 1913. While one may lament the fact that the foreigner seems to secure an undue share of our cheap metal, the really significant feature is that record production—835,137,652 lb. for the six months ended June—has not built up any surplus of any consequence. Every report of conditions abroad speaks of depression. Our own situation is best shown by the fact that our percentage of domestic consumption dropped from 46% in 1911 to 39% for the first half of the current year. What will be the result when domestic conditions are good again? Evidently the country will need all that the Inspiration, Braden, Chuquicamata, and other great mines can turn out. Miami produced in the half-year 20,043,056 lb., against approximately 16,000,000 lb. during the same period last year. Braden turned out 12,451,000 lb. for the six months' period, but material increases are expected in each month's output during the remainder of the year.

KALGOORLIE, WESTERN AUSTRALIA

SUCTION-GAS PLANTS AT SONS OF GWALIA, LANCEFIELD, AND CHAFFERS MINES—GREAT FINGALL MINE—LABOR TROUBLES.—LAVERTON DISTRICT.

The whole of the treatment plant on the Sons of Gwalia mine, after being thoroughly overhauled and brought up to date, is being driven by two Crossley gas-engines of 400 and 167 hp. respectively, and one Kynoch engine of 660 hp. The gas is generated by three Commonwealth down-draft gas generators of 380 hp. each, burning *mulga*, a local wood of high heating value, in 5-ft. lengths. After overcoming some trifling



SECTION OF COMMONWEALTH GAS PRODUCER.

initial difficulties, these generators are proving so successful that the plant runs a full month without a stop. The saving of firewood when gas engines are used is 7000 tons per year, or $21,840, taking firewood at $3.12 against charcoal at $14.16 per ton, in the proportion of 172 tons wood to 100 tons charcoal, comes to $1152 per month, and the running is more regular. After watching the operation on the Gwalia mine, the engineers of the Kalgoorlie & Boulder Firewood Co., which now owns the Lancefield mine, and supplies the firewood to the Sons of Gwalia mine, have ordered three 250-hp. Commonwealth generators for the Lancefield, and the management of Chaffers has also ordered one of 380 hp. These generators are also in use at the Yuanmi and Queen of the Hills mines, where they have replaced charcoal generators. No suction-gas plants have been installed on any of the large mines at Kalgoorlie.

The Great Fingall company, which for the last five years has been opening the new ore-shoot discovered by sinking an internal shaft at a point 900 ft. north of the main shaft at No. 13 level, is about to start breaking ore from this body. The lode at No. 15, 16, 17, and 18 levels has had the leading stope started, and 24 machine miners have been sent up from Kalgoorlie to start work. The shoot at No. 15 is 180 ft. long, and assays $10.46 per ton for the width of the drift, 72 in., at No. 16 it is 252 ft. long, and assays $10.62 per ton over 72 in.; at No. 17 it has been proved for a distance of 300 ft. to assay $9.60 per ton for the width of the drift; and at No. 18 level assays average $11.16 per ton for a length of 533 ft. Winzes sunk below No. 18 level show ore assaying up to $31 per ton. As in the upper levels, the lode bulges in places up to 40 ft. wide, but the full extent will only be disclosed in stoping. During the past 16 months the Company has worked at a loss of $72,000, including capital expenditure, and paid a dividend of $62,500 out of reserve funds, thus reducing the reserve to $218,700. H. P. Woodward, government geologist, in 1909, and Malcolm Maclaren in 1910, advised the management to continue sinking through the barren zone with the above result. It is interesting to recall that Mr. Woodward, in his handbook published 20 years ago, in 1894, stated that "This line is called the Day Dawn, and is a true fissure vein, but does not follow any definite course; but this is not of the least consequence, as, from its well defined walls, there is very little chance of it cutting out." In spite of that, the mine was abandoned on the first lens cutting out before the Great Fingall acquired the mine in 1899. Prior to that it had produced 30,000 tons returning $375,000 at a loss; and, since then, another 1,836,400 tons for a yield of $23,336,500, and paid dividends aggregating $8,734,000. The first lens pinched out at a vertical depth of 150 ft., and the ground was barren down to 460 ft., when the second lens, which has produced all the wealth and dividends, was encountered, and cut out at No. 13 level.

Labor troubles in this state still continue. Laborers on the Trans-Australian railway are still on strike, as their leaders insist on their receiving $3.20, and refuse to allow a ballot to be taken regarding the federal government's offer of $3, and to leave the arbitration court to fix a rate to be retrospective. All the builders, carpenters, etc., on the coast are now out, as the union men employed at Millar's sawmills absolutely refuse to work with three non-unionists, and the strike has spread to Perth and Fremantle, as the employers will not yield. The Australian Labor Federation has not yet made up its mind whether to insist on non-unionists in the goldfields being dispensed with, as the Chamber of Mines has frankly stated that it will close down every mine in preference to being dictated to by the labor unions. The deadlock shows no signs of reaching a conclusion.

Early in June the announcement was made that the Melbourne directors of the Mary Mac company, which holds a lease called the Lady Harriet, at Laverton, had bought out the tributers, Tasker and Hunt's interests for $60,000 cash and 4000 fully paid shares. In January, 1913, the Mary Mac company acquired the lease, and erected a hoist, boiler, headframe, 10-stamp mill, and cyanide plant, driven by a suction-gas engine. The first clean-up in November yielded $2000 from 1200 tons, or $1.67 per ton. The mine was then let on tribute for two years at 12½% royalty. Up to the end of April the tributers treated 2976 tons for $41,700, and paid the Company $5200 in royalty, besides clearing a profit of $25,000. The lode is in a hill about 60 ft. high, in which an adit has been driven and the ore is being mined over a width of 80 ft., and drops into the adit through passes for delivery to the mill. Included in the purchase is a claim on each end and one on the side. Thirty more stamps are to be added to the equipment, and a profit of at least $25,000 per month is expected. The Lady Harriet, previously known as the Enniskillen, is on the main line of lode at Laverton, which includes the British Flag, Union Jack, Pinnacles, and Craiggiemore, all first worked 15 or 16 years ago, and most of them abandoned for a dozen years. The Craiggiemore, between 1899 and 1906, produced 105,700 tons yielding $750,000, and was then abandoned.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

When all the survey parties are arranged, there will be 11 outfits in the field for the United States Government railroads, each with a certain section, as follows: Fairbanks to Nenana, Fairbanks to Healy crossing, Nenana to Broad pass, Broad pass to Susitna, Susitna to mouth of Matanuska, Matanuska to Turnagain arm, Turnagain arm to Seward, Turnagain arm to Portage bay, Chitina to Matanuska coalfields, Mile 140 on the Alaska Northern to Matanuska, and reconnaissance survey from Susitna to Matanuska river.

Chisana

According to G. E. Vergowe, who arrived at Cordova during the last week of June, there are 300 people at Chisana, of whom 180 are miners employed on the various claims. On June 16 about 115 men formed the Shushanna Miners' Association. Most of the operators were paying $6 per day with board, excepting F. T. Hamshaw, who paid $5. His men struck, but returned on payment of the $6 rate. Mr. Hamshaw has made the first clean-up of the season on Eldorado creek, 2700 ft. along bedrock yielding about $4300. There are a few other promising claims. There is not enough employment for all the men now in the camp, and outside papers should publish warnings not to come in. The mail service for letters and papers, etc., is good, there being two mails each way per month.

Valdez

(Special Correspondence.)—Reports here at Valdez are that Frank G. Manley and J. J. Price, who took options on the discovery holdings of the Chisana last fall, have sent in an engineer to Slate creek to make arrangements for a hydraulic project that would embrace the entire creek. Options have been secured on half of the creek already, with the exception of the Miller holdings. George Sias, manager of the Valdez Creek placer mines, left Cordova on July 6 for Valdez creek, by way of Chitina, to inspect the operations on the Company's claims. The new company has acquired control of the original Monohan claims, the Kain holdings, and the Valdez Creek Placer Co. and Valdez Creek Mining Co. The last payment was made January 1, 1914. A pipe-line is being installed under the supervision of Alfred H. Bryant, to take the water of Valdez creek and use it to operate three No. 4 giants with 6-in. nozzles, and one No. 3 giant with a 4-in. nozzle. When complete, the plant will be able to move 10,000 yd. of gravel per 24 hours. Late in 1913 a temporary plant was used to clean about 20,000 sq. ft. of bedrock on the lower part of the claims. The 'dirt' averaged $2.70 per yard. A Pelton wheel of 28 hp. furnished power for two prospecting drills, an electric compressor, a sawmill with a capacity of 5000 ft. per day, and an electric lighting system. The water for operations will be carried 6200 ft. by ditch, and from that point 1000 ft. of 36-in. pipe, 1000 ft. of 30-in. pipe, 1000 ft. of 24-in. pipe, and 1000 ft. of 22-in. pipe will carry the water to the nozzles, with a head of 350 ft. The installation of the present equipment is being made at the suggestion of Forbes Rickard, who completed an examination of the property in 1911. John Carlson is operating on Lucky gulch, a tributary to Valdez creek near its head. His holdings recently were assembled under the incorporation of Lucky Gulch Mining Co., which has headquarters at Fairbanks.

Valdez, July 8.

ARIZONA

Gila County

(Special Correspondence.)—On July 15 the upper 400 ft. of the main east shaft of the Inspiration mine was completed, there being 40 ft. remaining to be concreted in the main west shaft. The lower 200 ft. will be concreted as soon as guides and lumber have been fixed. The fourth and last compressor foundation in the compressor and hoist-house was poured last week. Work on the conveyor system is being hurried along. A 36-in. Overstrom fine crusher is being tried in the test mill. This machine depends for its grinding action on impact alone. It consists of an impeller revolving at 1800 r.p.m., and an annular die against which the ore is thrown by centrifugal force. The coarse ore, averaging 1½ in. diameter, is led into the top of the machine, is caught and hurled against the die with a velocity of about 18,000 ft. per minute. The design of the machine allows no choking, and the capacity

HEAD-FRAMES WITH HOIST AND COMPRESSOR-HOUSE OF INSPIRATION CONSOLIDATED, MIAMI.

is limited only by the power of the driving motor and the rate at which the ore can be fed. It is claimed that it will be possible to handle 40 tons of ore per hour with the machine now being tested at the experimental plant. Several kinds of oil are being tried in the flotation plant.

At the International smelter site, the Short Co. of Chicago, which got the contract from the Oscar Daniels Co., is erecting the stack. The first 100 ft. will be lined with brick. Bedding bins are complete. Stirling waste-heat boilers are being built in. Foundations for five 20-ft. Wedge roasting furnaces are being poured. Those for the engine-house machinery are finished.

Miami, July 16.

The Iron Cap company mined 718 tons of ore in May, yielding 109,759 lb. of copper. The revenue was $9655, and expenditure $8914. During the first five months of the year the respective totals were 3536 tons, 522,733 lb., $52,165, and $39,825.

Seventy-five miles northwest from Globe, in the Mazatzal mountains, H. H. Bowman has discovered a large deposit of cinnabar.

YAVAPAI COUNTY

It is probable that the new United Verde smelter being built for W. A. Clark will receive custom ore when finished.

CALIFORNIA

The Industrial Accident Commission has just made its second quarterly report to the governor, covering the operations of the State Compensation Insurance Fund during the period from April 1 to July 1. The total number of registered applications from employers has now reached 4417, and the estimated annual earnings of employees covered by state insurance is $50,000,000. The total premiums written amount to $579,400. Claims paid, in process of payment, and liberally estimated cost of accidents reported, total $67,122. Total expense, including all items other than compensation payments, amounts to $27,954, or only about 7.1% of the premiums collected. The accrued interest on funds invested amounts to $4550, and the actual balance of the fund now available, including appropriation of $100,000, amounts to $419,098. In addition, a special appropriation of $70,000 is available for contingent expenses of the State Compensation Insurance Fund. This latter amount is not shown in published statements, as there is now no likelihood of the necessity of its use arising. The total number of claim cases handled for the first six months is 1415, and only seven hearings have been applied for to the Industrial Accident Commission. In most of these cases, hearings were necessary to settle complex questions of dependency and to determine the extent of permanent disability.

AMADOR COUNTY

The Argonaut Mining Co., of Jackson, has just declared a dividend of $1.50 per share, amounting to $300,000, and reports an earned surplus of $641,000, or approximately 64% of the entire capital stock, with profits for the first six months of the present year in excess of $150,000, or at the rate of 30% per year. Litigation with the Kennedy Extension cost $113,000, but the above surplus was earned in spite of this suit. The mine is looking at its best, and 4050-ft. level just opened is showing average-grade ore. Jesse Lilienthal was elected president of the Company at the meeting held in San Francisco this week. E. A. Stent is secretary and treasurer.

BUTTE COUNTY

San Francisco men, C. J. Berry, W. W. Johnson, and H. G. Peaks, have bonded the Hupp property near De Sabla. A right-of-way was secured through the old Indian Spring mine 5000-ft. adit for drainage purposes. The adit has been cleared and retimbered for 2000 ft. E. T. Barnette is in charge.

ELDORADO COUNTY

The Plymouth Consolidated company under J. H. Collier is developing the Montezuma mine near Nashville.——The Shaw mine plant, near Eldorado, is to be operated by electric power.

INYO COUNTY

The Wilshire Bishop Creek mine has been unwatered in a week, against 10 weeks in 1913. Development is under way, and the cyanide plant will be erected at once.——Lessees at the St. Ives mine, 25 miles northwest of Bishop, have about 850 tons of $16 gold ore. A Tetrault mill, made in Tonopah, is to be installed.

NEVADA COUNTY

Through complaints of Auburn people, Placer county, the Anti-Débris Association is investigating the muddy condition of the Bear river, and hydraulicking at You Bet is under surveillance.——E. C. Klinker has resigned from the management of the Eagle Bird mine at Maybert to look after the Meister claims. H. S. Mourning takes his place.

SIERRA COUNTY

The new mill at the Mexican mine is crushing good ore. If Phelan Bros.' claims are leased the lessees will move an 8-stamp mill from Sierra City to Slate canon. A 1000-ft. adit has been started by the Bellevue Mining Co. which is working a drift-gravel mine near La Porte. Fifteen men are working at the Orient gravel mine. Rich ore has been opened in the Sierra-Poorman mine. The old Bald Mountain gravel mine is being reopened.

SISKIYOU COUNTY

The Southern Oregon and Northern California Mining Congress, I. J. Luce, of Etna, this county, presiding, which was held at Ashland, Oregon, during the second week in July, was rather lightly attended, according to the *Yreka Journal*. The display of minerals was not up to the standard, there being no exhibits from outside counties. The speakers who addressed the congress were able ones, which made the meeting interesting and instructive. Through the efforts of the persons from Siskiyou who attended, namely, M. J. Balfrey, editor of the *Etna Advance*; I. J. Luce and G. F. Hellmuth of Etna, G. M. Wells, manager of the *Farmer and Miner*; G. A. Reichman, of Fort Jones; and F. W. Armstrong, of Yreka, the next congress will be held at Etna Mills, Scott valley, during the month of June 1915. Scott valley is entitled to the congress as the valley and its tributaries have been great producers of gold and minerals; also, the people of Scott valley have always taken a great interest in the congress. F. W. Armstrong, of Yreka, gave an able address on the mineral resources of Siskiyou county; M. J. Balfrey, of Etna, addressed the congress on the advantages of holding the next convention in Scott valley. The following officers were elected for the ensuing year: president, James Logan, of Grants Pass, Oregon; vice-presidents, Mr. Metcalf of Kennett, O. A. Jillson of Shasta county, and G. A. Reichman of Fort Jones; secretary, G. F. Hellmuth, of Etna Mills; treasurer, J. W. Newman, of Redding, all of California.

COLORADO

GILPIN COUNTY

The Buckeye property, in the Quartz valley mining district, and owned by John Jenkins of Black Hawk, has been sold to capitalists of Grand Rapids, Michigan, through Thomas Cudahy, of Black Hawk, the consideration being $40,000. The new company will be known as the Gold Cup Mining Co. The claims have been opened to 200 ft., and show gold-silver-lead ore.——Operations are busy at the Gilpin Orion, Cyclops, Homer, Buckeye No. 1, Richardson, and other claims.

LAKE COUNTY (LEADVILLE)

The new zinc smelter is nearing completion, and the first lot of ore has arrived at the site. A number of contracts to supply ore have been made. Ores from Fryer Hill properties will supply the greatest tonnage for the start.——Recent developments in the Wolftone mine have been encouraging. Copper-gold ore has been opened in the Helen Gould claim in the East Tennessee district.——The Lake Park district is attracting considerable interest of late. The Silver Queen mine has been bonded by the Tulsa Mining & Milling Co. The ore contains gold and silver, also some copper and zinc. The mine has been idle for several years. Edward Best is manager.

SUMMIT COUNTY

The Breckenridge district is in a prosperous condition.——No. 1 dredge of the Tonopah Placers Co., four miles north of Breckenridge, made its first clean-up last week.——Gold worth $16,000 was sent from the Reiling dredge of the French Gulch Dredging Co. to the Denver mint.——Both of the Wellington Mine Co.'s mills are working full time. The ore-shoot at No. 5 level is opening well.

TELLER COUNTY (CRIPPLE CREEK)

On No. 14 level of the Elkton mine, on Raven hill, the Walter vein has been cut, showing 10 ft. of $30 ore, two streaks being worth $100 gold per ton.——The Portland com-

pany has distributed a 'safety first' pamphlet among its miners and millmen. This particularly draws attention to the evils of drink and subsequent accidents.——The Cresson Consolidated Gold Mining & Milling Co., a very close concern, held a meeting on July 15 for the purpose of considering the extension of the corporate existence of the Company, a mere formality. The main shaft on Raven hill is down 1500 ft., and the orebodies are said to be developing well. About $500,000 was paid in dividends last year. Richard Roelofs is superintendent.——In their contention that the county assessment of 1912 was invalid, the Vindicator and Granite companies have been upheld by Judge J. W. Sheafor of Colorado Springs. The county will appeal. If again upheld, the county would lose about $100,000 per year in taxes from the companies of the district.

RICO, DOLORES COUNTY, COLORADO.

IDAHO

Lemhi County

At the Musgrove mine, 35 miles west of Salmon, the mill and cyanide plant is working full time with good results. The Company has sufficient water power to operate the mill, and also an air-compressor for machine-drills in the mine. ——A 30-day mill-run by lessees at the Burlington mine, near Salmon, was satisfactory.——Stream tin has been found for some time in the placer workings of Eli Mineret in Prairie basin. He has had miners prospecting for the source of this mineral, and it is said that a lode has been found.——The Kirtley creek and Bohannon creek dredges, east of this place, are working this season.

Shoshone County

A shoot of copper ore cut in the Copper King mine at Mullan, last fall, is now being developed. It shows 5 ft. of 4 to 5% copper and 5 oz. silver per ton, opened for 127 ft. ——Some of the lessees operating in the upper workings of the Bunker Hill & Sullivan mine, at Kellogg, are seriously considering the advisability of erecting a concentrator near the mouth of the old Reid adit. Several have developed a large amount of milling ore, and the owners estimate that with a mill at hand it could be treated at a fair margin of profit. This would enable them to handle their shipping ore more advantageously and cut down considerably ore transportation charges.

MISSOURI

Jasper County

Good progress is being made generally in the Alba-Neck City district. L. G. Cole & Co. have let a contract for the erection of a 150-ton mill on the Penn Zinc Co.'s land at Neck City. The Shamrock Mining Co. will soon move its 150-ton mill to the Aylar ground at Alba. A mill will probably be erected by James Crissman & Co. between Alba and Neck City.

MONTANA

Silverbow County

The Butte-Duluth leaching plant produced about 127,000 lb. of copper in June. This is now treating 250 tons of ore per day. Leaching machines, electrolytic cells, and a 1250-hp. motor are to be installed for a total capacity of 1250 tons per day.

NEVADA

Clark County

Gold ore averaging $22 per ton has been opened in the Boss company's claims in the Yellow Pine district, 12 miles west of Goodsprings. Some rich ore has been selected and shipped to Utah.

Esmeralda County

Gravel from gulches around Palmetto, near the Nevada-California boundary, have yielded good results by panning and the dry process. The country around has been located for nine miles. The Nevada-California Power Co. has a substation at this point.——In a winze 85 ft. below the 100-ft. level of the Vernal mine at Goldfield, a vein 18 in. wide worth $250 per ton has been opened for 12 ft., according to the superintendent, Walter S. Norris.

Mineral County

At the end of last week there were 15 stamps working at the new Aurora mill. In June there were 220 men on the payroll. The Company will erect 30 cottages for employees near the mill.

Nye County

Owners of certain placer claims in Tule canon have been bothered with water in the shaft, but a Ford automobile is now used to drive a pump. This is done by jacking up the rear axle, taking off the tires and putting a belt on one wheel of the machine and the pump. Bedrock is at 35 ft. ——The Nevada Cinnabar Co. at Ione, is producing eight flasks of quicksilver per day. Fifty tons of 2% ore is mined daily from a glory hole. Two cords of wood is used per day in the furnaces. A 44-hp. gas-engine operates the plant.

Tonopah mines produced 11,617 tons of ore, worth $299,535, during the week ended July 18. June outputs were as follows: Belmont, 14,973 tons, 281,417 oz. silver bullion, and $120,859 profit; Tonopah Mining, 11,705 tons, 214,775 oz. bullion, and 94 tons of concentrate worth $29,470, and $80,540 profit; Extension, 4673 tons, yielding $68,651 and $19,090 profit; and Jim Butler, 4130 tons and $28,017 profit.— An adjustment of the Jim Butler-West End suit may be arranged by Charles E. Knox.

White Pine County

Through granting the Wide West Mining Co., at Cherry Creek, permission to use the North Mountain Mining Co.'s 1200-ft. adit, the latter Company may reopen its property after an idleness of 15 years. When shut down it was 190 miles from a railway, and there was no improved cyanide process for ore treatment. Three shafts have been sunk 80, 300, and 600 ft., and the adit driven 1200 ft. Some large shoots of $7.50 to $15 gold ore were opened. One lot of 2100 tons from the main shaft averaged $10 per ton. There is a good deal of equipment on the ground.

UTAH

Juab County

A report covering the term April 30 to December 31, 1913, has recently been issued by the Silver King Coalition Mines Co. The cost of excavating, concreting the station at the new Silver Hill shaft, which is 1670 ft. under the surface and 8400 ft. in from the mouth of the tunnel, was $46,770. The cost of compressors, electrical appliances, etc., was $50,422. Driving is under way on the 100-ft. level of this shaft, or 1770 ft. deep. The shaft is to be sunk to the orebodies on the lime-quartzite contact, 1000 to 1200 ft. below the collar, or 2700 to 2900 ft. deep. The profit during the period was $363,290, of which $182,970 was paid in dividends. With the previous balance there was a surplus of $904,466, but the Silver King Consolidated suit damages were $896,822 net, leaving a balance of $7644.

Some good silver-gold-copper ore, with some lead, has been opened in the Dragon Consolidated northern part of the property, where it is being developed from the 600-ft. level of the Iron Blossom. Water from the 800-ft. level of the Dragon is being used at the Knight-Christensen mill.——The Eagle & Blue Bell company has paid a dividend of 5c. per share, equal to $44,657.

WASHINGTON

Ferry County

A franchise, not exclusive, to erect and maintain power-transmission lines on all roads in this county has been granted to Mahlon McCain and Fred M. Shields of Spokane. A 33,000-volt line to cost $30,000 is to be erected within six months. At Danville, 30 miles from Republic, the line will connect with that from Bonnington Falls, British Columbia, owned by the West Kootenai Power & Light Co., which will generate the power for the Republic district.

CANADA

Ontario

The Hollinger mill treated 13,928 tons of $14.59 ore in June. The recovery was 95.2%; all costs, $4.58 per ton; and total profit $129,168. The surplus is $859,225. Dividends now total $2,000,000.

The Dome output in June was 18,250 tons of ore averaging $4.61 per ton.

Dividends paid by Cobalt and Porcupine mines to date amount to $53,638,011 and $2,100,000, respectively. Disbursements for the current year are as follows:

Name	1914	To date	Return on capital, %.
Central as	$ 720,000	$ 6,640,000	176
Temiskaming & Hudson Bay	69,849	1,940,250	25,000
Carlton Cobalt	50,000	75,000	7½
Crown Reserve	247,634	5,784,082	327
Kerr Lake	300,000	5,220,000	174
La Rose	524,525	4,600,346	64
McKinley Darragh	404,585	4,269,597	72
Nipissing	1,050,000	11,940,000	199
Trethewey	50,000	1,061,998	108
Seneca Superior	179,581	490,356	102½
Casey Cobalt	93,750	203,249	15
Buffalo	280,000	2,787,000	282
Cobalt Lake	150,000	465,000	15½
Cobalt Townsite	199,953	966,726	97½
Hollinger	540,000	1,980,000	66
Porcupine Crown	120,000	120,000	6
Total	$5,039,877	$48,544,604	.....

At the Tough Oakes mine, 27 tons of 32.25 oz. gold ore has been bagged. A report on the property by H. H. Johanson states that there is 26,000 tons of ore blocked out, 22,000 partly developed, and 8000 tons per month should be added to the reserves by development.

CHILE

Owing to storms and snowslides affecting transportation and the cutting off of electric power, the production of the Braden mine showed a decrease during June. There was milled 42,000 tons of ore averaging 2.2% copper, producing 3300 tons of 17% concentrate, the recovery being 63.35%. Production totaled 662,000 lb. The Company met its fixed charges during the first half of the year with a small surplus. Production totaled 12,845,000 lb. during the year, comparing with 8,438,000 lb. last year and 3,398,000 lb. two years ago. The following shows results at Braden in the first half of 1914:

Month.	Tons.	Copper, %.	Extraction, %.	Production, lb.
January	98,020	2.15	72.70	2,426,000
February	79,296	2.08	68.63	2,362,000
March	83,900	2.19	72.18	1,801,000
April	83,900	2.35	69.90	2,720,000
May	70,477	2.11	75.36	2,480,000
June	42,000	2.20	63.35	662,000

KOREA

The Oriental Consolidated Mining Co.'s output in April was $127,900.

MEXICO

Sonora

Colonel Calles, in charge of the forces at Cananea, has threatened to execute or deport all labor agitators, which brought the men to their senses. Eighteen were deported on July 14. Furnaces of the Greene Cananea company are again being blown in, and a full resumption of work is expected.

PHILIPPINE ISLANDS

A total of 1328 oz. gold was recovered from the Philippine Dredges, Limited, three boats in May. No. 1 treated 30,750 cu. yd. for 374 oz.; No. 2, 37,000 cu. yd. for 444 oz.; and No. 3, 60,000 cu. yd. for 510 ounces.

PERSONAL

H. F. Jobs is in San Francisco.

C. R. Forbes is visiting California.

D. C. Bard is examining mines in northern Montana.

R. A. F. Penrose, Jr., was in San Francisco Wednesday.

B. B. Thayer is on his semi-annual inspection trip to Butte.

Stephen L. Goodale is spending the summer at Saco, Maine.

W. H. Storms is in Plumas county on professional business.

Henry H. Armstead sailed from New York for Mexico on July 10.

Hennen Jennings is in San Francisco and will stay for some weeks.

R. H. Sales has been examining copper properties near Ketchikan, Alaska.

Ralph Arnold has returned from the East and was in San Francisco this week.

Howland Bancroft was married July 15 to Miss Alice Hannon at Dorchester, Massachusetts.

E. J. Carlyle, formerly of the Washoe smelter, has accepted the management of a copper smelter near Perm, Russia.

W. Lorrain Cook, formerly of Mexico City, is now superintendent of the Cia. Huanchaca de Bolivia, at Placayo, Bolivia.

R. H. Hutchison has resigned from the Coniagas mine, Cobalt, to go to the mining branch at the High School at Sudbury.

J. S. Diller, government geologist, has returned to Redding to make another and more detailed examination of the volcano at Mt. Lassen.

Walter W. Bradley, of the California State Mining Bureau, is investigating the mineral resources of Fresno, Merced, and other central counties of the state.

H. N. Thomson, formerly of Anaconda and Tooele, is at Clarkdale, Arizona, as consulting metallurgist at the new plant of the United Verde Copper Company.

F. A. Glynn, master mechanic for the Nevada Con. Copper Co. at Copper Flat, has resigned to accept the position of master mechanic for the Chile Copper Co. at Chuquicamata, Chile.

C. M. Eye has been appointed manager for the Benguet Consolidated at Bagui, Philippine Islands, and will sail on the *Minnesota* September 26. In the meantime he has gone to Colorado to test a shipment of Benguet ore and to purchase machinery for the mine.

Silver Market Conditions

The tone of the silver market is fairly steady, though dull, according to Samuel Montagu & Co. of London, writing on July 9. A certain amount of selling on account of China during the earlier part of the week, in addition to the ordinary supplies, rather overweighted the market, and prices eased for both deliveries on July 6. The pressure to sell from China then ceased, and a preference to buy for forward delivery at the slightly reduced level carried the quotation for two months to a premium of 0.12c. Inquiry has been fairly good from the Indian bazaars, and purchases have been made for the Continent. An examination of the statistical position of the exports and imports of silver for the first six months of this year afford little justification for the present lifeless condition of the market. The total imports for the last six months were 47,297,160 oz. as against 62,457,666 oz. in the similar months of 1913. The total exports this year up to the end of June were 10,854,795 oz. in excess of the total imports, so that the stock in London had to be heavily reduced in order to fill the demand. As a matter of fact, the visible stock in London shrank from 15,800,000 to 4,400,000 oz. during the period named.

SOCIETY MEETINGS

AUGUST

American Institute of Mining Engineers, Salt Lake City	10-14
British Association, Adelaide, South Australia	8
Canadian Mining Institute, Rocky Mountain branch, Banff.	
Lake Superior Mining Institute, Ishpeming, Michigan	31 to Sept. 3

SEPTEMBER

American Chemical Society, Montreal	15-18
American Institute of Electrical Engineers	not fixed
Colorado Scientific Society, Denver	3
Illuminating Engineering Society, Cleveland	21-25

OCTOBER

American Institute of Electrical Engineers	9
American Iron and Steel Institute	23-24
Colorado Scientific Society, Denver	3

NOVEMBER

American Institute of Electrical Engineers	13
Colorado Scientific Society, Denver	7

DECEMBER

American Institute of Electrical Engineers	11
American Museum of Safety	11-20
American Society of Mechanical Engineers	7-8

SCHOOLS AND SOCIETIES

The French Government has authorized construction of new buildings for the National School of Mines at St. Etienne, estimated to cost about $308,224.

The Panama section of the American Institute of Electrical Engineers held a meeting in the control house at Pedro Miguel lock on July 12. R. H. Whitehead presented a paper entitled 'Hydraulics of the Locks.' The rates of filling the lock chambers and the currents during lockage were discussed. Various features of the paper were demonstrated by actual operation of certain of the valves and gates.

The American Association for the Advancement of Science, the largest scientific organization in the United States, has decided to hold a general meeting of the Association in San Francisco and vicinity on the occasion of the Panama-Pacific Exposition in 1915. A committee of 31 representative scientists of the Pacific coast has been appointed to make the necessary arrangements. W. W. Campbell, astronomer and director of the Lick Observatory on Mount Hamilton, is the chairman of this committee; and John Casper Branner, president of Stanford University, is chairman of the general committee on scientific program. The Pacific Coast committee has recommended, and the American Association has approved, that the sessions of the meeting shall begin on Monday, August 2, and terminate on Saturday, August 7. It has also been decided that the general sessions of the meeting shall be held in San Francisco together with the general evening lectures open to the public, and through the courtesy of Stanford University and the University of California, that sessions for the presentation of addresses and papers in the separate divisions of science will be held in the halls of these universities. Subcommittees of the Pacific Coast committee have been appointed to supply information to the members of the American Association and to the members of such other societies as may desire it, on transportation by railways and by steamers.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Stocks and Bonds

SAN FRANCISCO STOCKS AND BONDS

(San Francisco Stock and Bond Exchange.)

July 22

BONDS

Listed	Bid	Ask	Unlisted	Bid	Ask
Associated Oil 6s	87		Natomas Consol	4	12
Natomas Con	25	2	Pac. Port. Cement 6s	100	—
Unlisted			Santa Cruz Cementus	—	87
General Petroleum 6s	35	40	Union Oil	86½	87½

STOCKS

Listed.	Bid	Ask	Listed	Bid	Ask
Amalgamated Oil	85	85½	West Coast, pfd	—	115
Associated Oil	39	40	Unlisted		
Du Pont, pfd	80	84	General Petroleum	3	—
Giant	81	82½	Noble Electric Steel	59c	65c
Pac. Cst. Borax, com	65	—	Pac. Port. Cement	60	62½
Sterling O. & D.	—	1½	Riverside Cement	—	60
Union Oil	66	75	Santa Cruz Cement	39	—
			Stand. Port. Cement	—	18½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

July 23.

Atlanta	$ .14	Montana-Tonopah	$ .78
Belcher	.40	Nevada Hills	.31
Belmont	6.25	North Star	.20
Con. Virginia	.12	Ophir	.11
Florence	.35	Pittsburg Silver Peak	.24
Goldfield Con.	1.37	Round Mountain	.36
Goldfield Ore	.07	Sierra Nevada	.01
Halifax	.40	Tonopah Extension	2.32
Jim Butler	1.02	Tonopah Merger	.31
Jumbo Extension	.18	Tonopah of Nevada	7.00
MacNamara	.01	Union	.08
Mexican	.45	Victor	.25
Midway	.17	West End	.03
Mizpah Extension	.22	Yellow Jacket	.39

CALIFORNIA STOCKS

(Latest Quotations.)

	Bid.	Ask.		Bid.	Ask.
Argonaut		$6.25	Kennedy	$8.00	
Brunswick Con.	1.50		Mountain King		0.50
Bunker Hill	1.90		South Eureka	1.37	
Central Eureka	0.14	0.16			

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

July 23.

	Bid	Ask		Bid	Ask
Allouez	$ 39	39½	Nevada Con.	$ 13¾	13¾
Ariz. Commercial	4¾	4¼	North Butte	24½	24¾
Butte & Superior	36	36¼	Old Dominion	49	49½
Calumet & Arizona	65½	66	Osceola	76	77
Calumet & Hecla	402	405	Quincy	56	57
Copper Range	35¾	35½	Shannon	5¼	5½
East Butte	9¾	10	Superior & Boston	1¼	2
Franklin	4	4¼	Tamarack	33	34
Granby	78¾	79	U. S. Smelting, com	35¾	36
Greene Cananea	31	31½	Utah Con.	10¼	10¾
Isle Royale	19½	19½	Winona	2¾	3½
Mass Copper	4¼	4¾	Wolverine	38	39
Mohawk	45	45½			

NEW YORK STOCK EXCHANGE

(By courtesy of J. C. Wilson, Mills Building.)

July 23.

	Bid	Ask		Bid	Ask
Amalgamated	$ 69	69¼	Miami	$ 22¾	22¾
Anaconda	30¾	30¾	Nevada Con.	13¼	13¾
A. S. & R., com	66	66½	Quicksilver, com	1	1½
Calif. Pet., com	22	22¼	Ray Con.	20¾	20¾
Chino	39¼	40	Tenn. Copper	33	33⅜
Guggenheim Ex	53¾	54	U. S. Steel, pfd	110¼	111
Inspiration	18⅜	18¾	U. S. Steel, com	60¾	60¼
Mexican Pet., com	67	67¼	Utah Copper	65¼	66⅜

NEW YORK CURB QUOTATIONS

(By courtesy of J. S. Bache & Co., Real Estate Building.)

July 23.

	Bid	Ask		Bid	Ask
Alaska Gold	6	7	Mason Valley	2	3
Braden Copper	7½	7¾	Mother Lode		70
Bruce Copper	1¾	1¾	Mines Co. Am.	3	3⅛
Cal. Cop. Mines	1¾	1¾	Nipissing	5⅞	6
Davis-Daly	½	¾	Ohio Copper	¼	⅜
First National	1¾	2	Stand. Oil of Cal.	349	352
Hollinger	18	18½	Tri Bullion	¾	1
Iron Blossom	1¼	1½	Tuolumne	¾	½
Kerr Lake	5⅞	6	United Cop. com	¾	¾
La Rose	¾	1⅛	Yukon Gold	2⅜	2⅝

LONDON QUOTATIONS

(By cable, through the courtesy of Hollister, Lyon & Walton, New York.)

July 22.

	£	s.	d.		£	s.	d.
Alaska Mexican	1	5	0	Mexican Eagle, com	0	15	9
Alaska Treadwell	7	7	6	Mexico Mines	4	0	0
Alaska United	3	7	6	Messina	1	12	0
Arizona	1	15	0	Oroville	0	10	6
Camp Bird	0	8	0	Pacific Oilfields	0	1	6
Cobalt Townsite	1	11	9	Rio Tinto	67	0	0
El Oro	0	14	0	Santa Gertrudis	0	11	3
Esperanza	0	13	9	Tanganyika	1	16	3
Granville	0	9	6	Tomboy	1	1	3
Kern River Oilfields	0	7	9				

Metal Prices

LOCAL METAL PRICES

San Francisco, July 23.

Antimony	9 — 9¾c
Electrolytic copper	15 —15¼c
Pig Lead	4.15— 5.10
Quicksilver (flask)	$37.50
Tin	39 —40½c
Spelter	6½— 6¾c

Zinc dust, 100 kg. zinc-lined cases, 7½ to 8c. per pound.

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, July 23.—Copper is weak here. In London the Amalgamated and Phelps-Dodge agencies quote 13.69c. for electrolytic; Hirsch, 13.75c.; and A. S. & R., 13.90c. Nevada Consolidated output in June was 1,483,175 lb., and Ray Consolidated, 6,226,536. Lead and spelter are unchanged, the latter being firmer in New York. In St. Louis lead is firm at 3.75c., and spelter strong and higher at 4.90c. Tin is firm at 31.62 to 31.87c. Bar silver in London is steady at 24⅝d. (50¼ cents).

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.		Average week ending	
July 16	55.12	June 10	56.48
" 17	54.37	" 17	56.56
" 18	54.37	" 24	56.24
" 19 Sunday		July 1	56.58
" 20	54.12	" 8	56.42
" 21	53.37	" 15	55.60
" 22	53.50	" 22	54.14

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.04	57.58	July	58.70	....
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask

or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
June 25	38.50	July 9	37.50
July 2	38.50	" 16	37.50
		" 23	37.50

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	....
Feb.	41.00	39.00	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
July 16	13.30	June 10	13.75
" 17	13.30	" 17	13.65
" 18	13.25	" 24	13.55
" 19 Sunday		July 1	13.28
" 20	13.25	" 8	13.44
" 21	13.20	" 15	13.47
" 22	13.20	" 22	13.25

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	....
Feb.	14.93	14.16	Aug.	15.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
July 16	3.90	June 10	3.90
" 17	3.90	" 17	3.90
" 18	3.90	" 24	3.90
" 19 Sunday		July 1	3.90
" 20	3.90	" 8	3.90
" 21	3.90	" 15	3.90
" 22	3.90	" 22	3.90

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	....
Feb.	4.33	4.02	Aug.	4.60	....
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date		Average week ending	
July 16	4.75	June 10	4.88
" 17	4.75	" 17	4.85
" 18	4.75	" 24	4.85
" 19 Sunday		July 1	4.75
" 20	4.75	" 8	4.75
" 21	4.75	" 15	4.75
" 22	4.75	" 22	4.75

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	....
Feb.	6.13	5.22	Aug.	5.51	....
Mch.	5.91	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	....
Feb.	49.07	39.76	Aug.	41.75	....
Mch.	46.95	38.10	Sept.	42.45	....
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

Gold imports and exports into London during the first half of the past three years are as follows:

	1912.	1913.	1914.
Imports	£24,816,548	£25,476,141	£28,934,112
Exports	19,533,236	18,841,946	22,364,842
Net imports	5,277,312	6,634,195	6,569,270

The Westinghouse strike at East Pittsburgh has been called off by the workmen on Thursday, July 9. While the date set for return to work was Monday, July 13, a large number of the men reported on the Friday and Saturday preceding. All the strikers were taken back with the exception of 300 men. The works are now running full time.

Camp Bird and Santa Gertrudis Affairs

On account of the Grenfell failure in London, several weeks ago, H. C. Hoover was appointed temporary chairman of directors of the above Companies on June 17. On the 25th he explained the situation to a number of English and French shareholders, who asked him to continue as chairman. J. S. P. Samborne resigned his position as a director of the Companies, and there is nothing reflecting on him, as he was abroad when the outstanding loans were made. But as he was a director of the Canadian Agency, Mr. Samborne felt that he should resign. R. J. Frecheville also resigned. He was for many years a technical member of the board, and consulting engineer, confining himself to the technical operations of the Companies and leaving the financial business of the Companies in the hands of the late chairman, A. M. Grenfell, whose assurances as to its administration there was no reason to question. Mr. Frecheville felt that as it is the desire of a large body of shareholders that there should be additions to the board, and that as his activities on behalf of the Companies are of a technical order, he would prefer to become the chairman of the technical committee which it is proposed to set up for the conduct and technical adminstration of the Companies' mines. Mr. Hoover was sure that the continuation of Mr. Frecheville's association would be of the greatest advantage to the Companies, and he had no hesitation in engaging his continued services as above. F. W. Baker was an active director and remains on the board. F. A. Govett of the Ivanhoe Gold Corporation, F. H. Hamilton of the Spassky Copper Co., and George de Pass, a large shareholder, have also joined the board of the Camp Bird; and the first two with Norman Craig joined the Santa Gertrudis board. The annual meetings will be held in September next.

Before accepting any responsiblities, Mr. Hoover insisted upon a special audit of the London accounts by Price, Waterhouse & Co. This shows the following condition of finances: Camp Bird assets: Santa Gertrudis shares, £1,122,328; Messina (Transvaal) Development shares, £4483; Nechi Mines (Colombia) shares, £790; Anglo Colonial Estates shares, £2500; and Imogene Basin company shares, £1000. In connection with a property in Central America, £40,095 was spent, and the Camp Bird has £36,500 7% income notes and 89 £1 shares in the controlling syndicate, the Central American Goldfields Syndicate, Ltd. Loans against security total £41,875; cash balance at Lloyds Bank, £23,856; and Glyn, Mills, Currie & Co., £5000; other balances, including Chaplin, Milne, Grenfell & Co., £15,871; and Canadian Agency, £795, against security of 3000 shares in Algoma Eastern Railway Co., 12,000 shares in Alberta Land Co., and 475 shares in Emba Caspian Oil Co. Liabilities include dividend on preference shares to June 30, 1914, £22,750; directors, office, taxes, etc., £2493; unclaimed dividends, £3508; and further contingent liabilities in the Nechi Mines, Anglo Colonial, and Central American Goldfields Syndicate, totaling £3770. The general manager at the Camp Bird mine, William J. Cox, estimates a profit of £60,000 remaining in the mine.

Santa Gertrudis assets: Compania de Santa Gertrudis and Compania Beneficiadora de Pachuca, shares, £252,101; Amistad y Concordia Aviado and Recuperadora, shares, £93,763; Messina (Transvaal) Development Co., £28,125; loans against security, £50,980; cash at Lloyds Bank, £64,611; and Glyn, Mills, Currie, & Co., £30,000; Chaplin, Milne, Grenfell & Co., £11,177. Liabilities include commissioners of inland revenue, £16,000; and directors, office, etc., £1165. Owing to trouble in Mexico, the mill is not working, but the mine is being developed without interruption.

Mr. Hoover estimates that the total loss which the Santa Gertrudis need incur on account of the loans against the Companies that failed need not exceed £27,000.

COMPANY REPORTS

CROWN MINES, LIMITED

Discussion of this great Rand company's results in 1913 will be found in the 'Review of Mining' of this issue. The following data are from the report for the past year.

	1912.	1913.
Ore reserves, tons	10,607,671	10,449,000
Stamps working (835 erected)		660
Tube-mills working		24
Ore treated, tons	2,183,305	2,483,622
Gold produced	£3,071,217	£3,248,132
Working profit	1,314,247	1,442,473
Cost per ton		$3.94
Dividends	1,034,116	1,034,116

GREAT FINGALL CONSOLIDATED, LIMITED

This is a Western Australian company operating an interesting mine and mill at Day Dawn, about 150 miles northwest of Kalgoorlie. Production to March, 1914, was 1,858,885 tons yielding gold worth £4,633,650, and dividends amounting to £1,749,875. The output in 1913 was 64,255 tons averaging $6.06 per ton. The following notes are from the report of the general managers, Bewick, Moreing & Co., the superintendent being C. H. Nicholson:

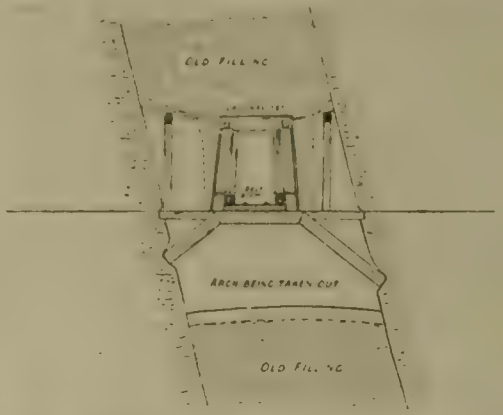
Development totaled 1921 ft., also 583 ft. of timbering and 5580 cu. ft. of excavation on the internal shaft. Driving, cross-cutting, raising, sinking by winzes, and work on the internal shaft cost $31.05, $30.21, $35.28, $45.44, and $178.87 per foot respectively. Interest centred around work at the internal shaft, which starts at No. 13 level, a vertical depth of 1519 ft., and is now below No. 18 level, which is 2280 ft. On No. 16 level the orebody was opened north for 194 ft., averaging $8.64 over 52 in. Winzes below No. 18 show good ore. Ore reserves, below No. 14, are estimated as 69,442 tons worth $9.20 per ton. Above No. 14 the available ore is negligible, although last year six levels above this one produced 41,742 tons. Forty stamps worked 64.27% of the total time, and averaged 7.05 tons of ore per 24 hours each. The cyanide plant residue averaged 27c. per ton, and the recovery was 91.49% at a cost of $2.13 per ton.

The year's income was £124,221, and operating expenses £96,964. After paying for purchased ore and concentrate, and special development, there was a deficit of £12,550 in Western Australia. On adding the previous balance, there was a surplus of £15,308, of which £12,500 was paid in dividends.

WAIHI GOLD MINING COMPANY, LTD.

The report of this great New Zealand company for 1913 is a voluminous publication of 80 pages, with an index, and contains all information necessary from the respective officials, E. G. Banks, superintendent; W. P. Gauvain, assistant superintendent; J. L. Gilmour, mine manager; and S. E. Fraser, engineer at the Victoria 200-stamp mill and cyanide plant. The output of gold and silver since 1890 amounts to £10,454,869, of which £4,478,539 was paid in dividends, and £386,769 as income tax.

In the mine, down to and including the No. 11 level, a total of 13,466 ft. of development was performed. Three shafts were sunk a total of 141 ft., these being 1227, 1256, and 1319 ft. deep respectively. Various work was done in the shafts in connection with the pumps. The 'C' Hathorn-Davey pump lifted 375,760,648 gal., and the electrically driven pumps 161,574,495 gal. of water during the year. Two air-compressors, each with 1750 cu. ft. capacity, were in use; one is steam and the other gas driven. The twenty-four 3½ in. machine-drills and eighteen stoping hammer-drills at work. Approximately 121,135 tons of waste was run into stopes. Development cost 59c. per ton milled. An important development in 1913 was the cutting of a profitable lode between the Empire and Royal lodes, and known as the Dreadnaught, 88 ft. below No. 10 level at No. 4 shaft. It has since been opened on No. 8, 9, 10, and 11 levels, there being 730 ft. of profitable ore on No. 10, 2 to 5 ft. wide and 160 ft. on No. 11. A branch vein on No. 10 has been driven on east for 231 ft., showing up to 4½ ft. of fair ore. Development on the Martha lode was disappointing on No. 10. On this level the Edward lode was 75 ft. wide in the first cross-cut, and profitable, but in other cross-cuts the lode is not so good. Ore reserves total 764,732 tons, not including 23,271 tons in dumps at the mine. Broken ore in shrinkage stopes on five lodes amounts to 42,934 tons, of which 41,202 tons is on the Royal lode. Ten lodes supplied the Victoria mill, 6 miles from the mine, with 184,768 tons of ore. Financial results were as follows:



METHOD OF REMOVING ARCHES FROM STOPES 15 TO 20 FT. WIDE.

Gold and silver revenue	£336,652
Interest	15,487
Balance from 1912	17,957
Total income	£370,096
Expenditure in New Zealand and London	211,395
Dividends (4)	99,181
Income tax (New Zealand £3504, and London £18,984)	22,488
Depreciation, money for Hora Hora electric account, etc.	27,837
Balance for 1914	9,194

Reserve account stands at £90,000, and investments at cost, £379,283. Stores are worth £28,933.

During the current year the Hora Hora hydro-electric scheme, 50 miles distant from the mine, on the Warkato river, was completed, and at the end of April 1914, 1100 hp. was being used at the mill, and 650 hp. at the mine. More motors are being brought into commission as they are ready. Great difficulties were experienced in erecting steel towers and transmission lines over the rough Te Aroha ranges of 2500-ft. altitude. A separate account is kept of this scheme, and the balance-sheet to December 31, 1913, shows that the Company provided £186,490 from revenue, reserve, and New Zealand government debentures. This amount, except £469, was spent the land costing £716; generating and construction plant, £102,289; transmission, £65,064; roads and bridges, £1927; and general expenses, etc., £17,741. Metallurgical work will be discussed in another issue of the *Press*.

MINING DECISIONS

Mineral Lease—Defects Cured

Failure of the lessee under a mineral lease to pay rentals, pending commencement of work thereunder, is satisfied by his subsequent commencement of work at the instance and request of the lessor or the lessor's successors in interest, and the lease cannot thereafter be declared forfeited for such non-paymnt.

Hudspeth *v.* Producer's Oil Co. (Louisiana), 64 Southern, 891. March 30, 1914.

Invalid Location—May Not Be Usurped in Bad Faith

Where the facts showed that one locator was in actual possession and occupancy of property after the discovery by it of oil thereon, the entry of other locators in bad faith and without any right or color of title, and subsequent ouster of the first locators does not entitle the junior claimants to make a valid location on the ground even though it be shown that the prior location was invalid. Under such circumstances the first locator could maintain ejectment against the second.

Little Sespe Consolidated Oil Co. *v.* Bacigalupi (California), 139 Pacific, 802. March 2, 1914.

Mining Company May Become a Public Utility

A mining company maintaining an electric power-plant for its own use, but supplying electricity for lighting purposes to such inhabitants of an adjoining village as have applied for service, is a public-service corporation within the meaning of the public utilities act, and can be compelled by the public service commission to furnish service to the complainants who were residents of the village, even though the corporation's charter contained no authorization to sell electric power. The corporation cannot plead ultra vires as to one consumer and continue to furnish service to others.

Wingrove *v.* Public Service Commission (West Virginia), 81 Southeastern, 734. April 21, 1914.

Ownership of Natural Gas—Character of Title

Where an owner of a tract of land executed a gas lease thereto upon stipulated royalties, and thereafter conveyed a portion of the tract to another, the grantee acquired the right to royalties from wells bored on the conveyed portion but not from wells drilled on the portion retained, even though it was proved that such wells drew the gas from beneath the conveyed portion. The ownership of gas beneath a tract of land is only a qualified title in the land-owner, conditioned upon his reducing the same to actual possession. Hence the grantee could not recover any part of the royalties received by his grantor from wells drilled on the grantor's land.

Fairbanks *v.* Warrum (Indiana), 104 Northeastern, 983. April 24, 1914.

Oil Lease—Implied Covenant for Diligence

A lease granted 'all the oil and gas' under the leased land together with the right to enter 'at all times' for the purpose of 'drilling and operating,' to erect and maintain structures, pipe-lines, and machinery necessary for the production and transportation of oil and gas, reserving royalties to the lessor, and providing that drilling must commence within ninety days from the date of said lease. Held, that as the lease did not expressly define the measure of diligence to be exercised in the work of development, that the implied obligation would be construed to require development work along such line as will be reasonably calculated to make the extraction of oil and gas from the leased land of material advantage and profit to the lessor and lessee. The right to forfeiture for breach of this implied covenant, however, must be exercised with reasonable promptness. Continued acquiescence in the lessee's plan and measure of development and payment of royalties will bar the lessor's right to a forfeiture.

Indiana Oil, Gas & Development Co. *v.* McCrory (Oklahoma), 140 Pacific, 611. May 12, 1914.

BOOK REVIEWS

Engineering Geology. By Heinrich Ries and Thomas L. Watson. P. 667. Ill., index. John Wiley & Sons, Inc., New York, 1914. For sale by the *Mining and Scientific Press*. Price $4.00.

It is no easy task to write a geology for engineers, for the reason that, essentially, geology is a science and engineering is an art. The skilled geologist is one trained long in the methods of scientific investigation; the engineer is one who accepts facts as they are, or even, often, as they appear to be, and makes the most of it. Many engineering structures have failed and all too many mistakes have been made because the engineer responsible had a too limited knowledge of geology. If, however, he had taken the years necessary to become a skilled geologist, he would probably not have become an engineer; and certainly geologists, speaking as one of them, can claim to no inborn skill that would entitle them to consider themselves as engineers. The chasm is not to be bridged save by a very few exceptional individuals who absorb knowledge apparently without effort and can think geologically while they build with the hard practical sense of the engineer. The ordinary busy practitioner will do quite well enough if he fortify himself with a sense of when it is necessary to call on the geologist for advice. The behavior of rivers, the vagaries of underground waters, the puzzling irregularities in the weathering of stones, and the unexpected effects on foundations of these and other geologic factors, are not to be learned by the engineer as an incident to his schooling. What is inexcusable for him is not to know when there is danger to his work from such a source. He must be on his guard and must be ready to call for assistance in planning his work.

The authors of the text-book under review have recognized this fact, and have not attempted the impossible, the making of geologists out of engineering students. Their book is frankly informational, and only the simpler methods of geologic field work are explained and illustrated. Engineers, however, and especially civil engineers, will find the book fully worth not only the purchase price, but the time necessary to read it. It is thoroughly modern, and is authoritative. A wide range of subjects is treated, from landslides to ore deposits, and each is well treated. There is no other book that covers this field, and it is fortunate that the first one in it is so excellent in choice of subject-matter, form of presentation, and in printing and binding. H. F. B.

The Tractive Resistance of a 28-Ton Electric Car. By Harold H. Dunn. Bulletin 74, Eng. Ex. Station, Univ. Illinois.

This records the results of tests made to determine the attractive resistance of a 28-ton electric car when running on straight track in still air. The tests were planned so as to eliminate wind resistance. The results are finally expressed in the form of a curve whose coördinates are car resistance and speed, which shows that the resistance varied between 5.25 pounds per ton at 5 miles per hour, and 26.12 pounds per ton at 45 miles per hour. The bulletin contains also a description of the car.

RECENT PATENTS

1,097,672—Method of making white lead. Alexander S. Ramage, Buffalo, New York, assignor to The Chemical Development Co., Buffalo, New York, a corporation of Colorado.

The method of preparing basic carbonate of lead from lead sulphate, which consists in reacting upon lead sulphate with an alkali carbonate in less proportion than is required for the conversion of all of the sulphate into carbonate, and treating the resulting product with an alkali hydroxide.

1,097,156—Process of reducing ores. Harvey Carroll Alford, St. Louis, Missouri.

In the reduction of metallic oxides, the process of externally heating a charge of the crushed material within a suitable container to a temperature approximately 1000°F., then mixing therewith, without access of air, a hydrocarbon with an excess of carbon sufficient to prevent reoxidization of the metal of the reduced oxide externally heating the mixture, thereby extracting the metal in the presence of such carbon excess.

1,097,227—Electrode for electric furnaces. Arthur Thacher Hinckley, Niagara Falls, New York.

An electrode for electric furnace uses, having at one end an integral pin of less diameter than the electrode, which pin has an annular groove, and having at its other end a longitudinal hole which is similar in shape and size to said pin, said hole having in its longitudinal wall an annular groove, and there being a lateral hole leading from the outer surface of said electrode to the grooved part of said longitudinal hole.

1,101,115—Extraction of copper and nickel, particularly from low-grade ores and products. Wilhelm Borchers, Aachen, Germany, and Harald Pedersen, Trondhjem, Norway.

Smelting the ore to a matte, roasting the matte, leaching the roasted material with acidulated water, precipitating from the resulting sulphate solution the copper by means of hydrogen sulphide, converting the precipitate into metallic copper, evaporating the residual nickel sulphate solution, roasting the dried nickel sulphate to convert the same into nickel oxide, and finally reducing the same to metallic nickel.

1,101,506—Process for the separation of metallic sulphides from gangue and apparatus therefor. Leslie Bradford, Broken Hill, New South Wales, Australia, assignor by mesne assignments to Minerals Separation, Ltd., London, England.

A process of concentrating ores which consists in mixing the ore with water to form a flowing pulp, adding to the pulp sufficient acid to bring about the evolution of gas by chemical action of the acid, subjecting the pulp and evolved gas therein to violent agitation, and then flowing the agitated pulp away from the place of agitation and separating the floating material.

1,100,071—Rock-drill. Louis W. Greve, Cleveland, Ohio, assignor by mesne assignments to The Cleveland Rock Drill Co., Cleveland, Ohio, a corporation of Ohio.

A hammer piston, a rotatable chuck, a drill steel extending through the chuck in slidable but non-rotatable engagement therewith, a piston working transversely with the chuck, a pawl provided with a plurality of ratchet teeth and mounted for oscillatory movement, above the chuck and having engagement with the last-mentioned piston, a ratchet wheel encircling the chuck in slidable but non-rotatable engagement therewith, and a spring pressing the ratchet wheel longitudinally of the chuck so that its teeth engage the teeth of the pawl.

RECENT PUBLICATIONS

Panama Canal. Photographs in color, reproduced from *Scribner's Magazine*, July, 1913. P. 7. 16 plates. Issued by the Ingersoll-Rand Co., 11 Broadway, New York.

A Chemical Study of the Enrichment of Copper Sulphide Ores. By John Dustin Clark. Bulletin 75 of University of New Mexico. P. 72. Illustrated. Albuquerque, June 1914.

Chemical Composition of Bornite, and its Relation to Other Sulpho-Minerals. By E. H. Kraus and J. P. Goldsberry. Reprint from *The American Journal of Science*, June, 1914. P. 15. Illustrated.

Summary Report of the Geological Survey of Canada. P. 544. Ill., maps, index. Ottawa, 1914. Under the director, R. W. Brock, reports were prepared by the following members of the staff: D. D. Cairnes, Charles H. Clapp, R. G. McConnell, G. S. Malloch, Norman L. Bowen, Charles W. Drysdale, Reginald A. Daly, John A. Allan, A. M. Bateman, Charles Camsell, Stuart J. Schofield, Heinrich Ries, John D. MacKenzie, E. M. Kindle, Elwood S. Moore, Frank Leverett, M. Y. Williams, Clinton R. Stauffer, W. A. Johnston, W. H. Collins, M. E. Wilson, H. C. Cooke, P. E. Raymond, Joseph Keele, J. W. Goldthwait, W. A. Bell, E. R. Faribault, W. J. Wright, Jesse E. Hyde, Lawrence M. Lambe, Robert A. A. Johnston, E. D. Ingall, W. H. Boyd, W. E. Lawson, K. G. Chipman, A. C. T. Sheppard, S. C. McLean, B. R. Mackay, D. A. Nichols, John Macoun, P. A. Taverner, E. Sapir, C. M. Barbeau, A. A. Goldenweiser, F. W. Waugh, W. H. Mechling, P. Radin, J. A. Teit, V. Stefansson, W. J. Wintemberg, W. B. Nickerson, C. Omer Senecal, M. Calhoun, S. Groves, Marc Sauvalle, John Marshall, and others.

U. S. Geological Survey publications, Washington, 1914:

Results of Spirit-Leveling in Oregon. 1896 to 1913 inclusive. Work done in coöperation with the state from 1905 to 1913 inclusive. John H. Lewis, state engineer. R. B. Marshall, chief geographer. *Bulletin* 556. P. 175. Ill., index.

Results of Spirit-Leveling in the State of Washington. 1896 to 1913 inclusive. Work from 1909 to 1913, inclusive, done in coöperation with the state. Henry Landes, state geologist. R. B. Marshall, chief geographer. *Bulletin* 557. P. 178. Ill., index.

Results of Spirit-Leveling in Kansas. 1896 to 1913 inclusive. R. B. Marshall, chief geographer. *Bulletin* 571. P. 47. Ill., index.

Useful Minerals of the United States. Compiled by Samuel Sanford and Ralph W. Stone. *Bulletin* 585. P. 250. This is a very useful compilation, and should be secured by prospectors and miners. It gives the location, by states, of the principal deposits of useful minerals, and includes a glossary showing the composition and character of each mineral and the location of its principal deposits.

Ohio River Basin. By A. H. Horton, W. E. Hall, and H. J. Jackson. *Water-Supply Paper* 323. P. 118. Ill., index.

South Atlantic Coast and Eastern Gulf of Mexico Drainage Basins. Stream-gaging stations and publications relating to water resources, 1885 to 1913. Compiled by B. D. Wood. *Water-Supply Paper* 340-B. P. 19.

Advance chapters from 'Mineral Resources of the United States, 1913':

Production of Anthracite. By Edward W. Parker. P. 16.

Production of Phosphate Rock. By W. C. Phalen. P. 17.

Production of Manganese and Manganiferous Ores. By D. F. Hewett. P. 18.

New Machines and Devices

New High-Voltage Oil Switch

The general principles of operation of indoor and outdoor oil switches are the same, but some of the details of construction are obviously different. In addition to performing the usual duties, the outdoor switch must be so constructed that successful service will result while exposed to the effects of the severest weather. All moving and operating parts must be totally enclosed and fully protected.

The new type F, form K-22 oil switches manufactured by the General Electric Co., Schenectady, New York, are designed for this purpose. They are built in single-pole elements and are

HIGH-VOLTAGE OIL SWITCH.

operated by hand, solenoid, or air. The mechanism for each element is self-contained and mounted on the top of a steel tank.

The standard hand-operating level consists of a removable wooden handle attached directly to the switch mechanism. This handle is removable to guard against unauthorized operation. The solenoid mechanism is similar to the hand mechanism, except that a direct current solenoid with a rod for connecting to the mechanism is used instead of the operating handle.

Since the insulating properties of oil are superior to those of air, the bushings are inserted through the cover at an angle converging at the lower end, which reduces the size of the oil tank necessary for any given voltage. The contacts are of the well known 'sliding-wedge' construction. Each phase contains two contacts in series. The stationary ones consist of widely flared fingers and extra long arcing tips of drop-forged copper. The movable element of the contact is a wedge-shaped copper blade. This blade moves in a vertical plane, being drawn up by the switch mechanism when the switch is closed and dropped by gravity assisted by springs when the switch opens. The switches are as a rule tripped on overload by trip coils acting directly on the switch toggle and operated by bushing-type current transformers; although the other methods of tripping oil switches in general use can be applied. The bushing transformer has been designed to furnish at a low cost a series transformer for high-tension systems. It may also be used to furnish current for ammeters where approximate accuracy only is required.

Commercial Paragraphs

Fred M. Prescott Steam Pump Co., of Milwaukee, Wisconsin, has for distribution Bulletins P-105 and P-106, which are devoted to power pumps for mines. All gears used on the power pumps are of cut double helical or herring-bone type and the many types of pumps presented are adapted to the varying conditions found in the operation of mines.

Marion Steam Shovel Co., Marion, Ohio, has recently published an attractive booklet entitled 'Stripping Coal with Economy and Speed.' Under the title, 'When Nature Meets You Over Half Way,' there is presented a brief history of the coal mining industry which is replete with illustrations showing the many applications of Marion shovels to coal mining.

The Redwood Manufacturers Co., San Francisco, has been awarded the contract by the Anaconda Copper Mining Co., of Butte, Montana, for the construction of 15 redwood slime-treatment tanks, which are 50 ft. diameter and have 14-ft. staves. The tanks are to be erected at the Anaconda plant of this Company.

The W. S. Tyler Co., of Cleveland, Ohio, has just recently issued catalog No. 36 which is descriptive of the testing sieves manufactured by this Company. The Tyler standard testing sieves are made from 6 to 12 in. diameter and from 1 in. opening to 300-mesh. For laboratory use the 8-in. sieve with brass frame is recommended. The 6, 7, and 8-in. sieves are made with dies that produce a seamless metal rim across which the cloth is stretched lightly. Sieves of this size are also furnished with bottom pan and cover which are pressed from sheet metal and made to fit each sieve of the set. The use of a pan and cover is to be advised as they facilitate the sifting operation and protect the fine wire cloth from injury when not in use. Telescope nests of sieves are also made by this Company. The bulletin also contains suggestions for testing together with considerable data on the use of screens in analytical work.

The Chain Belt Co., Milwaukee, Wis., has recently issued catalog No. 54 which is descriptive of the 'Chabelco' steel chain belt manufactured by this Company. The chain belt is an all steel, case-hardened-bearing roller chain belt. The side bars are punched from mild steel bar stock and the rollers for transmission purposes are made of the best grade of cold rolled steel shafting, which are machined out of the solid on automatic turret lathes. The object has been to obtain a metal having the correct hardness without brittleness and strength without softness. The rollers for elevating and conveying purposes are made of cold rolled steel, cast steel, or gray iron and the bushings are stamped out of cold rolled pickled steel. The pins are made of forged steel and milled flat on the ends to fit oblong holes in the side bar to prevent turning. The catalog contains a large amount of information regarding the different products of this Company together with illustrations of different installations of the 'Chabelco' steel chain belt.

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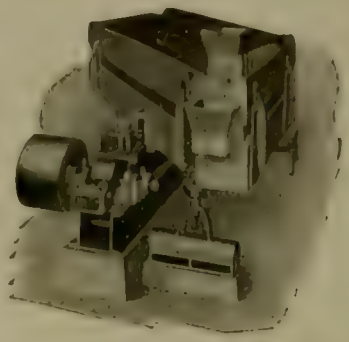

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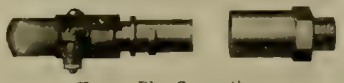

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THE WAR IN EUROPE

War and its consequences is the leading topic of conversation. The news that Austria and Servia were in actual conflict and that neighboring countries might become involved at any moment, has drawn interest from every other topic. War between Austria and Servia alone would mean relatively little to America or the world at large. It is the fear of a general European conflict that grips everyone. Face to face with the actual conflict, few if any find the prospect welcome. In the long run the world distributes its burdens, and whether life and property be destroyed by earthquake, fire, or war, we all suffer. War does not settle things; it too often merely engenders hatreds that lead to further conflict. None the less there may be compensations. For nearly a generation Europe has been arming for a conflict, and the expense has been cumulative, at the same time that the cost has been compounded. In the aggregate enormous sums have been spent on military and naval works and appliances that have later been scrapped. The waste has been as real as though the world had solemnly built locomotives and regularly sunk them unused, in the Atlantic. No one can measure the suffering and sacrifice that this mere preparation for war has entailed, and one may reasonably ask whether it is not better to have war than continued preparation for it at such cost. The question cannot be answered, but human nature is not to be permanently denied and, taking into account men as they are, it was reasonably sure that some time a general conflict would result. Apparently it has now come, though the danger has been so frequently avoided that the world may still escape. Fortunately for the United States, the Atlantic lies between us and the scene of conflict; and, fortunately for Americans, our own troubles in Mexico seem now on the mend.

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THE unhesitating and non-mediatorial manner in which Austria and Servia have set about adjusting their trivial differences will no doubt bring forth the plaudits of the jingo element of this country, which is still lamenting the fact that the United States is not at war with someone.

JAPANESE spelter is now offered at Liverpool, which is evidence of the growth of the Japanese zinc industry during the past few years. Until recently Japan has imported zinc, but the zinc production has increased to 600 tons per month, which is double the consumption of the country and has made it necessary to seek a European market.

COMPLAINT is made by subscribers and others at Dedrick, California, of non-delivery of mail owing to expiration of the contract for transportation from Junction City and failure of the contractor to agree with Postoffice officials on new rates. This is one of the incidental results of the introduction of parcel post. The matter has been taken up with the authorities for adjustment, but in the meantime letters addressed to Junction City will probably reach the persons to whom they are addressed.

SEEING ourselves as others see us often produces a shock. An English friend sends without comment a story of an American found wandering through the Geological Museum on Jermyn street, London. After inquiring as to the price of real estate in the neighborhood he is quoted as saying: "They try to make out that England is a back number, but when I get up against a country that wastes real estate worth hundreds of thousands on a place where no one ever comes, I've no more to say. It's too big a proposition for me."

THE provisional Government of Peru has recently issued a decree confirming the resolutions of 1910 and 1913 which prohibit the denouncement of petroleum producing land in that country. The object of the decree has been to prevent the location of other mineral claims on territory, which is in reality petroleum bearing, for the purpose of obtaining control of the oilfields. Under the Peruvian mining law, while an individual may denounce a claim for specific mineral, he is privileged to exploit the ground for any other mineral which it may contain.

CONFERENCES of diamond producers held in London recently are reported to have resulted in a curtailment in output. While no details have been made public, it seems to be generally understood that an agreement has also been reached between the South African interests and the German producers. The decline of the American market during the past year is held to be largely responsible for the present agreement. Shipments from South Africa last year were almost equal to the record production of 1910 and the price per carat shows a material advance; it is therefore difficult to see the logic of curtailment and is evidently only proposed to meet a temporary flurry in the market.

POLITICIANS may have gained, but the country lost heavily when Mr. Thomas D. Jones failed of confirmation by the Senate for a position on the Reserve Board. As one of the famous family that made the Mineral Point Zinc Company, Mr. Jones is well known to mining men, and to those intimate with the commercial life of Chicago and the Middle West in almost any phase, his name, if not his tall spare figure, is equally familiar. He is a man who looks at business in a large way and that he would have made a fearless and upright public official was assured by the career of his brother, who gave an excellent administration of the Indian office at the time that such administration was worse needed and less common than now, as well as by his own business record.

GROWTH of rumor is well shown in the newspaper reports that a second and more serious strike will soon be on in the Lake Superior copper district. A labor agitator, with no knowledge of actual facts, made some silly remarks at a convention; these were repeated and modified by others until they took the form of a definite statement that a general strike is imminent. As a matter of actual fact the district is remarkably free from unrest and is full of men seeking work. Nearly all the mining companies are increasing the scale of their operations as rapidly as possible, in order to decrease cost by increasing output, but with this it is impossible for them to take on all the men who are coming in from the iron ranges where production is at an unusually low ebb. If the leaders of labor agitation really are planning to attempt to incite a new strike in the 'copper country' they could scarcely choose a more inauspicious moment than the present.

THE Department of Agriculture is excepted in the recent action of Congress which prohibits government bureaus from sending representatives to meetings of the various associations and societies at public expense. In the past the Government has rightfully encouraged the coöperation of the bureaus with representative societies, and great good has been accomplished among others by the Bureau of Mines, through the friendly relations thus fostered. Of course the farmers have a great many votes, but why should this discriminate against the mines department? If a bureau is to collect and disseminate information, why not permit it to do this in the most effective way?

PLANS for the model mine at the Panama Pacific exposition are coming forward nicely. The coöperation of a number of the leading mining companies and machinery manufacturers is going to make possible a really educational exhibit. The effort will be to reproduce as closely as space will permit, actual stopes from representative mines. The list now assured includes the Bunker Hill & Sullivan, Goldfield Consolidated, Homestake, Copper Queen, a Jones & Laughlin iron mine stope, and rooms showing coal mining in both anthracite and bituminous fields constructed by several of the leading companies. Others are tentatively promised. Bureau of Mines officials who are in charge of the enterprise are meeting with every encouragement and we believe the mine will be one of the most instructive exhibits at the Exposition. If it serves the purpose of giving the general public a real insight into mining, a 'perceptive centre' around which to build an accurate concept of underground conditions, it will be well worth the time and labor expended.

THE personnel of the Foreign Trade Council, which has been created by a resolution presented at the national foreign trade convention, is most representative of American business, and if this council is to be a live organization, the purpose for which it was created could not be better represented. Mr. James A. Farrell, president of the United States Steel Corporation and chairman of the council, in outlining the purpose of this body, states that it is a necessary preparation for the evolution and expansion in the business life of the country. By gathering active and representative business men into such a body and coöperating with all firms in our oversea commerce, it is hoped to encourage every practical and sound policy designed to secure for the nation our share of the trade of the markets of the world. The foreign trade of the United States is now valued at four and one-half billion dollars per year, of which two and one-half billion dollars represent exports. This trade has developed largely by reason of our natural resources and the individual enterprise of American industry, but without an American merchant marine, comprehensive national policy, or commercial and industrial coöperation. It is for this that the council has been created, and it is hoped that something tangible may result.

SANITARY CONDITIONS ON THE RAND

The spread of vocational diseases among the mine workers of the Rand and other parts of the world has led to the serious investigation of causes and has resulted in an organized effort to reduce mortality and increase the efficiency of the working force. The report of General W. C. Gorgas on South African conditions presents many interesting features and the recommendations made are of a general nature and adaptable to other regions than South Africa. The death rate for the natives employed in the mines of the Transvaal during the year 1903 was 71.7 per thousand. This has been reduced to 26.84 in 1912, but is still very high. The death rate among the negroes employed on the Panama canal in 1912 was 10 per thousand. An examination of the reports of the Native Affairs Department for 1912 shows the four diseases which contributed most to the death rate were pneumonia with 9.8 mortalities per thousand, phthisis 5.4, meningitis 1.3, and enteric fever 1.1, each of which diseases is in some degree infectious and contractable. If they could be eradicated, the death rate from disease for 1912 would have been 5 per thousand. While this is not possible at present, it is highly probable that by proper hygienic measures a very appreciable reduction can be accomplished.

Statistics show that the recently arrived native is much more susceptible to pneumonia than the older workers, which indicates that the matter of immunity is most important. This condition is similar to that obtaining at Panama, where it was found that the death rate was four and one-half times greater among the men who had been on the Isthmus less than three months than it was among those who had been there longer. The decline in the death rate from pneumonia was coincident with allowing laborers to leave the barracks provided by the Commission and build cabins on the hills or to live in the towns of the Canal Zone, and have their families with them.

Overcrowding plays just as important a part in the spread of tuberculosis of types other than pulmonary as it does in pulmonary, and the same methods of control are applicable. Careful routine medical examination of the laborers should be made and disinfection of the dwellings is also important. With native labor the most important measure is the providing of individual quarters. The disease can be particularly combatted by fresh air, sunshine, cleanliness, and roomy quarters.

Miners phthisis, while comparatively unimportant, as shown by the death rate figures published, is nevertheless on the increase. The report for 1903 showed a rate of 0.05 per thousand and in 1912 a rate of 0.10 per thousand. The disease is essentially a silicosis and is caused by particles of silica getting into the lung tissue. This results in a reduction of vitality and increased susceptibility to disease. The hygiene of the disease is obvious, that of laying the dust so that the particles of

silica will not be floated in the air. Cerebro spinal meningitis, which at times causes considerable mortality among the native miners, is an infectious disease which is also best combatted by cleanliness, air, light, disinfection, and the provision of more adequate quarters for the laborers.

The most serious sanitary defect on the Rand is the manner of housing the native. The quarters are too crowded, each native having but 200 cubic feet of air space, which results in the air becoming vitiated. The crowding forces the occupants into close personal contact and therefore largely increases the spread of infectious disease, which applies particularly to pneumonia, tuberculosis, and cerebro spinal meningitis. It is therefore to be urged that the natives be housed in individual buildings and allowed to have their families with them, and if this is not feasible at present, the nearest approximation to it should be attempted. This, General Gorgas thinks, would probably reduce the death rate from 15 to 2 per thousand. A striking coincidence in this respect is the fact that where the natives on the Rand are living as they do on the Isthmus the health rate is approximately as good. In the opinion of General Gorgas this method of housing the natives would materially reduce the recruiting cost, which at present amounts to about £1,000,000 per year, in that with family quarters in place of the compounds a permanent force of skilled workmen would be available. While this would probably be true to a limited extent, it could hardly be expected that the average native who has been transplanted to the mines will become a fixture.

The compounds everywhere show neatness, cleanliness, and commendable care and discipline, but the interior of the native quarters shows the opposite most usually. This is largely due to the fact that authorities do not wish to interfere to such an extent as to cause the natives to become dissatisfied. It is not possible to make any great improvements as long as the men are in such crowded quarters and are allowed to eat and keep food in their sleeping quarters. Each native should be allowed 50 square feet of floor space and be furnished with an individual bed and box in which to keep his belongings and no food or utensils of any kind should be allowed in the dormitories, eating sheds being erected instead.

The report is replete with valuable data and recommendations regarding the local conditions. The record of the Isthmian Department of Sanitation, which in no small degree was responsible for the successful accomplishment of the Canal, is so well known as to require no comment, and if the experience of General Gorgas at Panama can be applied to the Rand and the communities which have similar problems to work out, a great good may be effected. This one branch of the welfare movement has been productive of excellent results in many of the industries outside of mining, and it is to be hoped that the impetus given the work on the Rand may be productive of results not only in South Africa, but in other parts of the world as well. The subject is one which is overlooked by the average operator, but is well worthy of attention from both a humanitarian and efficiency standpoint.

THE INSTITUTE AND CONGRESS

Projects for the revision of the mining laws have, incidentally, reacted in a number of directions. For example, it has made it necessary for the American Institute of Mining Engineers to face squarely the matter of whether it can or cannot make recommendations as to legislation affecting mining. It is evident to anyone familiar with the situation that Congress often needs disinterested advice as to technical matters, and it is equally well known to those who know Congress and the Congressmen that authoritative opinions from truly representative bodies would be welcomed by the real leaders. There are so many public bodies addressing Congress, and it has been shown repeatedly that it is so easy for adroit manipulators to secure favorable action on any project from a body that does not assume responsibility, that volunteered advice is at a heavy discount. At the same time a real expression of opinion from the American Institute of Mining Engineers would deserve, and would carry, great weight. The difficulty is to secure any such consensus of opinion. The proposed creation of a commission to codify and recommend revision of the mining laws, has attracted great interest among mining men and, following the thorough discussion of the matter at the New York meeting of the Institute a committee was appointed to further the project. We believe that there would be no material dissent from the proposal to create such a commission if the individual vote of each member of the Institute had been taken since, while, there are wide differences of opinion as to what revision is necessary, there is general agreement that the laws need mending and that preliminary consideration by a competent commission will be helpful. However, strict constructionists raised a question as to the authority of the Directors of the Institute to appoint any such committee, and, the matter being referred to counsel, the Directors were advised that, while a committee to recommend appointment of engineers on such a commission was proper, no authority existed for one to urge the creation of the commission itself. An amendment to the constitution has now been proposed so as to make clear the right of the Directors to act in such cases and this amendment is now before the Institute for consideration. Whether it should be passed, opens too large a question for discussion at this time. In general we feel keenly that the Institute has never exerted the influence in public affairs that it could and which would be good for it and for the industry, but before opinions are expressed they must be formulated and that requires development of machinery which the Institute as yet does not possess. The amendment as framed opens the way to what we consider a desirable change, but if adopted it must be supplemented by creation of machinery to give it effect.

Smelting Costs and Prices for Silver-Lead Ores

By L. S. AUSTIN

In the early history of silver-lead smelting in Utah the oxidized ores were smelted and sulphide ores avoided, and so but little matte was made. But when the supply of the easily obtained, surface, oxidized ores fell off, provision had to be made for treating the matte, consequent on the use of the complex sulphides. Heap-roasting of the matte was resorted to, followed later by the building of reverberatory roasters. Practice from that time has been that of the roasting and, recently, the sintering of such sulphides, not only for ridding them of sulphur, but to get them so agglomerated that little or no flue dust would be made. It was also found that by thus sintering or agglomerating, the tonnage of the furnaces was largely increased. Finally, it has become the custom to sinter, not only the sulphides, but the 'fines' of oxidized and silicious ores, these 'fines' constituting commonly about one-third of the whole.

System of Ore Buying

Meanwhile a system of buying ores, based on their mineral and metal contents, came into vogue, and this was gradually modified and added to as experience suggested. A contract for the purchase of ore as now prevailing would be to the following effect:

Gold to be paid for at $19 per oz., but no payment for less than 0.025 oz. per ton. In this case the smelter gains all between this and $20.40 per oz. when it sells its base-bullion.

Silver to be paid for at 95% of the New York quotation for bar silver, but no payment to be made when there is less than one ounce per ton. The 5% deduction is intended to cover the loss in smelting. If an ore is high in slag-forming constituents it may not do so.

Lead is to be paid for at 90% of the New York quotation for market lead, from which shall be deducted 1¼c. per lb. No payment is to be made if there is less than 5% in the ore. The deduction of 10% is to cover the loss of lead in smelting, due not only to the slag carrying off 1 to 1¼% of its weight as lead, but to the volatilized lead. The bag-house today prevents the volatilization loss. No doubt with silicious ores the slag loss may be exceeded. The deduction of 1¼c. per lb., or $25 per ton, is to pay for freight and treatment. Under head of 'freight and refining costs' it is shown that this cost is $18 only. The non-payment for less than 5% lead is a relic of days when lead was not so closely saved.

Iron to be paid for at 7c. per unit if the lead contents are over 30%; when from 30 to 25%, at 6c. per unit; under 25% lead, at 5c. per unit. Iron is paid for because of its fluxing value. The higher value set on it when the lead content is higher, is to encourage the shipper to maintain that content. It has been realized by the smelting companies that the higher the lead the lower the slag-forming content of the ore. It is also quite possible that the company may be short of lead, which, as a collector, must be maintained to a certain ratio of the charge, preferably 10% at least.

Insoluble (impure silica) is charged for at 12c. per unit. The insoluble content is more easily determined and is higher than the actual silica, and so gives an advantage to the smelter. The charge of 12c. per unit is made because the silica must be smelted, not alone with the addition of iron worth 5c. to 7c. per unit, but also limestone at 90c. per ton.

Zinc, when less than 5%, has no charge against it, but over that figure the excess is charged for at 2c. per unit. Zinc, especially as blende, goes in part into the matte, in part into the slag, and in part is volatilized, making trouble in the shaft of the furnace, and carrying off some silver. With the bag-house it is believed that no silver is lost. However, due to its making trouble, it has been penalized when, as in this case, it exceeds 5 per cent.

Arsenic forms speiss, and this latter, when in excess of 5%, is charged for at 20c. per unit. When a furnace is reducing well, speiss forms. It carries some silver and gold, and hence must be re-treated. Whether 20c. per unit is a just charge or not is an open question: it is a suspiciously round number.

Sulphur is charged for at 25c. per unit up to a maximum of $3 per ton. It has been assumed that $3 is to cover the cost of roasting an ore of 12% sulphur or over. If an ore contains to exceed 2 to 4% sulphur, it may well be sintered at a cost of 75c. per ton.

A treatment charge of $1 per ton is made for an ore of 30% lead. For each unit of lead over 30% a credit of 5c. per unit is allowed, and for each unit of lead under 30% a charge of 8c. per unit is made. It is evident that the lead in the ore is greatly desired; also, as the percentage of lead increases, so the silica decreases, with a less production of slag. The figure of $1 per ton for treatment, as will later appear, is less than the actual cost, and this is done in place of giving the full price for the lead. It is thought this makes it appear more satisfactory to the shipper.

Costs Under Ideal Conditions

The present paper is confined to the discussion of a method of estimating costs and prices of ores treated in the silver-lead custom plants of Utah, for a works where the flue dust from both sintering machines and the blast-furnaces is caught in a suitably constructed bag-house, and having an equipment suited to obtain low operating costs. It also implies that it is possible to obtain ores in such proportions that it is necessary to carry neither a low percentage of lead on the charge nor to buy ore for fluxing.

The chief cost factors involved are: smelting cost; roasting and sintering; re-treatment of matte; smelting limestone flux; slag-forming content; metal losses; iron or silica excess; profit; metal values.

Smelting Cost per Ton of Charge.—It is difficult to obtain present-day costs, and accordingly an illustrative estimate, based upon published figures, and hence open to correction, is here given. The following costs per ton of charge are assumed:

Labor	$0.500
Coke, 12½% at $7 per ton	0.875
Fuel for power	0.120
Lime for coke-ash	0.015
Maintenance and repairs	0.400
Delays (accidents, strikes, railroad)	0.100
Flue-dust recovery	0.040
Administration	0.160
Smelting per ton of charge	$2.210

This figure differs from that often quoted in cost estimates in which the items are differently distributed. It is assumed that whether the ton of charge is of ore alone, as in the case of a self-fluxing ore, or of ore and fluxes together, the same percentage of fuel is to be used—a matter worthy of further investigation. Certainly a silicious ore should take more fuel than one high in lead.

Assuming the slag content at 70% of the charge, the cost per ton of slag becomes $2.21 ÷ 0.70 = $3.16.

Roasting and Sintering.—It is good practice to screen out the 'fines' from a sulphur-free ore, and, before blast-furnace treatment, to sinter it. This fine material is assumed to constitute one-third of the run-of-mine ore. In the case of a concentrate, all would have to be sintered. An ore, carrying a minimum of 2 to 4% sulphur, should be sintered, and therefore all of it should be crushed. Ores high in sulphur are rough roasted in one of the multiple hearth roasters, such as the McDougall, the Wedge, or the Herreshoff, then sintered on a machine of the Dwight-Lloyd type. The figure of 75c. per ton is intended to cover both. When a sintered ore, still containing 4% sulphur, is smelted, it may be computed that 2% enters the slag and is volatilized, leaving 2% to form 10%, or 0.10 ton, of matte per ton of ore, which, as given below, costs $0.334 to re-treat.

Matte can be sintered, and re-treated like an ore. The estimate for so doing will be:

Rough roasting and sintering	$0.75
Crushing, sampling, and assaying	0.18
Re-smelting	2.21
Metal loss on 0.75 ton at $0.92	0.69
Profit per ton	0.86
	$4.69
Less 38 units available iron at 6c	2.28
	$2.41
Re-treating 0.25 ton matte	1.17
	$3.58
Less 4 units available iron at 6c	0.24
	$3.34

Smelting Limestone Flux.—The amount of limestone depends upon the quantity of silica carried by the ore. It is an inevitable charge against the ore, and not only must the limestone be smelted, but it must be paid for. The cost per ton of limestone is:

Smelting cost	$2.21
Cost of limestone	0.90
Iron to flux 4% SiO_2 = 3.1 units at 6c	0.19
	$3.30

In a slag of SiO_2, 33%; FeO, 33%; CaO, 20%; ZnO, 8%; the ratio of SiO_2 to CaO is as 1 : 0.6, or, since limestone is approximately 50% CaO, the ratio of silica to limestone will be as 1 : 1.2.

Slag-forming Constituents.—These vary with the ore, being roughly equal to the silica plus the unreduced bases. Thus a ton of a roasted ore of the composition PbO, 22%; CuO, 0.3%; ZnO, 20%; Fe_2O_3, 33.3% (FeO, 25.7%; As$_2$O$_3$, 1.1%; Al$_2$O$_3$, 1.8%; CaO, 2%; MgO 0.5%; SiO_2, 17.1%; S, 3.6%) would have for slag making 0.676 ton of silica and bases. Strictly speaking, this slag would carry 1% Pb and 1 to 1.5% S; while some of the zinc would be volatilized. Possibly the gain to the slag in lead and sulphur would be compensated for by the loss in zinc.

Now, in silver-lead smelting the losses in lead and silver increase proportionately with the increase of slag-forming constituents of the ore itself, plus an addition due to the presence of silica; and silica must be fluxed, not only by the iron of the charge, but limestone must be added. Thus for 33% silica must be added enough limestone to insure the presence of 20% CaO or 0.6 of the silica. For one ton of the roasted ore just cited, the figure 0.676 + (0.174 × 0.6) = 0.78 ton would accordingly be obtained, and this may be called 'the corrected slag content.' Since in practice it is not expected to make a complete analysis of each ore, the question arises, what can be done to obtain its slag content? A laboratory determination (using ammonium nitrate to aid oxidation if necessary) would give the weight of the well roasted ore and the loss of weight in roasting, as a basis for calculation.

Take for example an oxidized lead ore containing Pb, 39.2%; Fe, 16.4%; SiO_2, 8%; Zn, 1.6%; S, 1.3%; with 17.3 oz. Ag and 0.05 oz. Au per ton. Upon ignition and roasting, there is a loss of 16%, leaving per ton:

Weight of roasted ore		0.840 ton
Less PbO	0.425 ton	
Less Fe_2O_3 to FeO (14%)	0.023	
		0.448 "
		0.392 "
Add, due to silica, 0.08 ton × 0.6		0.048 "
Being 44.0% of 'corrected slag content'		0.440 "

Assuming that the loss of lead in smelting is 1%, and for silver 0.6 oz., per ton of slag produced, then:

880 lb. by 1% = 8.8 lb. lead at 3.1c	$0.273
0.44 ton slag by 0.6 oz. = 0.264 oz. at 50c	0.132
Loss due to slag	$0.405

Metal Losses.—To the actual cost of smelting should therefore be added the loss above computed. On the other hand, in any completely equipped plant, a deduction of 1% of the total gold, silver, and lead would be made to cover refinery losses and 1½% for the tie-up of metals for three months at 6 per cent.

Iron or Silica Excess.—The composition of a slag well suited to Utah conditions has already been given, namely, SiO_2, 33%; FeO, 33% (Fe, 25.7%); CaO, 20%; ZnO, 8%. The ratio of SiO_2 to Fe is as 1 : 0.77, hence the estimate on an ore, as in Case II, carrying SiO_2, 63.6%; Fe, 3.5%; CaO, 0.8%; is as follows:

Iron for silica, 63.6 × 0.77	49.0
Iron (and lime) in the ore	4.3
	44.7

This at 6c. per unit, which is what is to be paid for in case of an ore carrying an excess of iron, will be 44.7

× 6c. = $2.68. Where an iron-bearing ore can be bought with a lower figure than 6c. per unit for the iron, the silicious ore can be smelted cheaper, and so the smelting company can vary its payments for iron to suit its needs. The cost for smelting limestone is given as $3.30 per ton—approximately 6c. per unit.

Profits on Treatment.—On an investment of $2,000,000 for plant and equipment, and of $1,000,000 of working capital, to make a profit of 10% (which, considering the risks, is a fair return on the investment), a company producing 1000 tons per day, or, allowing 5% for delays, 347,000 tons of charge per year, should make 86c. per ton of charge put through the furnaces. Now in Case I below there is put through 1.492 tons, which at 86c. should give a profit of $1.28, or a total treatment charge of $8.66; and for Case II, similarly calculated, a charge of $10.31 per ton.

Factors Modifying Profits

Where operations proceed smoothly, where the slag losses are no greater than those given for good smelting, where small amounts of gold and copper are not paid for, and where skill is employed in the sale of the metals produced, profits may become greater than above specified. On the other hand, if iron must be purchased for fluxing, if the market for metals is a falling one, if it is not possible to get the best combination of ores for profitable smelting, these profits may be greatly diminished.

Freight and Refining Costs.—Where the smelting company has no greater investment than that of its smelting plant and operating fund, and has to sell its base-bullion, a favorable contract for this sale would be as follows:

1. A contract for a specified term and for a production, in the case of our typical works, of 100 tons per day, or of 3000 tons of base bullion monthly.
2. Gold to be paid for at $20.40 per ounce, but no payment for less than 0.05 oz. per ton.
3. Silver to be paid for at 99% of the New York quotation for bar silver, but no payment for less than 3 oz. per ton.
4. Lead to be paid for at 99% of the wet assay on the New York quotation for market lead.
5. Freight (Utah to New York), per ton $12
   Treatment 6

$18

The buyer agrees to advance 90% of the calculated net value, charging at the rate of 6% for such advanced payments.

Deductions for Metal Contents.—Now, if the smelting works is to make its profit on the treatment of the ore, and not on the gain between what is received and what it pays for metals, it will be found that when lead was 4c. per lb. or $80 per ton in New York, the payment for the lead should be (99% of $80) −$18 = $61.20, or 61.2c. per unit. For the silver, in the same way the price per ounce would be 49.5 cents. As a matter of fact, this method is not followed. The general way, as already shown, is to make a deduction of 10% from the lead and of 5% from the silver, and to say that it is due to losses in smelting; also to deduct from the lead present at the rate of $20 to $30 per ton.

Where competition exists, as it does in Utah, these deductions are, it is true, retained, but the profit thus made is applied to reduce treatment charges. Nor is competition the only factor; to obtain desired ores and to obtain those on which the compensation to the miner is small, prices are made on such ores as will bring them to the works. As prices are now quoted by the different companies, but little money is made in smelting. What is made comes from profits in other parts of the country, from the profits in refining, and skill in the sale of metals in the New York market.

Illustrative Examples

To apply the foregoing enumerated factors, four cases may be discussed in detail:

Case I.—This is a lead ore containing Pb, 30%; SiO_2, 41%; Fe, 2.8%; Zn, 0.9%; CaO, 0.9%; S, 5.2%; with Ag, 9.9 oz. and Au, 0.025 oz. per ton. The costs and returns will be:

Smelting cost		$2.21
Crushing, sampling, and assaying		0.18
Sintering		0.75
Re-smelting 0.10 ton matte		0.33
Smelting limestone, 0.41 ton SiO_2 × 1.2 = 0.492 ton × $3.30		1.62
Slag-forming contents:	Ton.	
Roasted ore (laboratory result)	0.870	
From limestone 0.41, SiO_2 × 0.6	0.246	
	1.116	
Less Fe_2O_3 to FeO 14% of 0.028	0.004	
PbO	0.324	
	0.328	
Total	0.788	
Slag losses:		
Lead, 15.8 lb. at 3.1c	$0.49	
Silver, 0.788 ton × 0.6 × 50c	0.24	
		0.73
Fe needed for SiO_2:	Units.	
41% × 77	31.6	
Less Fe and CaO	3.7	
	27.9 at 6c.	1.67
Profit on 1.492 tons at 86c		1.28
Total charges		$8.77
Metal values:		
Pb, 600 lb. at 3.1c	$18.60	
Ag, 9.9 oz. at 50c	4.95	
	$23.55	
Less 2½%	0.59	
Net metal values		$22.96
Charges		8.77
Net returns		$14.19

Case II.—This is a silicious leady ore of the following composition: Pb, 28.5%; SiO_2, 63.6%; Fe, 3.5%; Cu, 0.05%; Zn, 0.8%; CaO, 0.8%; S, 2.1%; Ag, 30 oz. and Au, 0.0035 oz. per ton. The costs and returns are:

Smelting cost		$2.21
Crushing, sampling, and assaying		0.18
Sintering ½ ton at 75c.		0.25
Smelting limestone flux, 0.636 ton SiO_2 × 1.2 = 0.76 × $3.30		2.51
Slag-forming constituents	Ton	
Roasted ore (by laboratory test)	0.970	
Limestone, 0.6 × 0.636	0.382	
	1.352	
Less Fe_2O_3 to FeO, 14% × 0.035	0.005	
PbO	0.308	
	0.313	
Total	1.049	
Lead loss, 21 lb. at 3c	$0.65	
Silver loss, 1.049 × 0.6 × 50c	0.32	
		0.97
Profit on 1.76 tons at 86c		1.51
Iron flux needed (77% × 63.6) −4.3 = 44.7 units at 6c		2.68
Total charges		$10.31
Metal values:		
Pb, 570 lb. at 3.1c	$17.67	
Ag, 30 oz. at 50c	15.00	
Au, 0.035 oz. at $20.40	0.71	
	$33.38	
Less 2½%	0.81	
Net metal values		$32.57
Charges		10.31
Net returns		$22.26

Case III.—This is an iron-bearing ore with iron excess, of the composition: Pb, 5.8%; SiO_2, 16%; Fe, 31.8%; Mn, 10.6%; Zn, 4%; CaO, 2.1%; S, 0.6%; with Ag, 4.5 oz. and Au, 0.01 oz. per ton. The costs and returns are:

Smelting cost		$2.21
Crushing, sampling, and assaying		0.18
Sintering ½ ton at 75c.		0.25
Smelting limestone flux, 0.16 ton SiO_2 × 1.2 = 0.19 ton × $3.30		0.63
Slag-forming constituents:	Ton.	
Roasted ore by laboratory test	0.900	
Limestone, 0.6 × 0.16 SiO_2	0.096	
	0.996	
Fe_2O_3 to FeO, 14% × 0.424	0.059	
PbO	0.063	
	0.122	
Total	0.874	
Lead loss, 17.4 lb. at 3.1c	$0.53	
Silver loss, 0.87 × 0.6 × 50c	0.26	
		0.99
Profit, 1.19 tons at $0.86		1.10
		$5.36
By iron excess, 42.4 (77% × 16.0) = 31 units at 6c		1.86
		$3.50
Metal values:		
Pb, 116 lb. at 3.1c	$3.60	
Ag, 4.5 oz. at 50c	2.25	
Total	$5.85	
Less 2½%	0.15	
Net metal values		$5.70
Charges		3.50
Net returns		$2.20

Case IV.—This is the oxidized lead ore quoted under 'Slag forming Constituents.' The figures are:

Smelting basis		$2.21
Crushing, sampling, and assaying		0.18
Sintering ½ ton ore		0.25
Smelting limestone flux, 0.08 ton SiO_2 × 1.2 = 0.096 × $3.30		0.32
Slag-forming contents = 0.44 ton.		
Lead loss, 9.6 lb. at 3.1c	$0.27	
Silver loss, 0.473 ton × 0.6 × 50c	0.13	
		0.40
Profits, 1.096 tons at 86c		0.94
		$4.30
By iron excess, 16.4 (77% × 8) = 10.2 × 6c		0.61
		$3.79
Metal values:		
Pb, 764 lb. at 3.1c	$23.68	
Ag, 17.3 oz. at 50c	8.65	
Au, 0.05 oz. at $20.40	1.02	
	$33.35	
Less 2½%	0.83	
Net metal values		$32.52
Charges		3.79
Net returns		$28.73

Contract Specifications

To simplify the method of paying for an ore under contract, which may vary within a considerable range in silica, iron, and sulphur, I would propose the following charges and prices per ton:

Preliminary Treatment

For crushing and sampling		$0.15
Assaying and testing		0.03
Total		$0.18
Where the ore must be sintered, an additional charge:		
For sintering	$0.75	
For re-treating matte	0.33	
		1.08
Total		$1.26

If the 'fines' only are to be sintered, the charge for sintering them is 25c. to 75c. per ton, according to their percentage.

Per Ton of Slag-Forming Contents

For smelting		$3.16
Slag loss:		
20 lb. Pb at 3.1c	$0.62	
0.6 oz. Ag at 50c	0.30	
		0.92
Profits		1.23
Or per pound 0.26 cents		$5.31

Per Ton of Silica

For iron, 77 units at 6c	$4.62
Limestone, 1.2 tons at $3.30	3.96
Slag loss, 0.72 tons at 92c	0.67
Profits, 0.6 ton at $1.23	0.74
Or per unit 9.85 cents	$9.99

The lead is not to be deducted from the slag-forming contents. To compensate for this, from the freight and refining cost should be subtracted the cost of smelting it, namely, $3.16

per ton of PbO or $3.40 per ton of lead. This leaves $14.60 per ton, or 0.73c. per lb., to be taken from the New York price of lead.

Taking Case I for example, the costs on this basis would be:

Preliminary treatment	$ 1.26
Slag-forming contents, 0.87 ton at $5.31	4.67
41 units SiO_2 at $9.99	4.10
	$ 9.97
Less 3.7 units (Fe and CaO) at 6c	0.21
Net costs	$ 9.76
Metal values:	
Pb, 600 lb. at 3.27c	$19.62
Ag, 9.9 oz. at 50c	4.95
Total	$24.57
Less 2½%	0.62
Net metal values	$23.95
Charges	9.76
Net returns	$14.19

The result is the same as in the first method, but the calculation is simpler.

Smelting companies do not take the public, or rather the shippers, into their confidence. The smelter knows how much profit he is going to make on any ore, while the producer or shipper is often ignorant regarding details, is suspicious, and complains that he is charged an undue price for the treatment of his ore. The ore-buyer gives no figures to reassure the seller; indeed, he must generalize, and were he too frank, would be admonished. Smelting company reports reflect this. They give information in a guarded way. The companies would be willing to give information were it to their stockholders only, but if it were divulged the shipper and the competitor would take advantage of it. Indeed, the shippers are often shrewd, well posted men. To give them details would mean that they would see the weak points of the buyer. The buyer, by a complicated system of prices, discounts, and penalties, casts an air of mystery around the transaction, and adds to it by making contracts on different systems. In consequence, he is profoundly distrusted, so that when, as at present, the smelting company is making little or no money, its statements are not believed, though true. Bad feeling exists where it should not, brought about by a policy of concealment. It is my purpose, as an independent engineer, to try to dispel some of this unfortunate antagonism.

I believe that in this paper I have set forth a fundamentally more rational way of estimating costs and fixing prices for ores. Indeed, the question of costs, a very extensive one, should be recast upon newly acquired data owing to recent changes in smelting methods. Attention has been chiefly confined to those metals and associated minerals affecting the general problem of smelting, without undertaking to estimate the value of lesser factors, such as small amounts of copper and gold, or the effect of zinc, antimony, arsenic, bismuth, and tellurium on the furnace charge.

The Three R Mine, Patagonia District, Arizona

By F. R. PROBERT

A pioneer of Santa Cruz county, Arizona, R. R. Richardson, of Patagonia, has held for many years a group of claims on the slopes of the Patagonia mountains known as the Three R property. Few properties have suffered the condemnation of competent engineers that this has been subjected to; fewer still have been as frequently examined. The Three R was almost a joke among the engineers of Arizona, and as each passed judgment it was recorded in Mr. Richardson's files, which today make interesting reading. The opinions of upward of twenty engineers of good repute are catalogued with such comment as the owner fancied would fit the findings. 'Turned down cold,' 'No good,' 'Reported unfavorable,' and the like are penned to the name of the engineer with date of visit. My own name appears on the list, July 1908. The reason for all this is readily explained. Large 'low-grade' coppers have been the fashion of recent years, and the Three R property was studied from this viewpoint; the possibilities of high-grade ore-shoots in a lean pyritized mountain mass were not considered, and had it not been for the chance finding of enriched ore by continuing an adit, which for nearly 600 ft. was in barren hard rock, it is likely that the list of 'experts' would be considerably larger than it is and the comment of the owner more forceful. Two years ago, N. L. Amster, of Boston, took a lease and bond on the property, and after careful geological investigation proceeded systematically to explore the more attractive ground. He has shipped to date approximately 30,000 tons of ore averaging 9% copper. The claims are about nine miles south of Patagonia and nineteen miles northeast of Nogales, stations on the branch line of the Southern Pacific system south of Benson, Arizona. The nearest railroad point is Bloxton, 3.7 miles west of the mine.

The Patagonia mountains are a continuation of the Santa Ritas, south of Sonoita creek. Copper, zinc, lead, gold, and molybdenum deposits have been prospected. The Three R property is situated on the northwest slope of the Patagonia mountains, and is characterized by a particularly rugged surface. The bold escarpments and prominent ridges are due largely to the relative resisting power of different igneous rocks, or phases of the same rock, to erosion. A depression once initiated would be rapidly worn by the scouring action of rock and water during the short-lived deluge of summer rains. The steep slopes cause a rapid run-off of all waters, and the rocks being dense compact masses showing little or no cleavage or jointing, would allow of but little of the oxygenated waters to seep far below the surface, except in fairly open fissures. Only igneous rocks are represented in the immediate neighborhood of the Three R mine, but inasmuch as similar rocks

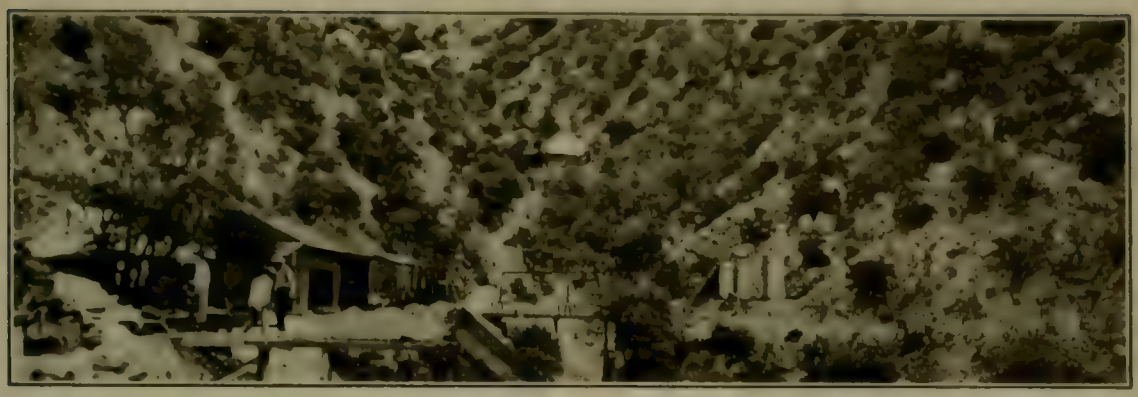


FIG. 1. THREE R MINE, LOOKING EAST.

are intruded in Paleozoic sediments at the property of the Helvetia Copper Co., I tentatively classify the rock of greatest economic importance as being post-Carboniferous, probably late Tertiary. The youngest rock, alaskite, is the most widely distributed. It forms the greater part of Three R mountain. In the fresh state, it is a coarse-grained macrocrystalline aggregate of quartz and alkali feldspar, orthoclase, with occasional biotite plates. In all exposures, whether fresh or in an advanced state of feldspathic alteration, the large blebs of quartz stand out conspicuously. Aplitic phases of the alaskite occur as silicious ribs in the parent rock, but have no economic importance. As alteration proceeds, the feldspars become earthy, and according to the amount of the original pyritization are white, brownish, or deep red, the quartz remaining unchanged. The alteration products of the feldspars are sericite, kaolinite, and alunite. This latter mineral is found not only in the vicinity of the chalcocite orebodies, but in altered pyritized areas, where the rocks have been more or less cleaved. F. C. Schrader, in *Economic Geology* (December, 1913), attributes the formation of alunite at the Three R mine to metasomatic replacement of the orthoclase by hydrothermal solutions ascending fissures following the intrusion of the mass itself or of later volcanics. Post-volcanic metamorphism is evidenced by silicification and cupriferous pyritization of the shattered rock near the main fractures, but the close relationship between chalcocitization and oxygenation of sulphides suggests a later origin of the alunite. I attribute it to the sulphurous waters of the oxidized zone. Alunite is by no means an uncommon associate of enriched copper ore. At the Ray Central mines it was found in the intrusive sheets of ore-bearing granite porphyry; and again at the Shannon and Ryerson mines of Metcalf and Morenci, I have noted it in the pyritized altered porphyry.

The alaskite is intrusive in the older trachyte and rhyolite (feldspar and quartz) porphyries, which are widely scattered. They occur as a series of isolated blocks in the alaskite without any visible connection one with the other near the Three R mine, although to the north, Red mountain and the adjoining hills are made up entirely of these older porphyries. The trachytic variety is the more common, and its dull white mottling makes it readily distinguishable both in the field and underground workings. The porphyries are strongly acidic, granular to aphanitic in texture, with distinguishing phenocrysts.

The intrusion of the alaskite caused little or no apparent alteration of the older porphyries. Chilled surfaces show as granular, even glassy phases, but a typical change is not noticeable as a direct result of the action of the younger on the older rock. The after effects of the alaskite intrusion seem to have a direct bearing on the economic importance of the property under consideration. Hot aqueous emanations from deep seated sources along lines of fracture and rock weakness initiated the mineralization, which by later processes has made ore. The sulphurous metallic contents have been deposited as cupriferous pyrite and associated minerals, along lines of weakness, and this primary mineralization has been converted locally, by metamorphic change due to oxygenated waters, into the orebodies now being mined.

While the igneous rock massif does not show any regular system of joints or cleavage planes, there are definite lines of fracture and faulting along which all ore of commercial value has so far been found. Underground, these fractures are sharply defined and readily followed, often being characterized by a clay seam several inches wide with variable amount of cupriferous pyrite and chalcocite concentrated in or near the fracture, and gradually diminishing in copper content on either side. The fractures penetrate all three of the recognized rocks. The work to date shows that the largest orebodies are found under an outcrop where the pyrite has been completely oxidized to earthy hematite and where the rock is more abundantly cleaved, the cleavage planes being filled with the rusty residuum of original sulphides.

The whole district in an area of three or four square miles is so heavily iron stained at the surface that in its broader aspects, it resembles the properties of the

so-called low-grade porphyry copper mines of Arizona. The rocks are pyritized throughout, but owing to the lack of shearing, cleavage, or jointing, the oxidation of these sulphides is very limited in depth except along the major breaks. The hematite outcrops of the stronger fractures are seldom copper stained. Oxidation is com-

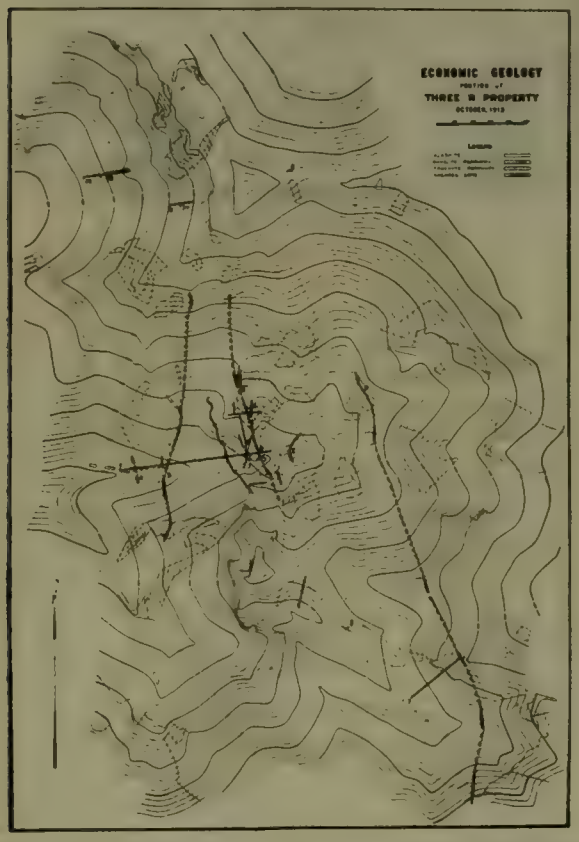


FIG. 2. THE RHYOLITE PORPHYRY AND TRACHYTE PORPHYRY FORM PATCHES AS OUTLINED IN THE ALASKITE.

plete, but lenses of locally enriched ore are found below. The outcrop of the *B*, Fig. 2, fracture shows massive black botryoidal limonite; that of the *D* shows as a bright red ochreous stain. The Three R fracture shows limonitic casts of pyrite in an extremely sericitized alaskite with occasional small masses of bornite enveloping original pyrite. At the *D* fracture oxidation of copper glance has resulted in metallic copper, while azurite and malachite are later oxidation products of the previously enriched mineral. The ore now being mined is all secondarily enriched. It consists of copper glance, both massive and disseminated, occurring in shattered area of alaskite or porphyry, on either side of one of the major breaks.

The main orebody of the *C* fracture, which has been extensively stoped, was indicated by a meagre hematite outcrop on the surface in a slightly crushed area. Approaching it underground, the alaskite is veined with secondary quartz and quickly changes from the normal pyritized rock to an altered alaskite heavily impregnated with copper glance. Masses of pure glance several feet across are found, the high-grade lens being at the main adit level (215 ft. below the surface) 37 ft. wide. The horizontal limits of the orebody are marked only by the change in value, not by any structural detail. This orebody has been followed a vertical distance of 500 ft., with high-grade ore still showing in the bottom of the winze. The stopes extend to within 40 ft. of the surface, where the glance slowly fades into the ochreous hematite. On the foot-wall side of the stopes, the chalcocite is finely disseminated around bright glistening pyrite grains in a soft sericite felt. The centre of the orebody is more completely alunitized and sectile slabs and masses of pure glance have the appearance of a conglomerate, so striking is the black and white contrast of mineral and gangue. On the hanging wall side perfect stubby octahedra of pyrite, two and three inches across, are found coated with a thick film of

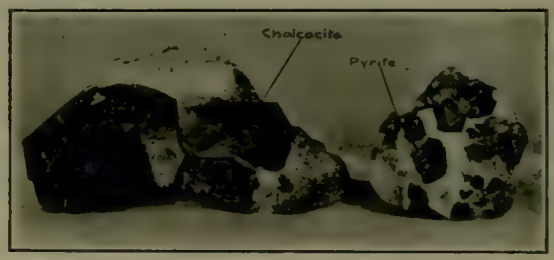


FIG. 3. PYRITE CRYSTALS COATED WITH CHALCOCITE.

chalcocite (Fig. 3). The compact masses of pyrite are but surficially altered. On the 500-ft. level, 110 ft. below the surface, stope No. 100, the pyrite was found coated with covellite of a purplish blue color, while on the Three R claim, bornite envelopes the crystal faces of pyrite. The high-grade ore is always found in close proximity to the major fractures and fades gradually into non-commercial unaltered pyrite on either side. Where the cupriferous pyrite is definitely crystalline it is but coated with chalcocite; enrichment seems to advance with distortion or crushing of crystal forms. L. C. Graton describes several slides made of Three R ore in his discussion of the 'Sulphide Ores of Copper.'* His further research along these lines will be awaited with interest, particularly as to the nature of unenriched portions of sulphide deposits in an ore horizon.

Other small lenses of high-grade ore have been exposed by drifts along the main fractures, but their distribution is very erratic between high-grade shoots. The rock on either side of the fault fissure contains disseminated chalcocite, 3 to 4% ore, which may later be mined and milled.

COAL PRODUCTION of Montana in 1913 was 3,240,973 short tons valued at $5,653,539, a record for the state. There were 3630 men employed, of whom 20 were killed, and the average coal broken per man-year was 893 tons.

Trans. Amer. Inst. Min. Eng., May 1913.

Dredge Construction in Portuguese East Africa

By CHARLES JANIN

The recent construction of a 7½-ft. California type, all steel electric dredge by the Bucyrus Co., in Portuguese East Africa, is of considerable interest to those connected either with dredge construction companies or with dredge operation. To each, it opens up new possibilities. The American dredge builder is slowly but surely invading the foreign field, and with the success attending the operation of first-class dredge equipment, further investigations will be encouraged, and other dredges built. This dredge is one of six California type dredges to be ordered in America for foreign countries.

The Kolchan dredge of the Orsk company in East Siberia, which was built by the New York Engineering Co., was the first modern California type dredge to be built in a foreign country. Other California type dredges are the Pato on the Nichi river in Colombia, built by the Yuba Construction Co., two dredges in the Philippine Islands, one built by the New York Engineering Co., the other by the Yuba Construction Co., and a dredge for the recovery of tin for the de Sabla interests near Belmonte, Portugal, designed by the Union Construction Co., and built by Fraser & Chalmers. The latter dredge is the first of American type built for tin recovery in a foreign country. All of these dredges are now operating successfully. In addition to the above, the Marion Steam Shovel Co. has shipped the machinery for a 7-ft. dredge to the Ural district in Siberia. It can be seen that nearly all the American dredge builders are now represented in foreign countries. Without doubt the success of these boats will attract more attention to American dredges, and American builders will be consulted upon proposed installations of any importance.

The Andrada dredge was built by the Bucyrus Co., and was constructed by C. T. Nicolson, to whom I am indebted for most of the information given below. The description of the dredge parts is taken mainly from specifications. It was considered unnecessary to go into more detail for the purpose of this article.

The dredge was constructed entirely of steel, equipped with 68 buckets of 7½ cu. ft. capacity, and arranged to dig 25 ft. below water-level. The dredge was shipped from New York by steamer, the last shipment being March 13, 1913. The point of delivery was Beira, Portuguese East Africa. From this point freight was hauled by the Beira & Mashonaland railway, a distance of about 200 miles, and from the railroad to the property, a distance of eight miles, freight was hauled by means of mule and ox teams. Eight head of oxen, comprising one team, would make a trip one way in three hours. The maximum load for these teams is 3½ tons. To handle the steel spuds and other heavy parts of the dredge, two sets of wheels and axles capable of carrying 25 tons were built and shipped with the dredge. These wheels were 5 ft. in diameter and had a 10-in. face heavily tired. To haul the spuds, which were the heaviest pieces of the dredge, 30 mules and 50 oxen were required. The digging ladder, which was of the plate girder type, was shipped in three sections.

As is customary under conditions prevailing in foreign countries, considerable delay was experienced in getting freight to the property on account of the poor transportation facilities. All dredge parts were on the ground by June 13, the last delivery being the material that was first required. The dredge pit had been prepared before the arrival of the construction engineer at the property, and actual construction began on the 13th day of June. Included in the equipment furnished for construction was a Curtis double compressor, with 35-hp. motor. This was a two-cylinder 10 by 10 vertical compressor, and required only 4 by 6-ft. floor space. It gave great satisfaction and furnished air at 88 lb. pressure for seven riveting hammers, two calking hammers, and two air-drills. For the machine shop a special lathe was taken that could either handle small work or swing the lower tumbler if necessary. This was arranged by having, with other accessories, blocks to raise the head and tail stock to any height desired. Power for compressor and pneumatic tools for riveting, which was not available until June 16, was furnished by a small plant from an operating mine belonging to the Company. From the time power was available work progressed rapidly in spite of the poor class of labor available, the only delays in construction being for lack of power, which was at times irregular.

The dredge was completed on October 22. After construction was finished, another delay was experienced for lack of power, before the trial run could be made. The hydro-electric power-plant which was being built by the Company independent of dredge construction and which was supposed to be finished before the dredge, was not completed until some time after. When power was supplied, the dredge did good work and was accepted by the Company, at the end of the 30 days trial, according to contract. A bonus given the construction engineer testified the appreciation of the management in his work, and their satisfaction with the dredge. Power was generated by a hydro-electric plant, about 18 miles from the property. Water was delivered at a head of 1000 ft.

through a pipe-line that was something over a mile long.

In addition to the construction engineer, one skilled workman and three winchmen were taken from America, the latter were to remain on the property to operate the dredge, and were used to advantage during construction. Local labor was of the usual floating class of white labor found in Africa, and Kaffirs. Some of the latter made good helpers after being broken in. The largest number of white laborers at one time was 22, and an average of 60 Kaffirs were employed. The illustration showing the crew gives a good idea of the number of men used to build this dredge.

Some difficulty was experienced in teaching unskilled labor the use of air riveting hammers. Inexperienced hands would turn on a full head of air suddenly, and the snaps, which are held in by springs, would fly out like shot from a gun. Several men were injured, and a number had narrow escapes. The proper way to use one of these riveting hammers is to turn on a little air, so as to give light taps at first, in order to spread or swell the rivet in the hole, then full air for finishing the head.

White labor received from 18 to 25 shillings per day; Kaffirs from 20 to 30 shillings per month; all for eight hours work, including Sunday.

Details of Dredge

The hull and housing are built entirely of steel. The hull is 115 by 40 by 9 ft. The plating on the hull is mostly of ⅜-in. steel. The well-hole plating is ½ in. with chafing plates ¾ in. The hull frame is spaced 30 in. centres, with floor beams of 8 by 11¼ in. channels. The deck beams are 6 by 8 in. channels. Vertical members are 4 by 3 in. To provide proper stiffening there are four longitudinal trusses extending from bow to stern. Besides cross-trusses there are two water-tight bulkheads, which divide the hull into four water-tight compartments. The framing of the housing is of structural steel, and the sides are of two layers of light steel plates separated by a layer of pressed paper insulation. The roof is covever with canvas, laid in white lead.

The dredge has a flotation of 2½ feet when fully loaded and operating. Buckets are made in three pieces. The lip is made of manganese steel 13½ in. wide by 1⅝ in. thick in the crown and curved portion, and tapers to ¾ in. thick at the back and lower edges where riveted to the hood. The hood is of nickel chrome steel, with two front eyes about 4½ in. thick, and one back eye about 17¼ in. long with renewable manganese steel bushings about ⅝ in. thick. Bucket pins are of nickel chrome steel 4⅞ in. diameter. The buckets weigh 2250 lb. each. The lower tumbler is six sided, made in two pieces, each piece being a single casting of high-carbon open-hearth steel. The tumbler flanges are circular, and the tumbler faces are faced with manganese wearing plates about 1½ in. thick. The lower tumbler shaft is of forged nickel steel of 10½ in. diameter, bored hollow so that the rod holding the ladder brackets from spreading can pass through it. Journals are run in renewable bearings on the order of the ball and socket joint, completely surrounded by cast steel boxes. The ladder frame is of plate girder type and is approximately 73 ft. long. Ladder rollers are of high-carbon steel 14 in. diameter, spaced about 6 ft. apart. Forged steel shafts of 3¾ in. diameter are pressed into rollers. Bearings are cast steel and designed to keep out sand and grit and pro-

vided with a cavity for lubricating grease.

The upper tumbler consists of a single casting made of basic open-hearth steel. It is six-sided and wearing faces are fitted with renewable manganese steel plates approximately $1\frac{7}{8}$ in. thick. The upper tumbler shaft is $15\frac{7}{8}$ in. diameter in tumbler, 14-in. journals, and $12\frac{1}{2}$-in. driving gear. The upper tumbler is driven at both ends through a double train of gearing on the head-frame. The gear trains are driven by a belt from a jack-shaft in the main deck. The gearing is made of open-hearth steel castings, and has machine-finished teeth. The large gears on the upper tumbler consist of gear rims bolted to cast steel spiders. The gear teeth are $2\frac{3}{4}$-in. pitch by 10-in. face. The pulley for driving the upper tumbler machinery is 44 in. diameter by 24-in. face. The driving pulley connecting the motor with the machinery is 50 in. diameter by 22-in. face. Intermediate jack-shafts are $4\frac{3}{8}$ in. diameter. The hopper is of the rock-bottom type, and is built of $\frac{1}{4}$-in. plate, 3 by 3 by $\frac{3}{8}$-in. angles, and lined on the back and sides with $\frac{3}{8}$-in. steel plates.

The revolving screen is 5 ft. 11 in. diameter and 35 ft. long and has $\frac{5}{8}$-in. perforations. It is carried on two cast steel friction tires with 7-in. width of tread. A spray pipe extending through the interior of the screen is provided with hydraulic nozzles on universal joints, in order to throw water in any desired direction.

The tailing stacker is of the belt-conveyor type 34 in. wide and 60 ft. long between centres of pulleys. The gold-saving tables are of $\frac{3}{16}$-in. steel, and are provided with 1 by 1 by $\frac{1}{8}$-in. angle-iron riffles of the Hungarian type. The table area is approximately 1500 sq. ft. The dredge is built to operate both on spuds and head-lines. Each spud is 27 by 36 inches in section, 48 ft. long, and weighs 15 tons.

For the gold-saving table there is one 8-in. double-suction centrifugal pump capable of delivering 2000 gal. per minute against 50-ft. head. For the revolving screen one 10-in. delivering 3000 gal. per minute against 70-ft. head. For hopper and washing bucket one 5-in. with a capacity of 700 gal. per minute against 150-ft. head. There is also one 3-in. bilge pump. All pumps are directly connected to independent motors. In addition to the above pumps, there is a hand pump for priming and cleaning up.

The list of motors is as follows:

	Horse-power.	Speed.
Digging ladder	150	Variable
Winch	25	"
Screen	35	Continuous
Stacker	35	"
10-in. pump	100	"
8-in. pump	50	"
5-in. pump	75	Continuous
3-in. pump	15	"
Total	485	

The transformers are three 200 kw. 50-cycle in 2100 volts, primary to 440 secondary, and one $7\frac{1}{2}$ kw., stepping down from 440 to 110, for the lighting system.

Following are the weights of dredge shipments:

	Pounds.
Steel hull	672,847
Machinery	809,177
Spares, tools, shop, etc.	268,466
	1,750,490

Heavy pieces.	Pounds.
One spud, 27 by 36 in. by 48 ft.	27,860

Heavy pieces.	Pounds.
One spud, 27 by 36 in. by 48 ft.	27,720
Upper section of ladder, 53 by 73 in. by 35 ft.	21,300
Middle section of ladder, 53 by 73 in. by 29 ft.	18,740
Lower section of ladder, 74 by 78 in. by 21 ft.	17,640
Upper tumbler, 55 by 55 in. by 10½ ft.	13,550
Lower tumbler, 64 by 64 in. by 62 ft.	10,370
One revolving screen piece, 64 by 93 in. by 93 ft.	7,500
One revolving screen piece, 43 by 77 in. by 77 ft.	4,450
One lathe, 4 ft. 3 in. by 4 ft. 3 in. by 20 ft. 10 in.	15,758

Details of cost are always a matter of interest, and for that reason I have added the following figures, although in the matter of freight from Beira and of construction cost they are only approximations. They are, however, very near actual cost, which has not yet been officially figured, and close enough for the purpose for which they are given.

First Cost		
Dredge cost f.a.s. steamer New York	$114,500	
Extra parts, erecting, tools, etc.	9,700	
		$124,200
Freight		
Freight to Beira	$ 14,510	
Beira to property (approximate)	15,000	
		29,510
Construction		
Cost of construction (approximate)		27,000
Total cost of dredge ready to operate, including spares, tools, shops, etc. (approximate)		$180,710

Up to the present time gold dredging in Africa has not been a financial success, though a number of dredges have been built and some have operated for years in different parts of the country. The operations of the Andrada dredge will be watched, therefore, with special interest. There is no question that if the gold content of the ground is as expected, a considerable operating profit will be made, and recent reports from the property are most encouraging for the future.

Ore Treatment at Waihi, New Zealand

The Waihi Gold Mining Co., prior to 1911, had three stamp-mills and cyanide plants, with 40, 90, and 200 stamps, and situated 1, ½, and 5½ miles respectively from the mine. The first, or Silverton mill, was sold in about that year; the second, or Waihi, was shut down in 1912; and the third, or Victoria, was used in 1913 to treat ore from the mine.

At the Waihi plant, according to the annual report of the superintendent, E. G. Banks, work was mainly directed to crushing 622 tons of $16.74 ore with 92.1% extraction; treating 4807 tons of old tailing averaging $4.49 per ton; and cleaning-up valuable material about the plant.

The Victoria mill of 200 stamps and 11 tube-mills worked 300.66 days, an average of 123.23 stamps dropping, and crushing 184,146 short tons of dry ore through a 10-mesh screen. An average of 6.36 tube-mills worked, and the average duty of stamps was 4.97 tons per day. The ore assayed $8.24 gold, and 2.75 oz. silver per ton. Vanners saved 2325 tons of concentrate, assaying $145.40 gold and 37.25 oz. silver per ton. This was treated by tube-milling, air agitation, and filter-pressing with 96.7% extraction, at a cost of $6.36 per ton of concentrate, and 8.01c. per ton of ore treated. Amalgamation was discontinued in July 1913. The proportion of sand, slime, and concentrate treated from the ore was 27.84, 70.93, and 1.23% respectively. The total recovery from leaching, filtering, and concentrate was 90.7% of the value of the ore, against 89.7% in 1912, 89.3% in 1911, and 88.5% in 1910. Silver recovery was 80.1 per cent.

The clean-up and melting department treated 76,853 lb. of precipitate from the zinc boxes, yielding 535,544 oz. doré bullion. The refinery treated this, producing gold 999.8 and silver 996 fine. There was also sent abroad 29 tons of refractory residue, and 135,629 oz. copper-lead bullion. The assay department handled 9132 samples of air, ore, and bullion. Receipts from bullion were $1,613,000, of which $572,000 was profit, and $475,000 was paid in dividends. Transport of ore and treatment cost $1.93 per ton.

Timber Flumes

The V-shaped wooden flume is held to be superior to the box or square-sided form, because it requires less water and, on the average, less repairs than the other type, is better adapted to act as a slide on steep grades, and offers fewer chances for jams. The metal flume will come into wide use soon. For handling railroad cross-ties, cants, poles, cordwood, mining stulls, and the like, a flume with the sides of the 'V' 30 in. high is large enough. For handling logs, piling, long timber, or brailed sawed lumber, a height of from 40 to 60 in. is recommended. The best angle for the 'V' is put at 90°, according to Eugene S. Bruce of the Forest Service. Flume lines should be surveyed with enough care to insure evenness of grade. Grades should be kept below 15% wherever possible, and the best results are obtained with grades between 2 and 10%. Abrupt curvatures in a flume should be avoided, for they are likely to cause jams. Curves should rarely be permitted to exceed 20°. The longer the material to be handled in the flume, the less abrupt should the curvatures be. Telephones are recommended as adjuncts to the operation of a flume. By their use a serious break or jam can be reported immediately to the head of the flume to prevent further shipment of material. A flume recently built on Rochat creek, near St. Joe, Idaho, is cited as a good example of modern V-shaped flume construction. This flume, which is unusually large and built to handle heavy logs and long timbers, is said to have cost approximately $8000 per mile for the five miles, including the cost of constructing a wagon-road and telephone equipment. Other flumes cost from $2000 to $7500 per mile.

PERUVIAN TRAILS AND THE WORLD'S HIGHEST WAGON-ROAD, ELEVATION 17,000 FEET.

Ore Treatment at the Santo Domingo Mine, Peru

This property is 142 miles from Tirapata, 104 miles of which is over wagon-road and 39 miles of trail, and at an elevation of 6000 feet. The old mine of the Inca Mining Co. has produced a large quantity of gold in past years, and a new mill has recently been started, according to *The West Coast Leader*. The gold occurs free, in sulphides, and is very fine in the *llauca*, or clayey material, and the ore averages about $750 per ton. The Company's mining engineer, E. G. Davidson, decided that the all-sliming cyanide process was most suitable for the ores. The new mill is erected on the side of a steep hill, and is 150 ft. from the ore-car track to the solution tanks. A Dodge crusher breaks the ore to 1-in. size, which is further reduced through a 30-mesh screen by two Huntington mills. On account of clayey material, 30% of the ore will pass 300 mesh on being ground, so the mills crush 20 tons each per day. The pulp flows to a Dorr classifier, where it is joined by 80 tons per day of old $8 tailing, which receives a little preliminary treatment before reaching the classifier. From this machine the slime goes to Frue vanners, and the sand to a Chalmers & Williams tube-mill. All the slime is thickened and then agitated in two sets of three 15 by 35 to 38-ft. Pachuca tanks. Pulp is filtered by an Oliver machine, and precipitation is on zinc shaving. Photographs are used by courtesy of A. B. Maxwell, formerly of the Inca Mining Company.

OVER THE ANDES TO SANTO DOMINGO, AND TWO VIEWS OF THE CYANIDE PLANT.

Relative Natural and Commercial Scarcity of the Metals

By EDWIN C. ECKEL

The present article attempts to summarize briefly the main facts regarding the relative scarcity of the different metals, in nature and in trade. Since the data employed in the discussion are necessarily inexact, the results cannot be considered final, but they seem to have a certain general interest which makes up for their lack of precision.

Commercial Abundance and Scarcity

As a basis for determining the present commercial abundance of the different metals, one may fairly use the statistics of world's metal production in 1910, as representing the output during the last year of widespread industrial activity. The total output of the commercial metal during this year, in metric tons, was as shown in the first column of the following table, the results in the last column having been computed as a convenient basis for comparison.

Metal.	Output, metric tons.	Commercial abundance, gold = 1.
Pig iron	65,300,000	92,000
Lead	1,139,700	1,600
Copper	836,900	1,180
Zinc	816,600	1,150
Tin	115,700	165
Aluminum	43,800	60
Nickel	24,500	35
Silver	7,437	10
Quicksilver	3,600	5
Gold	704	1

The output of the different metals varies from year to year, so that their relative commercial abundance is not definitely fixed; but the figures for the year taken as the basis may be considered typical of the present period of metal production.

Relative Natural Scarcity

For comparison with the results stated above, it will be of interest to put into convenient shape such data as are available concerning the actual relative abundance of the different metals in nature. Various geologists and chemists have made investigations along this line, and though from the nature of the case precise and accurate data cannot be secured, certain broad features as to relative abundance and scarcity are brought out sharply enough.

The following table contains the data available with respect to the natural or geological scarcity of most of the commercial metals. The figures quoted for zinc, lead, copper, and gold are estimates published by W. Lindgren in his recent work on ore deposits, and may be taken as representing the most authoritative statement upon the relative scarcity of the rarer commercial metals.

The percentages credited to aluminum, iron, nickel, and manganese are taken from the most recent work by F. W. Clarke, and are based upon the results of a very large number of analyses of sedimentary and igneous rocks, made in the laboratory of the United States Geological Survey. These analyses were compared, weighted, and averaged by Mr. Clarke; and the four figures quoted below may be accepted as being as close to the truth as we are likely to get in this matter. The figures for aluminum and iron, especially, are unlikely to be materially changed by any further analytical work. Those for manganese and nickel, owing to the fact that they are based upon a far smaller number of analytical determinations, are of course less definitely settled.

The first column of figures in the following table are those taken, as noted above, from Lindgren and Clarke. The results stated in the last column have been calculated, in order to bring out more sharply some of the comparative results.

Metal.	Percentage in earth's crust.	Relative abundance, gold = 1.
Aluminum	7.84	15,080,000
Iron	4.44	8,800,000
Manganese	0.08	160,000
Nickel	0.023	40,000
Copper	0.0075	15,000
Zinc	0.0040	8,000
Lead	0.0020	4,000
Silver	0.00001	20
Gold	0.0000005	1

Relations Between Natural and Commercial Scarcity

From the figures given in the two tables above, it is possible to draw some comparisons between the natural and commercial scarcity of the different industrial metals. Certain very marked disparities will appear immediately, and the extent and importance of these differences are sufficient to suggest that further investigation of the subject would be of interest. In the present place, however, it will not be possible to do more than call attention to their existence and general character.

It will be most satisfactory to confine attention to the more important commercial metals, omitting those whose place in the scale is less definitely fixed. This has been in the following table, where the six leading metals are compared in turn as regards estimated natural scarcity, actual tonnage produced annually, and average price per ton for the period under consideration. In each case gold is used as the basis for reference.

Metal.	Natural abundance.	Annual output.	Cheapness.
Gold	1	1	1
Silver	20	10	33
Lead	4,000	1,600	10,000
Zinc	8,000	1,150	5,000
Copper	15,000	1,180	2,600
Iron	8,800,000	92,000	40,000

It can be seen at once that natural scarcity has no very direct influence upon either the tonnage produced or the price of the metals covered by this table. Even allowing for wide differences in the commercial utility of the various metals, and for the great variation in the metallurgical and other difficulties involved in their preparation, there still remain wide disparities between the figures in the three columns above. These disparities are of such a type as to suggest that disproportionate efforts are expended in the search for certain metals, and in overcoming the mining and metallurgical difficulties encountered in placing them in form for commercial use. The most striking instance is that of gold, which is apparently produced in tonnages far larger than could be expected, while its relative commercial value is much lower than its natural scarcity would seem to justify. If the discrepancy were confined to gold, it might be assumed that the serious error lay in giving that metal a rank for natural scarcity which the facts did not justify. But comparisons further down the line will show variations of equal moment, and other explanations must be sought.

Methods of Taking Mill-Head Samples

By LLOYD ROBEY

In modern cyanide practice it is generally found advisable to stamp and grind the ore in solution. While this method has decided advantages in determining the system of stamping, it has one very serious disadvantage. This is, it is practically impossible to take a sample from the battery discharge stream that will give a correct indication of the value of the ore entering the battery. The reason for this is found in the fact that gold and silver are dissolved by the solution during the stamping process. The attempt has often been made to take a sample by the use of an automatic sampler below the batteries, determining the percentage of solution and dried pulp in the sample, and then assaying the solution and the filtered and washed pulp separately. This is sometimes varied by an attempt to dry the final cut-down sample.

These methods present great and obvious difficulties. As the amount of solution is from five to ten times the amount of ore, any error in the solution assay is multiplied by that amount before this assay is applied as a correction to the pulp assay. The difficulty is further increased by the fact that the so-called barren solutions are never entirely barren, but contain some gold and silver from the precipitation process; and as the assay results of these solutions are also multiplied from five to ten times before being applied as a correction to the pulp assay, it follows that another solution assay is necessary to determine the amount of gold and silver entering the mortar with the solution. Besides this, in many plants the pulp is thickened before entering the agitators and the surplus solution is pumped to the battery supply-tank without precipitation, so that a solution already comparatively rich enters the mortar and meets the ore. It is not denied that in an experimental run where every factor is carefully watched, pulp and solution samples being taken under supervision and thoroughly checked, approximately accurate results may be obtained. But the skilled labor and the care and patience required to do this accurately as a part of the daily routine, the mill superintendent may not hope to obtain. His aim is rather to so simplify mill processes that even ignorance and carelessness will not vitiate his results. I made a fairly complete series of tests by this method, checking against head-samples taken by other means. The solution carried considerable gold and silver. The work of sampling and assaying was entrusted to a skilled American assayer, and native millmen. In no instance did the assays check or show any uniformity. Occasionally, after making the proper calculations, the astonishing result was reached that the ore carried a minus quantity of gold.

The method of drying a sample can never be accurate because the evaporating solution leaves a large percentage of the precipitate on the sides of the container. To scrape this off and mix it accurately with the pulp is out of the question. The operator, therefore, apparently finds himself reduced to one of three courses: To build a sampling plant, expensive both in first cost and operation; to eliminate head-samples altogether, deducing his extraction from his bullion account and tailing samples, dispensing with the check of theoretical against actual extraction; or, finally, to depend on some cheap and apparently inadequate method of hand sampling, taking the sample somewhere between the crusher and the stamps.

The first method is often out of the question for small companies and is seldom advisable in other than custom mills if a satisfactory substitute can be found. In the second method the operator trusts to his vigilance and skill to prevent losses by leakage, millmen's mistakes, overflowing tanks, and stealing. Though he may be sure of himself, his confidence is not always shared by his superiors, especially when the heads are disappointingly low and the mine superintendent has a settled conviction that his ore runs higher than the mill reports show. The method has the added disadvantage that heads can only be known at clean-up time, and then only approximately on account of the ore still in course of treatment. Thus the miner has no check to enable him to supply a uniform grade of ore, and the mill superintendent has no data to enable him to make estimates of production for the information of the Company. The third method is often attempted, and frequently leads to much grief and tribulation. As a matter of fact the most of this

trouble is unnecessary. The millman who follows the simple plan outlined below will generally be able to place his trouble promptly and thereafter rest in peace.

The importance of taking a very large and definite quantity of the ore received for the first cut or primary sample in continuous non-custom mill-work has been greatly overestimated. Such a sample must be taken on shipments to custom smelters, mills, or samplers because each lot is paid for separately. But in an ordinary mill running full time the slight variations in the daily head-sample, due to taking a small cut or even taking one at irregular intervals, are compensating errors which will balance themselves and approximate the correct average in a very few days, providing that the cut, no matter how small or how seldom taken, is made in a correct manner, and also providing that the subsequent cutting down and assaying is correctly performed. If the ore is received from a bucket tram after crushing at the mine, every twentieth bucket may be dumped in a separate sample bin, thus giving an amply large sample. Otherwise, the sample may be taken occasionally by the battery helper from the lip of the feeder, using a wide shallow hand-scoop held just below the lip. In this case a small lined chute, leading to a sample bin under the ore-bins and back of the mortar blocks, is a great convenience. This may seem a very careless make-shift sample, but the operator will be surprised on testing this method to find how accurately these small samples will check in a month's run, providing only that they be fairly taken and exactly cut down.

If trouble has been encountered in checking samples the following procedure should be adopted: Take the original sample and cut it down by any good method to about 400 lb., cone and quarter this sample, and run each quarter separately through the entire remaining process to the final assay. It will probably be found that these assays vary widely. In the next day's sampling, repeat the operation but buck down about four times as much pulp and pass it through a finer mesh screen. With very difficult ores it may be necessary to buck down two or three pounds to pass a 150-mesh screen. If the trouble still continues, go back to the preceding step, passing an increased quantity of sample through the finishing rolls (say, to 20 mesh), and so on, working backward each day to the preceding step. As a general thing the trouble will be found long before the operator has worked back to the original sample. The four quarters should be cut down separately for several days until it is certain that they will check consistently, and then two of them may be dropped, but the other two should always be run. The point is that, in nearly every case where a serious discrepancy exists between the actual and so-called theoretical extraction, the trouble will be found (assuming that it does not exist in the actual mill work) not in the small quantity of the sample taken, nor in the unequal periods of sampling, but either in the lack of care in taking a fair cut, with too much or too little fine material, or more probably in the method in which the sample is handled in the laboratory. In my experience with a very difficult ore, averaging about 35 oz. silver and 0.3 oz. gold per ton, this investigation was made, and the four quarters failed to check by from 4 to 8 oz. After the laboratory procedure was revised, these quarters seldom failed to check within 0.5 oz. of silver. The moisture sample presents another troublesome problem, particularly with very wet ores. It is useless to weigh, sample, and assay the ore correctly if an error of from 1 to 3%, constant and always of the same side, be allowed to creep into the moisture account. The head-sample is useless for moisture determinations, because in standing for hours it loses moisture both by draining and evaporation. There is but one logical method for taking moisture samples, and that is by taking entire carloads or tram-bucket loads, which are weighed, dried, and re-weighed. This should be done on a number of cars at first, and checked occasionally afterward. By this method we substitute a compensating error, which tends toward a correct average, for an unbalanced and probably greater error. This point of taking all samples—head, tail, moisture, or others—in continuous mill work so that errors shall be of a compensating character, is of capital importance. The wise superintendent knows that he cannot depend on millmen, particularly natives, always to sample carefully in the long hours of the night shift. But if by careful study he can arrange his sampling so as to eliminate the unbalanced error, he may be sure that his compensating errors will never affect his bullion check to a noticeable extent.

COAL PRODUCTION of France in 1913 was 40,129,410 metric tons, against 40,394,177 tons in 1912. The output of lignite was 792,793 tons, an increase of 41,792 tons. Imports were 11,257,431 tons from Great Britain, 3,659,669 tons from Belgium, and 3,482,287 tons from Germany. There was also imported 3,070,036 tons of coke, and 1,086,045 tons of briquettes. Mining property of France covered 1,383,785 acres in 1913. Iron-ore production was 21,714,000 tons, against 19,160,000 tons in 1912; also 1,681,992 tons came from Algeria and Tunis. Output of steel was 4,635,166 tons. There are 103,000 men employed in the iron industry.

COAL was mined in Oklahoma in 1913 to the amount of 4,165,770 short tons, valued at $8,542,748, both record-breaking totals for the state, according to figures compiled by E. W. Parker, of the U. S. Geological Survey, in coöperation with the Oklahoma Geological Survey. Oklahoma, more than any other of the coal-producing states in the Mississippi Valley and the Rocky Mountain region, was benefited by the labor troubles in Colorado, as is shown by the increase in production over 1912, amounting to 490,352 tons, or 13.34%. The value of the product increased $675,417, or 8.6%.. There were 9044 men employed.

A THIRD blast-furnace is now treating copper ore at Katanga, Central Africa.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Rock Nomenclature in New Mining Districts

The Editor:

Sir—The article in the *Mining and Scientific Press* of April 25, 1914, on 'Geology of the Kalgoorlie Goldfield,' discussing at length its rock nomenclature, emphasizes again the difficulty of accurate nomenclature in regions of complex metamorphosed rocks, altered by subsequent mineralization. It also suggests another point of practical importance to the mining engineer and geologist, the inadvisability in a new district or where detailed geological work has not been done, of depending on petrographic names in describing surface and underground exposures, diamond-drill cores, etc., until the general characteristics, relations, and history of the formations have been determined by field and microscopic work.

Mr. Larcombe says: "I think all geologists are agreed upon the impossibility of different authorities giving the same name to highly altered rocks in the Archean complex." How much more then are young mining engineers and geologists, whose ideas of petrographical nomenclature are not so clearly crystallized, but who nevertheless have to do most of the routine work of geological note-taking, going to differ in their use of felsite, greenstone, metamorphosed tuff, and similar terms. The result is often that the notes of the man in the field are of little use to the next one until he succeeds in working out the former's conception of the petrographic names used and can in the field visualize what he actually saw when he wrote "cross-cut No. 3 N. at 30 ft. from drift cut contact of felsite and quartz andesite, the latter much altered, dipping * * *" Similarly reports and geological literature based on extensive microscopic work may be less applicable to future economic work through the use of petrographic names and descriptions drawn from examinations of thin sections, but lacking in sufficient megascopic description of hand specimens. The gold, silver, lead, and zinc deposits of the Altai in Siberia afford an excellent illustration. A mass of Russian reports and maps are available, but are of less practical use because they attempet to name rocks in part too metamorphosed and altered to classify petrographically without long study of thin sections, though frequently possessing sufficient physical differences in color, hardness, and structure for field identification and correlation.

I have lately, therefore, been trying to follow the rule in geological department work that to begin with all descriptions of cores, etc., must be as complete megascopically as possible, instead of seeking too early for names which involve more knowlege of the geological history and relations and more microscopic evidence than is usually available. Taking examples from recent notes, "very hard and dense gray rock with conchoidal fracture and no visible grain or phenocrysts" is preferable to 'felsite' or 'hornsite' and "rock as a whole unusually bright green in color (epidote?), mottled with white (altered feldspars?), and characterized by a minor amount of very dark greenish black chlorite" preferable to "greenstone probably metamorphosed diabase."

Of course, it is not necessary to repeat long descriptions every time one notes obviously the same rock underground; a name is soon found for every prominent type, but every variation from each type of which the full megascopic description is made should also be described the same way and not recorded in such terms as 'altered greenstone' which may carry a different significance to another man or the same man in the field again a month later. Furthermore, it should not be forgotten that even after the true character of the rocks has been established by microscopic work, these megascopic descriptions may be useful in correlating rocks cut by new drill holes; work which cannot always wait for thin-section examination.

Summarized, of course, this is only further emphasis on one phase of the necessity of detail in geological note-taking and on the danger of letting deduction run too far ahead of observation.

C. T. Brodrick.

Barnaul, Siberia, June 10.

[The difficulty of fitting the inexact knowledge of the field to a possibly overdetailed and very complex system of petrographical nomenclature is one of long standing. In a sense it is but one phase of the general problem of getting people to use words for the same meaning; a problem incapable of complete solution. In the case of rock names, the difficulty is especially keen because the methods of field and laboratory are so different as to require really two sets of names, and no agreement has been reached as to either set. The only safe rule to follow is the one our correspondent has suggested; namely, the personal one of making no pretense at any time to more exact knowledge than the note-taker really has. This coupled with clear descriptions of what is meant by any of the terms used is the best preventive of misunderstandings. Rocks may be numbered, lettered, or named temporarily after favorites of the footlights, provided that the notes include the description

of the essential characters of each rock type differentiated.—Editor.]

The Rand Banket*

Reply by Mr. Horwood to Henry H. Knox and to J. S. Hook's Criticisms.

I am much obliged to both Mr. Knox and Mr. Hook for pointing out that I misinterpreted C. R. Van Hise's rule for the change in volume for metasomatic replacement. I admit that I had done so,† and am glad to have this opportunity of expressing my regret to Mr. Van Hise for this mistake and my consequent criticisms on his work. As Mr. Knox and Mr. Hook point out, in the metasomatic interchanges described by me, the volume of the pyrite is to that of the replaced quartz approximately what it should be according to their interpretation of this formula. The figures I used for the molecular weights and specific gravities indicate that these volumes should be as 1.07 is to 1, but, as Mr. Knox points out, if these specific gravities, as might easily be the case, were 5.2 and 2.6, then the pyrite would occupy a slightly smaller space, which is more in accord with my observations.

Reply to S. J. Lett's Criticisms

Mr. Lett, in his discussion dated October 26, 1913, states that he found a piece of vein quartz containing pyrite in a Cretaceous conglomerate. I fail to see what bearing this has in relation to the pyrite replacements of the Rand banket. There may be pyrite in some of the quartz pebbles of these bankets which was present in the quartz long anterior to the formation of the banket; and in my paper, I made this perfectly clear in footnote 132 in Part III (cont'd). Mr. Lett maintains that the solubility of iron pyrite is no argument against the presence today of true pebbles of pyrite in the Rand banket. I would remind him that in his second contribution to the discussion on my paper, dated January 15, 1914, he speaks of the matrix of the banket as "a porous medium"; and as the cementation and induration of the banket probably took place at a fairly late period in its history there was plenty of time for the complete dissolution of such solution pebbles. Mr. Lett admits that he had at the time only received the first installment of my paper. In footnote 187 in Part IV, I stated that "It is quite possible that there may be a small proportion of pyrite and gold of detrital origin in the banket; but, if so, it is admittedly unimportant in discussing the genesis of the pyrite and gold." In some of the succeeding parts to the one Mr. Lett is criticising, I demonstrated the secondary origin of the pyrite.

Mr. Lett hoped that I would give an analysis of one of the typical dikes that occur in the mines of the Rand. In appendix No. 2 at the end of my paper there are analyses of two of these basic dikes.

As regards his further criticisms, dated January 15, 1914, I have read the paper by Mr. Todd to which he alludes. There has been no straining by me 'after a more complex origin' for concretions than that given by Mr. Todd. In the introductory portion of Mr. Todd's article he disclaimed intimate acquaintance with the chemical aspect of the subject. Mr. Todd explained the growth of concretions as due to particles gathered together toward a centre so as to produce growth regularly and steadily from the centre outward, and he termed these accretions, and said that they may sometimes have radiate structure that may be due to development of a modified crystalline structure. While admitting that a cracked interior may sometimes originate owing to internal shrinkage, he himself holds the opinion that such an interior is in general due to expansion of the outer portion. As explained in my paper, the microscope and other evidence clearly shows that some of the pyrite 'pebbles' or replacements in the Rand banket occur as metasomatic pseudomorphs; that the new mineral had to make room for itself by solution of the host mineral; and, that the original internal structure of the replaced mineral has sometimes been faithfully preserved.

Referring to my summary of Parts I and II, Mr. Lett says that I have forgotten the rejection by Mr. Lindgren of the molecule for molecule idea. I fail to see how he arrived at this conclusion, since I stated that in these metasomatic replacements the interchange had taken place by equal, or approximately equal, volumes; and that in such cases the change is usually considered to be molecular, but if so, it must be governed by some law of multiple proportion, because molecules of different substances vary in size so that if the exchange were molecular, equal volumes before and after would be the exception and not the rule. Later on in Part III (cont'd) I said that Mr. Lindgren in dealing with metasomatism considers that the reaction does not take place molecule for molecule, although he thinks it is molecular, or at least sub-microscopic.

At the beginning of Part IV of my paper, I pointed out that the examination of thin sections under the microscope showed that the commencement of growth of the concretionary pyrite pebbles was started by a minute amount of pyrite being precipitated, either directly from solution or by replacement of silica or silicates, or by both of these means. Thus a centre of growth was created around which pyrite continued to be precipitated, and that the rounded shape of the replacements was explained by fairly uniform growth around such centres. Further, that the microscopic investigation showed that there were generally several centres of growth for each 'pebble,' and I fully explained the final rounding of several such masses that had coalesced.

*[In this and subsequent issues Mr. Horwood will reply in detail to his various critics. His original articles and the discussion are to be reprinted in the form of a book, at which time various typographical errors that crept into the material as printed will be corrected.—Editor.]

†This will be rectified when my series of articles are published in book form.

As regards the selection of particular pebbles for replacement, I pointed out in Part III cont'd that the angular, indurated, slaty quartzite pebbles were more readily replaced by pyrite than pure quartz pebbles, and I dealt with the preference shown by the pyrite for replacing aluminium silicates and instanced, as pointed out by Mr. Lindgren, the frequent development by replacement of cubes of pyrite in shale; and also its frequent development in fine grained compact argillites after the hardening, and metasomatism of the rock at a time when it was exposed to mineralizing solutions that were producing ore deposits in adjacent fissures.

Mr. Lett suggests that the carbon was probably produced under pressure and at considerable temperature. He states that he has read my paper 'The Mode of Occurrence and Genesis of the Carbon in the Rand Bankets,' and that there I showed its origin to be attributed to magmatic vapors or solutions derived from neighboring basic dikes before their final solidification. This naturally implies such conditions.

I remarked that J. P. Iddings had pointed out that in the case of a crystal surrounded by a dissolving liquid, its angles and edges will be the parts most rapidly dissolved, resulting in a rounding of its shape. Mr. Lett criticises me for applying similar reasoning to the obliteration of rough outlines in the formation of these pyrite bodies. I can only conclude that Mr. Lett cannot have read this portion of my paper carefully since he bases his remarks on Mr. Iddings' statement that it does not follow "that curved, or rounded, surfaces develop only through solution of plane-faced crystals." On the same page and just before my reference to Mr. Iddings, I showed that the rounded shape is also largely due to the following factors: to fairly uniform growth around a centre: and in cases where two or more such bodies coalesced the combined surfaces would be exposed to modifying influences, due to continually renewed portions of active solutions, consequently any roughness of outline would tend to be destroyed, especially since any of the surrounding quartz embaying the surface of any such pyrite body would be gradually replaced by pyrite, as the whole process indicates that the already precipitated pyrite acted as a precipitating agent for that still in solution and that under the conditions that then obtained, the solutions had a greater chemical affinity for the silica than for the pyrite. Further, I pointed out that any roughness of outline would have presented greater frictional resistance, and since solution is most active at points of greatest pressure, any unevenness of surface would be toned down.

I showed that the black coloration of certain quartz pebbles was due to minute traces of chromium and manganese, and Mr. Lett argues that gold is more volatile than chromium and therefore a marked increase of the latter would mean diminution of the former, as it would have traveled further from its ultimate source; this reasoning appears to me far-fetched. The amount of chromium necessary to produce coloring effect is so minute that the amount present could hardly be gaged by this means with any degree of accuracy at all.

Mr. Lett refers to my suggestion that the pyrite and gold may have been present in the mineralizers as a eutectic mixture and says, if so, one would expect to find a fixed ratio between the gold and pyrite in the banket. I do not agree with him, and in Part IV of my paper, I pointed out that if such a mixture existed the pyrite present in excess of the eutectic ratio would have been precipitated first, until the eutectic point was reached when the gold and pyrite would have come down together. Thus there would always be pyrite present in excess of the eutectic ratio. Mr. Lett apparently suggests the possibility of an area in vertical range where gold and pyrite in eutectic proportions alone might be deposited: I think this is highly improbable, and there is certainly no evidence of such area on the Rand.

As regards alternating poor and rich zones, I have already dealt with this subject at considerable length in Part V of my paper, and illustrated it by a series of curves, and I would especially refer Mr. Lett to Fig. 23, 24, 25, and 26.

Small Type

The Editor:

Sir—In an editorial of May 9 you ask the indulgence of your readers for presenting the decision in a recent lawsuit in small type. This, to my mind, is an exceedingly valuable feature and I wish it were followed in all technical journals. Small space and weight are points of great importance to engineers, who, as most of us do, extract from the technical press, and especially so to those who travel much on expensive stage and railroad lines. The precis of technology given in *The Mining Magazine* of London is a model of compactness. Many a good article has found its way into the waste basket which, if it weighed half as much, would have been placed on file.

'Rolling Stone.'

Globe, Arizona, May 26.

Ore

The Editor:

Sir—Your issue of March 14, containing T. A. Rickard's reply to my criticism of his definition of ore, published in the January 24 number, has only just reached me.

I wish to express my appreciation of the tone and tenor of Mr. Rickard's reply. I accept gladly and with humility his correction in regard to the split verb. I regret my lapse. The lance of a watchful opponent has found an entrance into an armor that is all too vulnerable; nevertheless, I hope that admission to the circle of the best families will not be denied me when, as at this present juncture, I place a humble and hesitating foot on the literary threshold.

G. Aubrey Gow.

Wellington, New Zealand.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

OIL PRODUCED in the British Empire amounts to only 2.06% of the world's total.

ELECTRIC POWER in Germany is frequently sold at $19.04 per horse-power year.

AMALGAMATION TREATMENT is responsible for 70% of the output of gold from Rhodesia.

ALLOYS OF GOLD AND SILVER show only a slight reduction in melting point below that of pure gold as long as the silver is not in excess of the gold.

FINE GOLD, according to Rose, may be drawn into wire of such thickness that 1 oz. will cover fifty miles. Gold leaf can be made one-three hundred thousandths of an inch in thickness.

CARBON BISULPHIDE is used as a solvent to extract the remaining oil from pulp and stones of olives after the 'expressing' process. The product obtained is known to the trade as sulphur oil.

PRESSURES up to nearly 300,000 lb. per square inch have been obtained in the physical laboratory at Harvard University. With reasonable accuracy these were measured up to 175,000 pounds.

TUBE-MILL FEED can seldom be arranged so that the mill works under absolutely ideal conditions. A certain amount of elasticity of operation is available with this machine, and pebble volume can be varied to conform with a slightly higher or lower feed than may have originally been intended.

GRAPHITE is mined, and is also manufactured by electric furnaces. The percentages of the world's production of graphite used for various purposes have been estimated as follows: crucibles, 55%; stove polish, 15%; foundry facings, 10%; lead pencils, 5%; paint, 5%; lubricants, 5%; all other uses, 5 per cent.

LEAD POISONING is rare in regular foundry work, or where alloys containing under 8% lead are melted and worked. Lead enters the body through the nose and mouth, and leads to indigestion, lead colic, diseases of the heart, blood vessels, and kidneys, and to paralysis of the hands, known as 'wrist-drop'. The poison acts slowly and insidiously.

A SILVER-COPPER ALLOY of homogeneous composition may be made when the proportion of silver amounts to about 72%. With a variation in silver percentage above or below this amount a 'segregation' is liable to take place on cooling which will result in the outside of the cast being poorer or richer than the average fineness of the alloy.

COAL GAS for lighting and power, manufactured by the Widnes corporation or municipality in England, is sold for 24c. per 1000 cu. ft. to users of less than 3,000,000 cu. ft. per year, 20c. for over that quantity, and 16c. for all power purposes. New retorts have resulted in gas being made 20 to 27% cheaper than that of the nearest competitor, the Sheffield Gas Company.

HYDROGEN PRODUCED as a by-product of the electrolysis of the alkaline chlorides in Germany, amounts to 10,000,000 cubic metres per year, equal to 896 metric tons. Also about a similar quantity liberated in the electrolytic production of oxygen for commercial purposes, from solution of alkaline hydronides. Hydrogen is sold at Griesheim and Bitterfeld for 12c. per pound.

ALKALINITY ESTIMATIONS, involving the calculation of the exact amount of pure lime to be added to an ore to counteract acidity, are of little practical use because the acidity of the ore and the alkalinity of commercial lime are both liable to fluctuate daily. A better plan is to add sufficient lime to the ore so that daily titrations of plant water or solution demonstrate the presence of a definite percentage of alkali. In buying lime for neutralizing purposes the sale should be effected on the actual percentage of CaO present. Powdered quicklime should be rejected, as it invariably leads to a loss on the part of the buyer, due to the difficulty of estimating lime content; and also on account of the wide variation in moisture content.

COAL PRODUCED in the United States is nearly all mined by the room-and-pillar system, or some modification of it. The longwall method of mining, so well adapted to many thin seams, is neither understood nor appreciated in this country. The only field where longwall mining produces any considerable tonnage is in northern Illinois in Will, Woodford, Putnam, Marshall, La Salle, Grundy, and Bureau counties, where the annual output is over 5,000,000 tons, or 9% of the state's total coal yield. The production of this tonnage is attended by 24.5% of the non-fatal accidents in coal mines in the state. The per capita production per employee is only 2.1 tons as compared with 4.5 tons for the state as a whole. The longwall method of mining makes an almost complete extraction of the coal in the bed, and produces about 15% more lump coal over 1¼ in. than is produced in Illinois room-and-pillar mines.

REVIEW OF MINING

As seen at the world's great mining centers by our own correspondents

BUTTE, MONTANA

UNIONS AT BUTTE. THE RECENT CLASH AND CAUSES OF THE OUTBREAK.—FURTHER TROUBLE LIKELY.—EFFECT ON BUSINESS.—GENERAL MINING ACTIVITY.—OIL PROSPECTING.

Butte is now experiencing the unusual situation of having two miners' unions competing in the same field. The new and recently formed organization is called the Butte Mine Workers' Union; the old organization is called Butte Miners' Union Number One, Western Federation of Miners. The events which have led up to this anomalous situation are briefly as follows: On June 11 the miners in two of the mines refused to go to work under conditions requiring them to show the old union cards. On June 13, Miners' Union Day, only a few score men tried to take part in the miners' parade, while a large crowd of disaffected ones gathered on the streets, jeering the paraders, and finally attacked them in person. The attackers then rushed for the Miners' Union Hall, broke into it, and destroyed records, furniture, and everything breakable, throwing the refuse out of the windows. When the acting mayor of the city tried to prevent this destruction by making a speech to the men, some one pushed him out of a second-story window to the stone pavement below, injuring him seriously. That night a crowd took possession of the miners' union safe, carried it to a point without the city, blasted it open, and carried off its contents of money, papers and records. Within the next few days the disaffected miners formed the Mine Workers' Union and began to enroll members.

These disturbances brought C. H. Moyer, president of the Western Federation of Miners, to Butte. On June 23 he attempted to hold a meeting of the old union in the hall, which had been temporarily repaired for that purpose. A large crowd gathered outside the building during the meeting, jeering at those who entered. Finally some one from within the hall shot and seriously wounded a miner who was just entering the building. This was the signal for a volley of shots from both sides, with the result that an innocent bystander across the street from the hall was shot and killed. The shooting so angered the crowd without that, in spite of protests from the leaders of the new union, dynamite was secured and the old union building was blasted again and again during the night until only a tangled mass of ruins remained. The city and county authorities claimed to be unable to prevent these acts of violence, stating that armed interference on their part would result in a greatly increased loss of life and probably uncontrollable riot. In fact, when the mob besieged the city jail and demanded the release of two of their number who had been arrested, the authorities were not long in complying.

In the foregoing statement an attempt has been made to record the facts impartially. Now, as to the cause which produced these events, the two sides of the case offer divergent evidence. The adherents of the old union, who are decidedly in the minority, aver that the rebellion was brought about by a radical element of the union who had not been paying their dues and who were anxious to have the Butte miners affiliate with the I. W. W. or some similar anarchistic organization. The sponsors for the new union claim, on the contrary, that they are not interested in the I. W. W. or any other outside organization; that their rebellion was necessitated by a long series of abuses in the old organization which they had been unable to correct by peaceful means. They say that the old union has been run in recent years in a manner not to the interests of the miners, that excessive dues and assessments have been levied for the support of unsuccessful strikes in other districts, that the funds so collected have been in part misappropriated, and that an inside clique has controlled the affairs of the union to the exclusion of the rank and file.

Just at present all is apparently quiet in Butte, but those who claim to know, believe that more troubles are yet to come. Moyer and his supporters are marshaling their forces apparently with the purpose of deciding whether they are strong enough to try to oust the new union. Their method of trying this will probably be to send representatives to the mines and demand the old union cards of the men who go down to work. The immediate objection to this method is the difficulty of securing lieutenants who would try to carry

RESULT OF A DISPUTE BETWEEN LABOR UNIONS AT BUTTE.

out such a plan. It would undoubtedly be a foolhardy thing for any man or group of men to appear at the mines now for that purpose. An alternative would be for the Western Federation to persuade the hoisting engineers, smeltermen, and other allies to strike if the mine continued to employ the so-called scab labor.

The mining companies have been able so far to keep out of the trouble, and the mines continue to work as usual; but the situation is admittedly tense, and has already reflected adversely on business conditions in Butte. Real estate men are especially 'blue,' and the mine promoters claim that investors have been so frightened by the threatening conditions that no money can be raised at present for Butte ventures.

Smelter superintendents and others in a position to know of ore shipped and smelted, state that there is a noticeable increased activity among the smaller operators throughout the mining districts of the state. No one property can be credited with any great developments or greatly increased production, but the general outlook is encouraging, with a good'y number of small shippers active.

The success which has been had recently in the fields about Calgary has aroused eastern Montana anew to prospect further for oil. Various attempts have been made in times past to find commercial amounts of petroleum in Montana, but so far without success. A well is now being drilled at Great Falls, and preparations are under way for the drilling of several wells near the Canadian boundary in the region of the Sweet Grass hills. A seepage has been found in the latter place, and the conditions appear favorable for oil concentration. A broad anticline runs north and south through this region for several hundred miles. This anticline has been locally 'domed' by igneous intrusions in the Sweet Grass hills, and in the region of this doming the wells are to be sunk. Butte capital is interested in one of the companies.

NEW YORK

DISCUSSION OF BUSINESS SITUATION.—CHILE COPPER CO.'S FINANCES.—BRADEN MINE.—UTAH COPPER MINE.—STEWART MINING CO.'S AFFAIRS.—NIPISSING AND LA ROSE.—TOMBSTONE, ARIZONA.

The undertone in the New York market has been largely lost to sense of sight, sound, or touch during the past week, while the deplorable consequences of unsound financing of the railroads has claimed the attention of federal authorities and banking interests alike. The present time is evidently to be marked as one of those eras of reorganization that are apparently bound to follow periods of constructive activity in this country. American financiers have hitherto found justification for undue expansion in the ability of the country to grow up to anything within the compass of reasonable expectation. The coming generation of financiers must learn to face changed and changing conditions. The press of population in congested centres is no longer easily and automatically relieved. There are no longer new empires to be developed on the old basis of vast subsidies to pioneer railroad builders. We have much work to be done, more work than ever; never was there so great need for that class of labor that can win an independence from the soil, but we have yet to overcome the traditions of our country; to learn that greater effort is necessary to secure smaller rewards; that there is no longer unearned increment to accrue to everyone as in earlier years. Crystallization of conditions, in as far as it has progressed, has in nearly all lines, except those of agriculture, worked toward the elimination of the individual as a factor. This has been true in mining as in other industries. The larger part of our present condition of unrest and stress and struggle is the attempt of the individual to win back his place in the work of the world. Through the dust of the present struggle between financial and political powers can be seen a turn in steel; mills are being started up, those that have been running one shift are working double shift, and plates, shapes, and bars are being advanced in price. Whether copper is to follow cannot as yet be foretold. Nearly every copper authority expresses the opinion that the world's uses for the metal have so grown as to make improbable, if not impossible, the accumulation of stocks of metal large enough to threaten price stability. The copper producers themselves are, apparently, assured of their position, and such price concessions as are made are due to general business conditions and not to anything inherent in the copper situation. At the moment, the metal market is flat with prices around 13¾c. per pound. The one element in copper production that works against true economics lies in the necessity of keeping the huge units in operation, the tremendous organizations together, and consequent price reductions to a level that is too close to production cost.

The management of the Chile Copper Co. has distributed about $2,000,000 of the convertible bonds remaining in the Company's treasury. The Chuquicamata was capitalized on a rather odd basis, the authorized stock issued being $110,000,000, of which $15,000,000 was retained in the treasury against a convertible bond issue of like amount, the $95,000,000 of stock was stated to have been taken by the Guggenheims, who also took one-third of the $15,000,000 of convertible. $5,000,000 was distributed to the public at the time of the organization, and now $2,000,000 more has been subscribed, leaving about $3,000,000 in reserve. The marked success of the Guggenheim organization is shown in the fact that the flotation of the Chuquicamata has been made without any open appeal to the public. There has been no market flotation of stocks or bonds, and it must be recognized as something of a triumph to be able to get together a following strong enough to finance privately a new mining property in a far country to the tune of $15,000,000.

Braden, now the second in importance of the Guggenheim propositions in Chile, makes haste slowly. A recent snowslide was attended unfortunately by a considerable number of fatalities among the native laborers. The enlargement of the present mill and later additions to mill capacity to where there can be handled 10,000 tons of ore per day is the present program for Braden. There are some other copper deposits in Chile that are being examined in behalf of the Guggenheims, which are said to be quite promising.

In the meantime, the magnitude of operations at the properties in this country controlled by this group continues to increase. Time was when 100,000,000 lb. of copper per year was looked upon as a barely possible achievement for Utah—now further expansions are being discussed. The steam-shovel department is getting to a point where it can deliver ore in larger quantities, and the only obstacle in the way of increased output would be bringing up certain sections of the mills, mostly a matter of addition to vanner-table and fine-crushing departments.

The fight for control of the Stewart Mining Co. which has been going on between F. A. Heinze and the Assets Realization Co., the latter faction headed by John W. McKinnon, has resulted in a receivership for all of the assets of the Company in the state of New York. A like fight is being waged in the courts of Idaho for the control of the mining property, though the McKinnon people are endeavoring to have the cause transferred to the United States courts. Recently, shareholders were surprised to receive dividend checks drawn on Saratoga (New York) banks. Evidently this was a part of the court fight, and the shift was made to avoid threatened injunction proceedings. Heinze's loans on Ohio Copper bonds are still in the 'Street'; some of these are also mixed up in injunction proceedings. While it would be hard to find many sympathizers for Heinze in Wall Street, it does seem something of a shame that one who could do as much as Heinze could do, should not have been able at the same time to spend his energy in the right direction.

There has been recently some little talk of declining production and decreasing ore reserves in the Nipissing at Cobalt. President E. P. Earle, who has just returned to New York from the camp, says that conditions at the mine are excellent; that net earnings for the first six months were $900,000 (dividend requirements are $600,000); that ore reserves were increased to such an extent as to justify the positive prediction that earnings would not decline during the latter half of the current year. Nipissing, like other properties in Cobalt, has been holding its own by dint of increased efficiency in milling operations. La Rose, which has always been coupled with Nipissing, as one of the leading producers of the Camp, is not in so good stead. A report has just been mailed to the shareholders by the secretary of the Company stating that unless operations during the next 90 days showed a very considerable improvement, the Company would distribute its surplus, which now amounts to $1,547,420, suspend operations, and surrender its charter.

Not everyone who attempts to keep up with the mining news concerning Utah Copper and the camp of Bingham realizes that Bingham cañon turns out anything besides copper. As a matter of fact, the output of lead is very important, amounting to no less than 75,000,000 lb. per year.

The story of some of the big mines and their vicissitudes, their triumphs, their eclipses, and their occasionally surprising rejuvenation make up some of the most interesting chapters of reminiscence. The old tales of the camp of Tombstone, Arizona, and its bonanza days will be worth digging out of pioneer history now because of the possibility of the renewal of production, now that the Phelps-Dodge company has acquired the Tombstone property. The Development Company of America, which some years ago undertook the exploitation of several large properties in the Southwest, secured control of the Tombstone mine and organized as its leading subsidiary the Tombstone Consolidated Mines Co., Ltd. This particular enterprise was to be the backbone of the whole organization. A securities-selling campaign landed the stocks and bonds in many hands all over the country, as discussed in the *Press* of June 13 and 27. The difficulty, as is well known, was the handling of a surprisingly heavy flow of water found in the mine.

CALGARY, ALBERTA

GASOLINE PRODUCTION FROM WET GAS, AND PLANTS CONTEMPLATED.—NEW HIGH-GRADE OIL DISCOVERIES.—DRILLING OPERATIONS.

The most important of recent developments in connection with the Calgary oilfield is the success of the tests made at the Dingman well in distilling gasoline from the flow of wet gas. A testing plant was put in and worked intermittently for two days, resulting in an extraction of gasoline somewhat in excess of the analysis which showed about 1.5 gal. per 1000 cu. ft. If this is borne out in practical working, it will make possible the economic development of large areas not within the oil zone, as flows of wet gas are often met with in the course of comparatively shallow drilling, where the oil lies too deep to be reached. At 700 ft., Dingman well No. 2 is giving 1,000,000 cu. ft. of wet gas per day, and should the results of further development justify it, the installation of a $50,000 condensing plant for the production of gasoline is contemplated.

A small quantity of oil has been taken from the well of the Southern Alberta. The analysis shows a light oil of specific gravity about 45° and a smaller quantity of heavier brown oil. Though not great, the find is regarded as decidedly encouraging.

Drilling is progressing rapidly in many of the wells. Contracts for the drilling of 30 new wells have been closed with the Janse Drilling Co., which will be proceeded with as soon as the equipment can be brought to the ground. The wells now contracted for include six for the Alberta Associated Oils, Ltd., three for the Western Canada, and from two to five each for the following: Livingston Fork Syndicate, Stokes-Stephens, Fidelity, Sarcee, Huron-Bruce, Mr. Stephen, Lion, Peerless, Noehren-Mannix, and Western Petroleum. Wireless communication has been established between the oilfields and Calgary. Field stations have been installed at about a dozen of the leading properties in charge of government-licensed operators. It is hoped that this will have a tendency to prevent the spreading of false reports regarding oil finds, and to insure a reliable news service. Some excitement over prospective oil discoveries in the neighborhood of Nakamun, in the Edmonton district, has been occasioned by the visit to that field of Julius Fried, of California, a prominent and wealthy operator, who has secured large holdings in Nakamun. A large amount of land in that vicinity has been taken up by local capitalists, and drilling will shortly be undertaken.

WASHINGTON, D. C.

OIL AND GAS LAND LEGISLATION IMPORTANT TO CALIFORNIA INTERESTS. GOVERNMENT DEPARTMENTS NOT TO SEND OFFICIALS TO MEETINGS OF SOCIETIES

The House of Representatives has under consideration the bill already passed by the Senate protecting locators of oil and gas lands in California. The bill especially considered, and which is hoped soon to pass, provides temporary relief pending final settlement of various suits. There has been some objection on the part of the Navy Department and the Department of Justice. As a result of conferences, an amendment to the bill has been agreed upon. The substance of it is that the royalties that come from the oil in the so-called 'naval reserve' lands are to be set aside for the Navy Department. There are 7600 acres in the two reserves, created under the Pickett act. Approximately half of that land—30,800 acres—is patented to the Southern Pacific railroad; 7500 acres of the other half is claimed by locators. The unentered and unclaimed lands amount to 29,650 acres, but there are some locations in that area which have not been applied for, so that there remain but 21,000 acres not in litigation. The proposed legislation is important to California, where a large number of locations and applications are under investigation or involved under proceedings which challenge the validity of the locations or the regularity of the applications presented. Many oil and gas wells are in actual operation upon these and adjacent lands, and by reason of the investigations of the Department of Justice and certain suits instituted by the United States to enjoin parties from removing oil from the lands, the operators are unable to dispose of the oil or gas pending adjudication. Failure to operate the wells continuously may result in the diminution or the destruction of the gas or oil through the introduction of water or by reason of the draining off of the oil or gas deposits from under the lands involved through wells sunk and in operation upon adjacent patented land. The legislation does not provide a method for disposing of the lands or deposits after final adjudication of the cases. Opposition to an amendment developed in the House, and pending a settlement the bill was left on the calendar without prejudice. There is before Congress and now on the calendar a general bill for the leasing of lands containing deposits of oil, gas, and certain other minerals, which will prevent future difficulties, and it is believed that the necessity for passing the temporary measure outlined only emphasizes the need and importance of general legislation.

Congress has done away with the liberty of bureaus not in the Department of Agriculture of sending experts to appear before public meetings and associations. It has been the custom to send experts, and even to pay their dues to belong to such bodies, wherever this was thought expedient. Congress has never liked this expenditure, and has positively forbidden it except in the case of the Department of Agriculture, where there are many bureaus conducting experimentation for the benefit of farmers. Congress has a profound regard for the Department of Agriculture, which teems with experts of all sorts who go out to the farmers, the Government paying all expenses. Other bureaus have not this popular support and hence they have been cut off. In consequence, hereafter the meeting of mining associations will not be attended as heretofore by government experts, either to learn for the government or to impart information to the miners. The Bureau of Mines regards this prohibition with great sorrow, for it is hard hit in its work of disseminating mining knowledge through direct personal touch.

The conference report on Sundry Civil Bill, carrying appropriations for the Geological Survey, Bureau of Mines, and many other bureaus, has now been accepted. The bill carries few increases in appropriations.

LONDON

ST. JOHN DEL REY AND OURO PRETO COMPANIES' OPERATIONS IN BRAZIL; THE FORMER A GREAT SUCCESS, THE LATTER UNPROFITABLE AT PRESENT.

The two English-owned gold mines in Brazil present considerable variation in fortune. Whereas the Morro Velho mine, owned by the St. John del Rey company, has mined to 5226 ft. vertically, and has had continuous success for ten years, the Passagem mine, belonging to the Ouro Preto company, has recently been in a poor zone and has had to raise further working capital. The St. John del Rey company has been in existence for 83 years, and the last annual report, covered in the *Press* of July 4, shows that £10,000 was paid in dividend on the 10% preference shares and £54,627 was paid on the ordinary shares, being at the rate of 10%. The labor situation has greatly improved of late, and the full complement of men is now employed; this is due to the construction of several railways and public works having been suspended. In regard to development at the mine, the 'G' shaft has been sunk 223 ft. below No. 18 or 5226-ft. level. It is to be continued to 5526 ft. and then a drift will be started to intersect the lode. George Chalmers, who reopened the mine in 1884, continues to direct the fortunes of this remarkable mine.

The other company, the Ouro Preto, owning the Passagem mine, is under the guidance of John Taylor & Sons, and it has been far from successful. It was formed in 1884, and reconstructed in 1893; now comes another writing down of old shares, and another subscription of new capital. Dividends on a small scale have been paid occasionally, but on the whole the venture must be classed as unprofitable. The report for the year 1913 shows that 66,139 tons of ore was raised and sent to the mill, and gold worth £90,433 was extracted, being at the rate of $6.56 per ton. The year before, 68,486 tons was raised and the yield per ton was $7.48. The working cost was £90,452, and £3584 was allowed for depreciation, so that the year ended with a small deficit. The fall in the yield was due to the stopes on the 770-metre level proving to be poor. On the lowest level now being opened, at 920 metres, the ore shows a substantial improvement, so that the outlook is brighter. The Paredao shoot on the 215-metre level has also given cause for expecting an improved ore supply. The labor question has continued to cause anxiety, for railway and other surface works provide real attractions. The Passagem lode is flat and the men descend and ascend the shafts on foot. In order to avoid this unnecessary exertion, cars are now being provided. The feeding arrangements have also been improved. It is hoped that by studying the men's comfort in these and other ways, labor shortage will no longer be felt. The directors, during the year, commissioned Thomas Richards to examine the mine with a view to determining, in conjunction with Mr. Bensusan, the best way of conducting operations in the future, in the hope that the mine may be restored to financial prosperity. He recommends that the scale of mining should be extended, and the monthly output raised to at least 7000 tons, and if possible to 10,000 tons. To effect this, it would be necessary to sink a new incline shaft in the neighborhood of the Paredao shoot and to provide additional hoisting and metallurgical plant. The capital expenditure required for this purpose is estimated at £30,000. This money is to be raised by the issue of new preference shares, and at the same time the present capital is to be drastically reduced. The £100,000 ordinary shares are to be written down to £15,000, and the £36,634 preference shares are to be exchanged for £12,212 in new preference shares and £24,422 in new ordinary shares. With the expanded system of working it is hoped to reduce the cost to $5.04 per ton, and to extract gold worth $6.24 per ton. On December 31 the ore reserve was estimated at 114,528 tons, as compared with 125,193 tons a year previously.

HOUGHTON, MICHIGAN

WHITE PINE MINE AND NEW MILL.—WORK AT THE ISLE ROYALE.—CALUMET & HECLA MILLS.—WORK AT THE PHOENIX, FRANKLIN, AND NEW ARCADIAN MINES.

Good progress is being made in the development of the White Pine mine, one of the Calumet & Hecla subsidiaries. This mine is in the Porcupine mountains, some distance southwest of the most southerly of the other Lake Superior properties, and is peculiar in that the copper is not disseminated through trap rocks, but is in a vein in the Freda sandstone. The ground is considerably faulted, and development of the property required careful engineering as well as good geological knowledge, but the copper content is high and the mine is a promising one. A mill is being built near the shafts, and will also be unusual in that coarse crushing will be done in the mill in gyratory crushers, instead of in jaw crushers in the usual Lake Superior rock-house. As the ore contains almost no mass copper, the method of crushing offers obvious advantages.

Another Calumet & Hecla subsidiary of much promise is the Isle Royale, which is being pushed to such an extent that the capacity of its mill, and one-stamp head in the Allouez Centennial mill as well, is being overtaxed. The Isle Royale is an old mine which has never paid a dividend, and though the Isle Royale lode is of good width and is persistent for miles, it is low grade, and it is only by selective mining underground and sorting out the poor ore at the surface that the copper content is maintained at its present level of 14 lb. per ton. The obvious thing, which is being done, is to mine and mill the ore on a large scale, cutting operating costs so as to make a profit even with the low yield. When the Benedict leaching process is in full operation, the tailing losses will be reduced to so low a figure that 14-lb. ore should yield a good profit.

The construction of the leaching plant at the Calumet & Hecla mill is proceeding apace, under the direction of C. H. Benedict, who devised the process to be employed. Secrecy is still maintained as to the details of the process, but it is generally known that the solvent is an ammonia salt, and that the success of the operation depends upon good results attained in the recovery and re-use of the ammonia. Mr. Benedict has not given out any figures, but it is stated that he expects to make a recovery of 75% of the copper in the sand, at a cost of 30 to 35c. per ton. The Bucyrus suction dredge for the reclaiming of the sand from the bed of Torch lake is nearly completed, and the regrinding plant is well advanced. Some of the Hardinge mills are already in operation regrinding the sand from current ore, and most of the other mills are in process of erection.

The Keweenaw Copper Co., controlled by Thomas F. Cole, is exploring the old Phoenix mine. A shaft which has reached a depth of 530 ft. is yielding ore which is full of shot copper, and if the lode proves uniform, this old property will make a large new mine. The properties at the north end of Keweenaw point all ceased work many years ago, and it will be most interesting if mining can be revived in that part of the district. Another discovery which may revivify another old property is in the Franklin. Under Enoch Henderson, the superintendent, a cross-cut has been driven to the east on the No. 32 level, and cut the Allouez conglomerate at a point where it is about 18 ft. thick, and contains 30 to 35 lb. copper per ton. The conglomerate has been driven on for about 500 ft., and a raise has been put up 75 ft. A cross-cut on the No. 37 level will be started soon, and if the copper content of the conglomerate is found to keep its value at that depth, the Franklin will have an excellent chance of resuming its former annual output. The New Arcadian is to sink its shaft to the 900-ft. level, on the strength of the copper content of the ore uncovered on the 750-ft. level for a length of 200 ft.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press

ALASKA

JUNEAU

The Alaska Treadwell mills crushed 79,254 tons of ore in June, yielding gold worth $119,115 by amalgamation, and $95,337 by cyaniding 1784 tons of concentrate. The estimated net profit was $125,630. Development in the mine totaled 361 ft., and the stock of broken ore decreased 38,464 tons. —— The Alaska Mexican mill crushed 19,824 tons, yielding a total of $41,383, of which $14,773 was profit. No development was done in the mine, but expenses include work in the 700-Ft. Claim for the Company by the Treadwell company.——The Alaska United mills crushed 38,601 tons, yielding $76,480, with a profit of $15,778. There was a loss of $1829 on work at the 700-Ft. Claim, the ore averaging $1.67 per ton. Stock of broken ore in the Ready Bullion mine increased 27,460 tons.

ARIZONA

COCHISE COUNTY

Gold-bearing ore has been discovered at Juniper Flats, near Bisbee, by Truax and Zayne, and hundreds of claims have been located. The granite-schist contact is said to be favorable for further development.

GILA COUNTY

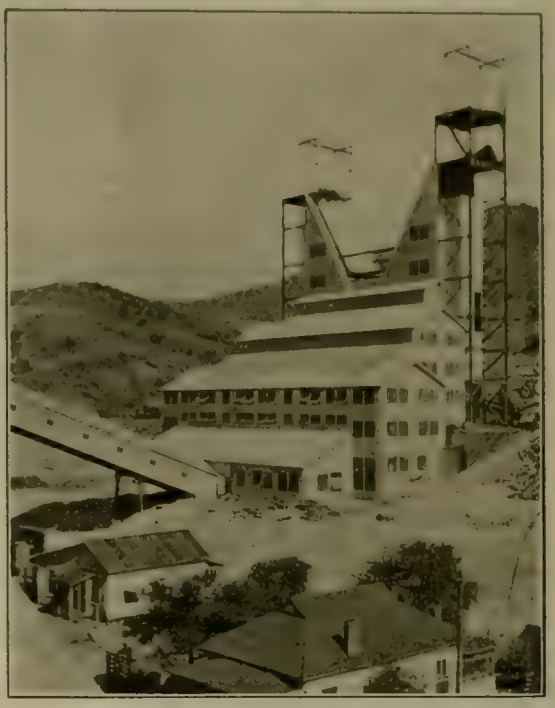
(Special Correspondence.)—Machinery is being installed in the Inspiration compressor and hoist house at a rapid rate. A Nordberg 3000-cu. ft. compressor is at work. An Ingersoll-Rand 1325-cu. ft. machine to compress to 1000 lb. pressure for underground haulage is being set up. These machines are of the cross-compound type with a motor between. A Nordberg hoist is being installed, with C. V. A. Reed in charge. There are in reality two separate hoists, one for each shaft, but it will be possible to handle both from a single operating platform, as when running automatically they will act as a single machine. Hoisting will be done in balance, and as there are two shafts, this means that four skips will be in continuous operation. The skips will weigh 1500 lb. each and will have a capacity of 2400 lb., the net load to be hoisted. To allow ample time for repairs and emergencies, the hoisting period has been limited to 14 hours per day, and the capacity for the set for the period is 10,000 tons from a depth of 600 ft., corresponding to a skip of ore to the surface every minute. The hoist is so designed as to be entirely automatic in its operation, requiring no attendant whatever, either on surface or underground at the loading pocket. It can, however, be disconnected at will so as to eliminate the automatic feature, making it hand operated. So far as known, this is the first large hoist to be entirely automatic in its operation. Although the initial cost is much higher than it would otherwise have been, the amount saved in wages of engineers and attendants will soon offset the extra outlay. Work has been started on the concreting of the 5,000,000-gal. reservoir. The entire reservoir is to be concreted, reinforced with Clinton fabric. It presents a unique problem in ferro-concrete construction, as the sides are all sloping, with the two ends semi-circular.

Miami, July 23.

Mines of the Globe district are being examined by the state mine inspector, G. H. Bolin. He is accompanied by the deputy inspector, John Harper.

PINAL COUNTY

(Special Correspondence.)—Churn-drills are being set up on the Gila Canyon Copper Co.'s 16 claims in the Banner district, about four miles from the Arizona & Eastern railway.



HEAD-FRAME, COARSE-CRUSHING PLANT, WITH BELT-ELEVATOR HOUSING TO MAIN ORE-BINS OF INSPIRATION CONSOLIDATED, MIAMI.

About 5000 tons of ore has been smelted from the property in the past.

Christmas, July 23.

CALIFORNIA

Oil production of the state, for the first time, exceeded 300,000 bbl. per day in June, when the total was 9,431,863 bbl. The amount shipped or consumed was 8,616,610 bbl., another record. Field operations showed 22 rigs completed during the month, 218 wells drilling, 46 completed, 6 abandoned, and 5954 producing.

AMADOR COUNTY

The Hardenburg mill has been shut down for several weeks, and all but one engineer have been laid off. The next move in connection with the property is awaited with interest.

LASSEN COUNTY

A number of copper claims in the Last Chance district are being prospected, and there is talk of a concentrating plant being erected later on.

MODOC COUNTY

The Modoc Mines Co. at High Grade, is shipping five cars of ore to the smelters. A vein about 8 ft. wide has been opened to 100 ft., and in it is an 8-in. streak averaging 4 oz. gold and 4 oz. silver per ton.

NEVADA COUNTY

The Union Hill mine, east of Grass Valley and adjoining

the Brunswick mine, has been sold to San Francisco and other California men.

SHASTA COUNTY

On August 1, the Victor Power & Development Co. took control of the Midas mine at Harrison Gulch. Old tailing dumps contain about $3 per ton in gold.——A new electric hoist, driven by a 275-hp. motor, has been installed at the Gladstone mine at French Gulch.

TUOLUMNE COUNTY

(Special Correspondence.)—High-grade ore has been opened in the Hart & Jacobs mine, seven miles northeast of Columbia, by A. E. Caldwell. A box of the ore has been placed on exhibition at a local bank, and is convincing evidence that the find is a bonanza. The small mill on the property is now in operation.——C. E. Rives, a mining man from Arizona, has taken a bond on the Schindler ranch, at the base of Bald mountain, and is developing a vein which is giving encouraging prospects. The ranch contains nearly 600 acres and is traversed by several quartz veins.——Rock showing gold is being taken out of the Darrow mine, north of Rawhide, by the Darrow brothers. The shoot has been opened sufficiently to convince the operators that they have made a valuable find.——The Springfield Tunnel & Development Co. is moving its milling plant to the mouth of the long adit being driven to cut the old workings. The adit is now 1400 ft., and will be about 6000 ft. when it reaches the objective point. Raises will be run from the adit when it reaches the Buchanan channel, 700 ft. ahead of present face of adit. A foundation is being laid for a mill twice the size of the one now being re-erected, which would increase the capacity to 500 tons per day.——Suit has been instituted in the Superior Court of this county by 51 lien holders against the Santa Ysabel Mining & Milling Co., C. E. Shafer, Charles Benton, and L. R. Saunders. The plaintiffs hope to hold the property responsible for debts contracted while the mine was being operated by Benton and Saunders, on the point that the Company failed to post notices of non-liability. The question on which the result of the suit depends is whether the notice of non-liability posted by a former operator named Mitchell, who recently sold his interests to Benton and Saunders, was sufficient to protect the Company.

Sonora, July 18.

COLORADO

LAKE COUNTY (LEADVILLE)

Bags are now being hung in the bag-house at the new zinc smelter, and the plant should be started any day.——At the Mt. Champion mine additional equipment is being installed, and officials of the Company from the East are inspecting the property. A tunnel to connect the mine and mill, to take the place of the present tramway, may be driven through the hill. A large tonnage could be treated, and a 250-ton mill may be erected. Lucien Smith is manager.——There is a good deal of activity in the Twin Lakes district. Going into the Lackawanna Gulch district by way of Twin Lakes, Bull hill is at the east end. The Fidelity Gold Mining Co. has 14 claims here. A cross-cut has been driven 800 ft., with 350 ft. to go to cut the main vein. Several small veins have been cut. Sam Smith is manager for C. J. Fox of Philadelphia. The adjoining property is the Golden Fleece, where an adit is to be driven this summer. Other development in this area is being done at the Lackawanna Gold, Miller Gold, Evening Star, Lone Star, and many other properties.

PITKIN COUNTY

The Hope adit at Aspen was advanced 113 ft. in June. A small streak of 127 oz. silver and 22% copper ore was cut. Prospects are bright.

SAN MIGUEL COUNTY

On July 27 a cloudburst wrecked about 100 buildings at Telluride, besides killing two persons and doing other damage in the district. The damage is estimated at $300,000.

TELLER COUNTY (CRIPPLE CREEK)

An extra quarterly dividend has been paid by the Portland company, making with the usual one a total of $120,000. A large body of good ore is being developed at the bottom of No. 2 shaft.——The Neville mill, on the Wilson claim of the Free Coinage company, is to be increased to over 100 tons daily capacity. A Chilean is to work in place of a Hardinge mill.——Car tracks, air pipe, and drainage ditch are now up to the heading of the Roosevelt drainage tunnel. Timber is being placed under bad ground there, the Black Belle dike of granite.

IDAHO

SHOSHONE COUNTY

The National Copper Co. proposes to increase its capital from $2,000,000 to $2,500,000, and a meeting of shareholders will be held on August 22. The Company wishes to purchase the adjoining Nellie lode claim of the Continental Mining Co.——The Cedar Creek property is in the Murray district. It has been opened by adits No. 1 and 2, totaling 5000 ft. of general development, and two veins being opened. The ore contains lead, and a good shipment has been made. No. 3 adit is in 200 ft., but will go 2300 ft. farther to cut the veins. The property is equipped with a good plant.——Work is again under way at the Pilot at Murray.

MONTANA

SILVERBOW COUNTY

The Clark Montana Realty Co. and the Elm Orlu Mining Co. have filed suit in the federal court asking for an order restraining the Butte & Superior Copper Co. from operating on the Elm Orlu and Rainbow lodes, also asking for an accounting for all ores previously extracted by the Butte & Superior from these claims.——A good shoot of zinc ore has been opened at 2400 ft. in the Pilot-Butte mine.——Butte & Superior production for the first half of 1914 is as follows: ore treated, 193,090 tons; concentrate, 60,667 tons; zinc in concentrate, 52.4%; and recovery, 89.3%, against 111,400 tons, 38,397 tons, 46.9%, and 80.58% respectively for the same period of 1913.

NEVADA

ESMERALDA COUNTY

During June there was 2417 ft. of work done in the Goldfield Consolidated mine at a cost of $6.44 per foot. The mill treated 25,955 tons, yielding $147,100 net. Costs totaled $6.12 per ton. Lessees mined 368 tons, worth $8243. There was 1750 tons of Jumbo Extension ore treated also. A general clean-up of the plant is under way and should yield about $100,000. A new pipe-line is to be put in for the precipitating plant to replace and clean the one in use since the start of the mill. During the second quarter of 1914 the mill treated 84,326 tons of ore, yielding $945,179, realizing $445,813 net. Ore reserves in the Aurora mine recently acquired, are estimated to yield $893,000 net, the average value being $4.81 per ton, of which $1.50 should be profit. The last cash payment of the $763,011 for the property is due on October 25. After making the first payment of $388,800, the Goldfield Consolidated company had $445,000 cash in its treasury, and bullion in transit worth about $154,000. As there is not enough money for a dividend, this will be passed.

HUMBOLDT COUNTY

A 100-ton custom mill is to be built at Rochester according to John F. Cowan, president of the Rochester Mines Co. A good site has been secured, also plenty of water four miles away.——In the Codd lease, work is in 100 ft. on the vein at a depth of 425 ft. Ten feet of ore averages $20 per ton. ——Rich ore is still being shipped from the Packard lease.

LYON COUNTY

The Mason Valley smelter received an average of 501 tons of ore per day during the third week of June. Chalcopyrite has been opened in the Ludwig section of the Nevada Douglas property, near the gypsum deposit. Good progress is being made at the Greenwood, Bovard, Empire-Nevada, Montana-Yerington, and East Side properties.

MINERAL COUNTY

A new 10-stamp mill and cyanide plant is working at Candelaria in charge of George Threfall, who states that the owners have started plans for a 200-ton mill.

NYE COUNTY

There was a very heavy electric storm in southern Nevada on July 20, and the Nevada-California Power Co.'s power lines from California needed considerable repairs, and power was off from Tonopah and districts for several hours. This was the worst storm since September 13, 1913.——On July 22, three miners were overcome by gas in a 90-ft. shaft at Crow Springs, 23 miles northeast of Tonopah, and Bureau of Mines rescue-car No. 5 immediately went to the rescue. One died and the other two recovered. The men were Servians.

Tonopah mines produced 50,133 tons of ore worth $877,580 in June. Last week's output was 12,038 tons worth $306,290, a record for the district.——Mine-rescue car No. 5 was in Tonopah last week, being on a side track of the Tonopah Mining Co.'s Mizpah mine. Mr. Blackburn, the superintendent, placed part of the 400-ft. level at the disposal of the engineers for demonstrations and instruction. Teams from all the larger mines were shown the work.

STOREY COUNTY

The Mexican and Union companies are preparing to prospect and open ground at 2650 ft. on the Comstock lode. Pumps are to be installed at certain points.——The Con. Virginia is mining ore at 2500 ft.——The Ophir is doing most of its work at 1600 feet.

WHITE PINE COUNTY

According to C. B. Lakenan, general manager of the Nevada Consolidated and subsidiary companies, nine steam-shovels are moving about 10,000 tons of 1.6% copper per day. A recovery of 69% is made at the mill. At the Giroux, six Star churn-drills are working, the Boston-Ely is diamond-drilling, and underground work is under way at the McDonald-Ely. Generally the Ely district is active and looking well.——A mill will probably be erected to treat the lead-silver ore of the Macon City claim in Robinson cañon.

OREGON

The mine output of gold, silver, copper, and lead in Oregon in 1913, according to Charles G. Yale, was valued at $1,746,402, compared with $849,886 in 1912, an increase of over 100%. With the exception of copper, all these metals showed an increase in output. The gold yield for 1913 was $1,627,710, of which $1,177,082 was derived from deep mines, and $450,628 from placers of various kinds. The yield of silver aggregated 179,036 fine ounces, valued at $108,139, an increase of 121,955 oz. in quantity and $73,034 in value over that of 1912. The mine production of copper in 1913 was 43,330 lb., valued at $6176, a decrease of 217,099 lb. in quantity and $36,255 in value, from that of 1912. In 1913 Oregon produced 87,207 lb. of lead, valued at $3837, compared with 39,317 lb., valued at $1769, in 1912. There were fewer mines in operation in 1913 than the year before, but the tonnage from deep mines was materially enlarged, and the placer mines, including one new dredge property, made a record year.

BAKER COUNTY

An examination of the Ben Harrison mine has been finished by an engineer of the United States S. R. & M. Co. This concern is operating the Rainbow mine in Mormon basin. A large mill will probably be erected at the Azurite mine, near Homestead, to treat gold-silver-copper ore. The North Pole mill is shut down. Engineers are to examine the Cougar mine in the Granite district. A test mill is working at the Last Chance mine at Cable Cove, and machinery for a 20-stamp mill is being delivered. Dredging machinery is being assembled at the Gold Center property on Bull Run creek.

JOSEPHINE COUNTY

(Special Correspondence.) The Old Channel hydraulic mines, of Galice district, have been sold to Chicago people for $10,000. Of this amount, only a part has been paid down, the remainder to be handed over within the next two years. The deal was completed by J. R. Harvey, the former manager of the mine. The Old Channel is one of the best equipped hydraulic properties in southern Oregon. It was for years one of the largest gold producers, but during the past few seasons has been practically idle, this being due mainly to

MAP OF OREGON.

litigation and dissatisfaction among the shareholders. The property includes about 600 acres of timber and mineral lands, with fine water rights. There are over 20 miles of ditches and flumes, and many thousand feet of pipe-lines. Three No. 6 giants are operated when the mine is at work, these working under a head of 500 ft. The gravel is deep, occupying the fill of an ancient river bed.

About 360 oz. of gold, the weekly clean-up from the Braden mine, is being shipped each week through the local banks to the mint at San Francisco. The management of the Braden is not only doing a great deal of improvement and development work on this property, but is showing also that there is a long life for it.

Grants' Pass, June 24.

UTAH

JUAB COUNTY

At the Knight-Christensen mill at Silver City the recovery of copper and gold and silver is 90 and 85% respectively, at a cost of about $2 per ton. The present ore does not contain lead or zinc. N. C. Christensen, who devised the process, is satisfied with results.

SALT LAKE COUNTY

Development amounting to 1400 ft. per month is being accomplished at the Utah Consolidated. Lead ore containing 18 to 20% metal has been opened for 200 ft. on the 700-ft. level transportation adit. It averages 3½ ft. wide. Reserves of lead ore at July 1 about 500 ft. are 10,000 to 12,000 tons, and from 500 to 700 ft., 60,000 to 65,000 tons, a good increase on previous estimates. Work in the copper area is opening more ore. Flotation tests on 1.75% copper ore at the Highland Boy

mine show promising results.——The Ohio mill at Lark treated 74,600 tons of ore in June, a record run. The new crusher and rolls should be ready in a week or so.

SUMMIT COUNTY

The Mines Operating Co.'s plant at Park City, according to Theodore P. Holt, was designed to treat the low-grade filling in old stopes of the Ontario mine. This material assays 6 to 14 oz. silver, 1 to 2 lb. copper, 0.01 to 0.015 oz. gold, and a little lead and zinc. Treatment consists in mixing the crushed ore with coal dust and salt and then roasting in a new type of furnace by combustion of the contained fuel. The roasted ore is leached with an acid salt solution to dissolve the silver, gold, copper, and lead. At present these metals are precipitated together on scrap iron and the product sold to a refinery. The only new feature of importance in this scheme of treatment is the roasting process, which makes possible the chloridizing of ores without any loss of the valuable metals, and at a very low cost.

CANADA

NOVA SCOTIA

The following minerals, all previously unknown to occur in the province, have been identified by Alexander McLeod: magnesite, tourmaline, stannite, allanite, and molybdenite.

ONTARIO

(Special Correspondence.)—The gradual decline of the Cobalt silver-mining industry owing to the exhaustion of some of the leading producing mines is indicated by the closing down of the Temiskaming & Hudson Bay mine and mill, and the slump in La Rose Consolidated, which recently dropped below $1, and is now selling at about 92c. per share. It has been officially announced that the ore reserves of the La Rose are at a low point and that, failing new discoveries, the Company will be wound up. The production of ore has been gradually diminishing since the record year 1909, when it amounted to 6757 tons, the shipments for the present year so far being only about 700 tons. There is a cash surplus on hand of something over $1,000,000 in addition to other realizable assets. The Temiskaming & Hudson Bay has another Cobalt property, which may prove of value in addition to a controlling interest in the Dome Lake of Porcupine. The Nipissing has also apparently passed its zenith. The estimated net production for June was $183,558, as compared with $211,256 in May, and it is stated that the results of development at the 900-ft. level have been disappointing.

Cobalt, July 20.

Under direction of the Department of Mines for Canada, W. H. Boyd, chief topographer of the Geological Survey of the Dominion, and Mr. Dickison have arrived at Sudbury to map the nickel area.

YUKON

The Lone Star quartz mine, at the head of Victoria gulch, a tributary of Bonanza creek, near Dawson, is working steadily, and up to June 30 of this season the mill had crushed 1540 tons of ore, of which 1028 tons was crushed in June.

JAPAN

The Kano copper mine, in the Fukushima prefecture, has proved a disappointment. A company with a capital of 5,000,000 yen was organized seven years ago to work it. The company is in debt 200,000 yen, and but 400 miners (formerly 1200) are employed.

MEXICO

SONORA

There has been further trouble at Cananea, and on July 24 the Veta Grande and Oversight mine shafts of the Cananea Consolidated company were on fire. Damage so far is estimated at $300,000. Rescue appliances were sent from Bisbee, Arizona.

PERSONAL

HARRY J. WOLF was in San Francisco.

WILLIAM HAGUE was in San Francisco.

CHARLES JANIN has arrived from London.

C. W. MERRILL was in the city Wednesday.

SIDNEY JENNINGS was in San Francisco Wednesday.

EDMUND JUESSEN was down from Tonopah for last Sunday.

PHILIP WISEMAN has been in San Francisco returning from Mono lake.

HOYT S. GALE is visiting California, being at present at Sacramento.

PHILIP ARGALL & SONS are examining the Buffalo Boy mine, at Silverton, Colorado.

DONALD F. IRVIN has resigned from the Tigre Mining Co., and has returned to California.

R. H. RICHARDS is visiting California in the course of a general trip through the West.

ELMER E. FICKETT, who has been visiting Western mines, passed through San Francisco this week.

S. H. SHERMAN, superintendent for the Gila Copper Sulphide Co. at Christmas, visited Globe and Miami, recently.

MORTON WEBBER, who was recently engaged in a placer examination in Idaho, has gone to Montana on professional business.

Information regarding the present address of THOMAS SANDERSON PARKINS, formerly of Chatham, Canada, is desired by relatives.

FREDERIC E. CALKINS, recently with the American Smelting & Refining Co., has been made mine inspector by the mining companies at Morenci, Arizona.

R. B. STANFORD sailed from New Orleans on July 23 for Choluteca, Honduras, by way of Puerto Barrios, where he will be engaged in examinations for sixty days.

LORIN KEMP, who for a number of years has been in charge of the cyanide plants of the North Star Mines Co. at Grass Valley, California, has resigned, to accept a position in Chile, South America.

SCHOOLS AND SOCIETIES

THE MINING ENGINEERS' ASSOCIATION has been formed in London, with offices at 18 Eldon street, to assist mining engineers and metallurgists abroad and at home in various ways.

THE ROYAL GEOLOGICAL SOCIETY OF CORNWALL, ENGLAND, held its centennial celebration at Penzance on July 3 and 4. Congratulations were received from all of the principal societies of England. Interesting statistics were given on the tin and copper outputs of the county.

THE CHEMICAL, METALLURGICAL AND MINING SOCIETY OF SOUTH AFRICA met on May 16. Hydraulic classifiers and classification was discussed by G. H. Stanley; charcoal in gold-bearing cyanide solutions by Morris Green; rock temperatures by E. J. Moynihan; dust in mines by B. C. Gullachsen; and soda deposits of Africa by John Watson.

THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS has been formed with offices at Madison, Wisconsin. Officers for 1914 are: president, W. F. MacGregor; first vice-president, J. L. Mowry; second vice-president, W. J. Brandon; chairman of council, A. R. Greig; and secretary-treasurer, F. M. White. The object of the society is to interest men concerned with the application of engineering principles to agriculture.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Stocks and Bonds

SAN FRANCISCO STOCKS AND BONDS

(San Francisco Stock and Bond Exchange.)

July 29

BONDS

Listed.	Bid	Ask	Unlisted.	Bid	Ask
Associated Oil 6s	$ 97½	—	Natomas Consol	—	10
Natomas Con	24½	25	Pac. Port. Cement 6s	100	—
Unlisted.			Santa Cruz Cement 6s	—	88½
General Petroleum 6s	30½	—	Union Oil	86½	87½

STOCKS

Listed.	Bid	Ask	Listed	Bid	Ask
Amalgamated Oil	84½	84½	West Coast. pfd	—	115
Associated Oil	—	38	Unlisted		
Du Pont, pfd	80	84	General Petroleum	2½	—
Giant	80	81	Noble Electric Steel	69c	75c
Pac. Cst. Borax, com	—	70	Pac. Port. Cement	60	70
Sterling O. & D	—	1½	Riverside Cement	—	60
Union Oil	—	67	Santa Cruz Cement	39	—
			Stand. Port. Cement	—	18½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

July 30.

Atlanta	$ .13	Montana-Tonopah	$ .58
Belcher	.45	Nevada Hills	.25
Belmont	5.55	North Star	.20
Con. Virginia	.07	Ophir	.07
Florence	.30	Pittsburg Silver Peak	.23
Goldfield Con	1.40	Round Mountain	.35
Goldfield Oro	.16	Sierra Nevada	.03
Halifax	.30	Tonopah Extension	2.25
Jim Butler	.86	Tonopah Merger	.31
Jumbo Extension	.18	Tonopah of Nevada	7.00
MacNamara	.01	Union	.18
Mexican	.43	Victor	.23
Midway	.15	West End	.03
Mizpah Extension	.25	Yellow Jacket	.25

CALIFORNIA STOCKS

(Latest Quotations.)

	Bid.	Ask		Bid.	Ask.
Argonaut	...	$6.25	Kennedy	$8.00	....
Brunswick Con.	1.50	....	Mountain King	...	0.50
Bunker Hill	1.90		South Eureka	1.50	....
Central Eureka	0.17	0.18			

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

July 30.

	Bid	Ask		Bid	Ask
Allouez	$ 37	38	Nevada Con	$ 10	10¾
Ariz. Commercial	3¼	3¾	North Butte	20	21
Butte & Superior	24½	25	Old Dominion	45½	46
Calumet & Arizona	56	57	Osceola	—	69
Calumet & Hecla	390	395	Quincy	52	54
Copper Range	29	30	Shannon	4½	5
East Butte	8½	9	Superior & Boston	1½	1⅝
Franklin	4¼	4½	Tamarack	29	30
Granby	66	67	U. S. Smelting, com	31½	32
Greene Cananea	28	28½	Utah Con	9¾	10
Isle Royale	17	18	Winona	2¼	—
Mass Copper	3¾	4¼	Wolverine	—	37
Mohawk	38	40			

NEW YORK STOCK EXCHANGE

(By courtesy of J. C. Wilson, Mills Building.)

July 30.

	Bid	Ask		Bid	Ask
Amalgamated	$ 49¾	49½	Miami	$ 17½	18
Anaconda	25	25¼	Nevada Con	10¼	10½
A. S. & R., com	53	54	Quicksilver, com	1	1½
Calif. Pet., com	16¼	17	Ray Con	13¾	13½
Chino	31¼	32½	Tenn. Copper	24¾	25
Guggenheim Ex	40	40½	U. S. Steel, pfd	106½	07
Inspiration	14¼	14¾	U. S. Steel, com	51⅝	51¾
Mexican Pet., com	52½	53¼	Utah Copper	46	46½

NEW YORK CURB QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

July 30

	Bid.	Ask.		Bid	Ask
Braden Copper	6¼	6⅝	McKinley-Dar	18	.35
B. C. Copper	1⅝	1⅞	Mines Co. Am.	2¾	3
Con. Cop. Mines	1⅝	1⅞	Nipissing	5	5¼
Davis-Daly	½	⅝	Ohio Copper	¼	⅜
First National	1⅝	1⅞	Stand. Oil of Cal.	270	275
Hollinger	18	18½	Tri Bullion	⅛	¼
Iron Blossom	1¼	1½	Tuolumne	¼	½
Kerr Lake	5	5½	United Cop. com.	⅛	¼
La Rose	⅝	1	Yukon Gold	2¼	2⅝
Mason Valley	2	2½			

Metal Prices

LOCAL METAL PRICES

San Francisco, July 30.

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore producer could expect to realize. Ore contracts usually call for settlement on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

Antimony	9 — 9¾c
Electrolytic copper	15 —15⅛c
Pig Lead	4.15— 5.10
Quicksilver (flask)	$37.50
Tin	35 —36½
Spelter	6½— 6¾c

Zinc dust, 100 kg. zinc-lined cases, 7½ to 8c. per pound.

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, July 30.—All metals are quiet and weak, copper showing a decided slump. Gold amounting to $14,750,000 has been engaged for shipment to Europe, totaling $27,850,000 since July 23, and over $110,000,000 since the beginning of the year. A large turnover of stocks and bonds is being made on the Stock Exchange. European exchanges have been temporarily closed, but London is still open. Bar silver is weak in London at 24d. (48c.). Lead and spelter at St. Louis are 3.75c. and 4.90 to 4.95c. respectively. Greene Consolidated Copper Co. has passed its dividend.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.		Average week ending	
July 23	54 12	June 17	56.56
" 24	53.87	" 24	56.24
" 25	53.12	July 1	56.58
" 26 Sunday		" 8	56.42
" 27	52.62	" 15	55.60
" 28	53.37	" 22	54.14
" 29		" 29	53.42

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	....
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per pound more. Prices are in cents per pound.

Date.		Average week ending	
July 23	13.10	June 17	13.65
" 24	13.05	" 24	13.55
" 25	12.85	July 1	13.28
" 26 Sunday		" 8	13.41
" 27	12.80	" 15	13.47
" 28	12.75	" 22	13.25
" 29	12.70	" 29	12.87

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	.. .
Feb.	14.93	14.46	Aug.	15.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
July 23	3.85	June 17	3.90
" 24	3.85	" 24	3.90
" 25	3.85	July 1	3.90
" 26 Sunday		" 8	3.90
" 27	3.85	" 15	3.90
" 28	3.85	" 22	3.90
" 29	3.85	" 29	3.85

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	....
Feb.	4.33	4.02	Aug.	4.60	....
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
July 2	38.50	July 16	37.50
" 9	37.50	" 23	37.50
		" 30	37.50

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	....
Feb.	41.00	39.00	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
July 23	4.75	June 17	4.85
" 24	4.75	" 24	4.85
" 25	4.75	July 1	4.75
" 26 Sunday		" 8	4.75
" 27	4.75	" 15	4.75
" 28	4.75	" 22	4.75
" 29	4.75	" 29	4.75

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	....
Feb.	6.13	5.22	Aug.	5.51	....
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	. . .

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per pound higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	....
Feb.	49.07	39.76	Aug.	41.75	....
Mch.	46.95	38.10	Sept.	42.45	....
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

The gold production of Australia and New Zealand for the first five months of the year is as follows:

State.	1913. Fine ounces.	1914. Fine ounces.
Victoria	170,116	171,951
New South Wales	57,849	50,244
Queensland	111,662	96,767
Western Australia	524,883	523,160
*South Australia	3,500	3,500
*Tasmania	15,000	15,000
Commonwealth	883,010	860,622
New Zealand	140,953	130,990
Total	1,023,993	991,612

*Approximate.

New York Metal Review

Though the domestic consumption of copper continues far under normal, as statistics show and the market almost daily demonstrates, there are some bright spots from which encouragement may be drawn. July set in with heavy buying of copper for export. Prices of finished products have gone no lower. Lead has been steady, partly because of support from abroad, where scarcity and high prices prevailed. Spelter has held its own, and galvanizers have taken good-sized quantities. Tin, as is often the case, has been erratic, but transactions have been numerous. Antimony was dull and uninteresting. Aluminum saw some activity. In various lines of trade there are indications of a betterment in demand, which, while it is irregular, is believed to be the forerunner of a gradual and natural improvement in trade conditions. A revival in business, however, cannot be as sudden as some prophets would have the industrial world believe, and many of the printed reports of returning prosperity have little basis when analyzed. But that there is real improvement here and there, and a better feeling nearly everywhere, cannot be denied, despite inspired reports which are given publicity for their 'psychological effect.'

COPPER

Two features stood out in the copper situation of early July. One was extremely heavy buying for export in the first week, and the other was the disappointing showing of the June statement of the Copper Producers' Association. This came on the heels of disappointment that American consumers did not take hold as the foreign buyers did. They did some buying, but it was conservative. In this connection it is pointed out that Europe usually takes advantage of low prices, while domestic consumers must be stimulated by a rising market and they do not ordinarily buy so advantageously as do the foreigners. In the movement referred to, Europe took 40,000,000 to 50,000,000 lb., and most of it was obtained at 13.37½ to 13.50c., cash, New York. After Europe ceased buying, the price went up steadily until by July 7 the quotation for electrolytic was 13.87½c., 30 days, delivered, or 13.75c. cash, New York; but there was not much doing and such activity as there was died out when, on July 8, the Producers' statement showed an increase in stock of 21,768,022 lb. The poor showing was entirely due to the lessened domestic deliveries, which in June were but 46,227,353 lb., or 9,364,817 lb. less than in May. It is estimated that home consumption is about one-third under normal, and there can be no betterment until there is a pronounced increase in melting by the brass and copper mills. Consumers must first find justification for departing from their policy of not stocking up beyond actual current requirements. When general business improves, the meagre state of stock in manufacturers' hands will mean an unusual demand and great strength to the market. By July 10 prices were on the down grade again, and 13.50c. cash, New York, and probably lower, could be done by July 15 and for a week thereafter. The quotation July 24 was 13.37½c. cash, New York. The market in the third week of the month (July 15 to 21) was in a state of stagnation, Europe showing no more interest than domestic consumers. Following electrolytic, prime Lake went to 14c. cash, from 13.87½c. in the first week, but by July 15 it was down to 13.75c. for prime and less for inferior grades. Exports in June totaled 35,182 tons, and those of July up to the 24th amounted to 28,175 tons. The Waterbury average for June was 14.37½ cents.

LEAD

The New York quotation was steady at 3.90c. from July 1 to 24. When the month opened, the St. Louis price was 3.77½c., but in a couple of days it settled to 3.75c. and remained there, this price being one with New York at 3.90c.,

which enables independent producers to undersell the large interest at all points except New York. Perhaps prices would have gone lower were it not that a scarcity prevailed in Europe with correspondingly good prices there. The quotation in London, July 10, was £19 to £20 for English lead, with the tone strong. Exports in July were good. Late in July the New York quotation was unchanged, but there was possibility of concessions from the St. Louis price, the New York market still being supported by London. The Bureau of Foreign and Domestic Commerce, Department of Commerce, reports the total amount of lead remaining in warehouses May 30, 1914, at 13,339,418 pounds.

SPELTER

A better feeling was created at the outset of July by the averting of trouble over wages between the sheet mills and their employees. The New York price was fairly steady at about 5c. from July 1 to 24, although the St. Louis price, near the third week, was relatively five points lower, 4.80c. having been quoted. At this latter basis some good-sized orders were reported to have been taken, with smaller ones at 4.82½c., most of the demand coming from the galvanizers. Business in sheets is better. The brass mills showed little interest. A rumor afloat, but not generally credited, was that some of the smelters were unwilling to give their production figures for the first half of 1914 to the United States Geological Survey, and that mid-year statistics might be delayed. It is no secret that producers' stocks are extremely large.

TIN

The market was erratic, at times feverish, in July, but some good business was done. In the first three days there was good action in both prompt and future deliveries, and the market assumed more optimistic tone than had prevailed in weeks. Under this stimulus, London advanced £4 on July 6. The trend of prices is indicated by the following figures at which sales were made: July 1, 31.10c.; July 6, 32.20c.; July 9, 32.55c.; July 14, 31.50c.; July 18, 32c.; July 21, 31.60c.; and July 24, 31.15c. Beginning about July 8, the market was particularly lively, with days of good buying interspersed with hesitancy on the part of buyers or unwillingness to sell on the part of operators. On July 14, London declined £3, which was attributed to the report of the Interstate Commerce Commission on the New York, New Haven & Hartford railroad and illustrates the sensitiveness of the tin market. Much of the buying of the second and third weeks of the month was speculative, dealers figuring as purchasers in many of the transactions. The arrivals in July up to the 24th were 3144 tons, and there was afloat 2650 tons. The total visible supply June 30, 1914, was 16,027 tons, as against 11,101 tons June 30, 1913. June deliveries totaled 3650 tons, and the total deliveries for six months of this year showed a decrease of 600 tons, as compared with the same time last year. Government statistics show that the imports of tin at Pacific ports in May (by districts) were as follows: Oregon, 31,494 lb.; San Francisco, 67,233 lb.; and Washington, 88,745 pounds.

ANTIMONY

This market was uninteresting and neglected. Quotations throughout the month were about 7c. for Cookson's, 6.75c. for Hallett's, and 5.40c. to 6c. for other grades.

ALUMINUM

About the middle of July some good-sized inquiries were reported which caused European makers to offer low prices, some sellers being willing to go under 17.50c., duty paid. The quotation for domestic metal, 98 to 99% pure, on June 15 was 17.50 to 17.75c. for prompt and future, but by July 20 futures had declined to 17.37½ to 17.62½c. Average prices of domestic aluminum by months were as follows: January, 18.86c.; February, 18.80½c.; March, 18.30c.; April, 18.08c.; May, 17.93c.; and June, 17.82c. per pound.

Current Prices for Oils and Candles

(Corrected monthly by Standard Oil Co. California.)

All prices are f.o.b. San Francisco except where otherwise specified and are subject to change without notice.

Granite Mining Candles	Per set, cents	Granite Mining Candles	Per set, cents
6s-12 oz.-40s	8¾	6s-14 oz.-20s	9¼
6s-12 oz.-20s	9	6s-16 oz.-40s	10
6s-14 oz.-40s	9¼	6s-16 oz.-20s	10¼

Extra hard 1c. per set higher than the above.

The following prices are for oils (Calol) in wood barrels, cases (2-5 gal.) 3c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Compressor oil	40	Light gas engine oil	28
Amber gas engine oil	40	Red compressor oil	26
Castor machine oil	20	Red engine oil	17
Dynamo and motor oil	24	Turbine oil	35
Engine oil	24	Turbine oil, heavy	35
Gas engine oil	26	Diesel engine oil	40
Heavy gas engine oil	45	Cylinder oil	37
Heavy red engine oil	19	High-pressure cylinder oil	50
Heavy red journal oil	21	Low-pressure cylinder oil	37
Ice machine oil	28	Valve oil	50

The following prices are for oils in iron barrels, cases (2-5 gal.) 7c. per gallon higher, except on Eocene, which is 8c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Pearl oil	9	Red Crown gasoline	14½
Headlight oil	10	Engine distillate	7
Eocene oil	11	Aroturps	23

	Per bbl
Star fuel oil, f.o.b. Richmond Refinery	$1.00

	Per ton.
Petrolastic cement X	$12.00
Petrolastic cement XX	11.00
Asphaltum	$5.50 to 12.50

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, per ton	*$18.00	$20.00
Arsenic, white, refined, per lb.	0.03	0.04
Arsenic, red, refined, per lb.	0.08	0.08½
Asbestos, chrysotile	100.00	350.00
Asbestos, amphibole	5.00	10.00
Asphaltum, refined, per ton	11.50	20.00
Barium chloride, commercial, per ton	40.00	42.50
Barium sulphate (barytes), prepared, per ton	20.00	30.00
Bismuth ore, 15%, per ton	*250.00	upward
China clay, English, levigated, per ton	15.00	20.00
Chrome ore, according to quality, per ton	10.00	12.50
Cobalt metal, refined, f. o. b. London, per lb.	2.50	....
Coke, foundry, per 2240 lb.	12.00	15.00
Diamonds (according to size and quality):		
Borts, per carat	2.00	15.00
Carbons, per carat	55.00	80.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Silica, per M	50.00	55.00
Snowball, per M	40.00	45.00
Flint pebbles for tube-mills, Danish, per 2240 lb.	21.50	22.50
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	40.00
Graphite:		
Amorphous, per lb.	0.01½	0.02½
Crystalline, per lb.	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Iridium	55.00	....
Magnesite, crude, per ton	5.00	7.50
Magnesite, dead calcined, per ton	20.00	25.00
Manganese ore, oxide, crude, per ton	10.00	15.00

Manganese, prepared, according to quality, per ton	30.00	70.00
Mica, according to size and quality, per lb.	0.05	1.00
Molybdenite, 95% MoS_2, per ton	750.00	1000.00
Monazite sand (5% thoria), per ton	150.00	200.00
Nickel metal, refined, per lb.	0.45	0.60
Ochre, extra strength, levigated, per 100 lb.	1.60	2.00
Osmiridium, per oz.	25.00	
Platinum, native, crude, per oz.	30.00	45.00
Silex lining for tube-mills, per 2240 lb.	35.00	45.00
Sulphur, crude, per ton	15.00	25.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	425.00	450.00
Tungsten ore, 65%	400.00	425.00
Uranium ore, 10% min.	25.00 per unit	
Vanadium ore, 15% V_2O_5, per ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are f.o.b. San Francisco and subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, per 100 lb.	$ 0.80	$ 1.10
Acid, sulphuric, com'l, 66°, carboy, per 100 lb.	1.25	2.00
Acid, sulphuric, C. P., 9-lb. bottle, bbl., per lb.	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, per lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, per 100 lb.	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., per lb.	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, per lb.	0.10½	0.15
Acid, nitric, com'l, carboy, per 100 lb.	5.50	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., per lb.	0.16	0.22
Acid, nitric, C. P., bulk, carboy, per lb*	0.12½	0.15
Argols, ground, bbl., per lb.	0.10	0.20
Borax, cryst. and conc., bags, per 100 lb.	3.00	4.35
Borax, powdered, bbl., per 100 lb.	3.38	4.50
Borax glass, gd. 30 mesh, cases, tin lined, per 100 lb.	10.50	14.00
Bone ash, 60 to 80 mesh, bbl., per 100 lb.	0.50	6.50
Bromine, 1-lb. bottle, per lb.	0.55	0.65
Clay, domestic fire, sack, per 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, per lb.	0.18	0.23
Cyanide, 98 to 100%, 200-lb. case, per lb.	0.18	0.23
Cyanide, 129%, 100-lb. case, per lb.	0.22	0.25½
Cyanide, 129%, 200-lb. case, per lb.	0.22	0.25
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white broken, casks, per 100 lb.	10.50	10.75
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white, crystals, per 100 lb.	12.50	13.25
Lead, C. P., test., gran., per 100 lb.	13.00	15.00
Lead, C. P., sheet, per 100 lb.	15.00	18.00
Litharge, C. P., silver free, per 100 lb.	11.50	13.50
Litharge, com'l, per 100 lb.	8.00	9.50
Manganese ox., blk., dom. in bags, per ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, per ton (85% MnO_2—¾% Fe)	35.00	50.00
Nitre, double ref'd, small cryst., bbl., per 100 lb.	7.00	8.00
Nitre, double ref'd, granular, bbl., per 100 lb.	6.50	7.50
Nitre, double ref'd, powdered, bbl., per 100 lb.	7.25	8.00
Potassium bicarbonate, cryst., per 100 lb.	12.00	15.00
Potassium carbonate, calcined, per 100 lb.	7.50	9.00
Potassium permanganate, drum, per lb.	0.10¾	0.13
Silica, powdered, bags, per lb.	0.03	0.05
	Min.	Max.
Soda, carbonate (ash), bbl., per 100 lb.	1.45	1.75
Soda, bicarbonate, bbl., per 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., per 100 lb.	2.75	3.25
Soda, caustic, solid, 98%, drums, per 100 lb.	2.50	2.75
Zinc shavings, 850 fine, bbl., per 100 lb.	12.00	13.00
Zinc sheet, No. 9—18 by 84, drum, per 100 lb.	10.20	11.00

*Extra charge for packing nitric acid for shipment to conform to regulations.

The Messina copper mine output in May was as follows: ore milled, in 25 days, 6377 tons; concentrate produced, 1046 tons; average copper, 39%; reverberatories smelted 416 tons of middling producing 80 tons of 54% matte, total output 1126 tons averaging 40% copper. Development in the mine was satisfactory.

MINERAL STATISTICS

Coal Production of the United States

The production of coal in the United States has again broken all previous records, the output for 1913 being 570,048,125 short tons, which is considerably more than double the production of 1900 and more than eight times the production of 1880; according to Edward W. Parker, coal statistician. The value of the coal mined in 1913 is given as $760,488,785. Compared with the previous year the output for 1913 shows an increase of 35,581,545 tons, or nearly 7%. The increased activity indicated by these figures was well distributed throughout the 29 coal-producing states, 23 of which showed increases and only 6 decreased production, the decrease in one of these, Colorado, being due solely to labor trouble. Of those showing increase, 12 made record yields, and Pennsylvania, the leading coal state, broke records in both bituminous and anthracite production. The states which broke all former records in coal production were Alabama, Illinois, Kentucky, Montana, New Mexico, Ohio, Oklahoma, Pennsylvania, Texas, Utah, Virginia, and West Virginia. The largest increase in the production of bituminous coal was in Pennsylvania, where 11,915,729 tons was added to the output of 1912. West Virginia showed the second largest gain, 4,522,295 tons, and Kentucky the third largest gain, 3,126,079 tons, which was also the largest percentage of increase, amounting to 19%, of all the important coal-producing states, Indiana was fourth, Illinois fifth, Ohio sixth, and Alabama seventh. While the total increase was very large as figured in tons, the percentage is what may be considered normal and indicative of healthy industrial activity throughout the country.

Coal mining, like all other industries in the Ohio Valley states, was seriously interfered with by the great floods during the spring of 1913, and Mr. Parker estimates that from 5,000,000 to 10,000,000 tons of coal would have been added to the year's output but for this disaster. With no violent fluctuations in the demand by blast-furnaces, steel works, and other manufacturing industries, the demand for coal for those purposes shows only a normal increase. The continued decrease in the use of fuel oil in the Mid-Continent oilfield and the strike in the Colorado coal mines resulted in an increased output of coal in the Central and Southwestern states. With a few exceptions, notably in Illinois, Indiana, and Oklahoma, prices ranged higher than in former normal years, so that from the producers' standpoint the conditions in 1913 were fairly satisfactory.

The development of our coal-mining industry with reference to population presents some interesting comparisons. In 1850 the coal output was 7,018,181 tons, or 0.3 ton for each of the 23,191,876 inhabitants; in 1880 the population had increased to about 50,000,000 and the production of coal to about 71,000,000 tons; an average of 1.42 tons per capita. At the close of the nineteenth century the population was 76,303,387, an increase of a little over 50% as compared with 1880, while the production of coal had increased nearly 400% in the same period and averaged 3.53 tons for each person. In 1913 the per capita production was figured at 5.85 tons.

The coal mines of the country gave employment in 1913 to an army of 747,644 men. The average number of days worked by the bituminous miners in 1913 was 232, against 223 in 1912, while the average time made in the anthracite mines in 1913 was the best on record—257 days for each man. The average production per miner in the bituminous mines increased from 820 tons in 1912 to 838 tons in 1913, both being record-breaking averages, while anthracite miners increased their average from 485 tons in 1912 to 532 tons in 1913.

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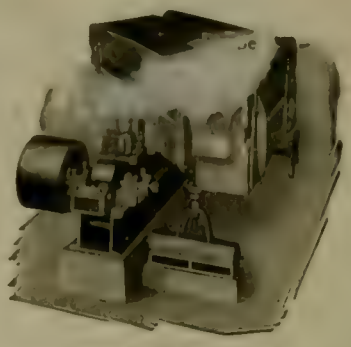

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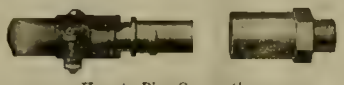

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MEMBERS of the American Institute of Mining Engineers are anticipating a pleasant visit to Salt Lake City next week and their hosts have made preparations that fully assure realization of these anticipations. Excellent provision has been made for both the technical and social phases of the meeting.

A SUNDAY holiday for the employees of the Utah Copper Company went into effect the first of August and work at both the mines and mills of the Company will be completely suspended on Sunday in the future. While this order means that about 100,000 tons less of ore per month will be handled and the output of copper will be decreased by 1,500,000 pounds per month, the 4000 employees will be glad for the opportunity to take an occasional 'dip' in Salt Lake or sit on the bleachers and root for the home team.

RESIDENTS of Marysville will receive about $210,000 from the sale of the gold-dredging lands on the Yuba river adjoining the Hammond property. The property purchased by the Guggenheim interests includes the Sunset claim of 128 acres, the Gilt Edge of 107 acres, and the Archimedes claim. The property of the Mammoth Gold Dredging Company, which amounts to 190 acres, and that of the Marysville & Nevada Power & Water Company, which is adjacent to the claims purchased by the Guggenheim interests, are also pending sale. The gold-dredging industry in California has not become so entirely a matter of history as many believe.

OPENING of the Cape Cod canal on July 29 marks the completion of an important undertaking, and coastwise shipping along the Atlantic will be greatly benefited. This waterway connecting Buzzards bay with Massachusetts bay will enable vessels to avoid the dangerous passage around Cape Cod and reduce the shipping distance between ports north and south of it by 70 miles. The canal is 13 miles long and 100 feet wide at the bottom, with 300 to 400 feet at the passing points. The depth is 25 feet at low tide. There is an appreciable current, due to the difference in tide in Massachusetts and Buzzards bays. It is estimated that between twenty-five and thirty million tons of freight and about 500,000 persons are transported over the Cape Cod route annually. It is recorded that during the past 60 years more than 2000 vessels have been wrecked while making the passage around the cape and nearly 1000 lives have been lost. The $12,000,000 which has been spent in the construction of this canal has been to good purpose and Mr. August Belmont and his company are to be congratulated upon the successful completion of this work.

JAPANESE advices are to the effect that a large body of 'black ore' has been developed at the Hanaoka mine owned by the Kobayashi interests, as a result of drilling. The orebody is reported to be 4000 feet long and similar to that which, at the neighboring Kosaka mine, long yielded so plentifully. A small smelting plant is to be built, but in the main the ore will be handled at Kosaka where the metallurgists first learned to smelt this difficult ore. With 30 per cent barium sulphate, nearly 10 per cent of zinc, and a trifle over 2 per cent each of lead and copper, it was only by mixing ores and by large scale operations that the Fujita metallurgists met the situation. Whether the Hanaoka will develop into a mine as big as the Kosaka, long the largest in the Far East, cannot yet be said, but the find proves the old rule that orebodies do not occur singly, and we may hope that the mantle of Kosaka has fallen on Hanaoka.

MINING LAW REVISION AGAIN

Legislation regarding general revision of the mining laws is halted at Washington though our correspondent notes that remedial acts covering the present difficulties in the oilfields and existing locations in phosphate lands are at least in position for prompt passage. There should be no delay. In both the oil and phosphate regions grave injustice is being done and in the case of the oil, serious injury to public as well as private interests may well flow from continuance of present conditions. The remedial acts have been carefully drawn, amply considered, and should be promptly passed. This, however, would not relieve the situation materially as regards the much needed general revision. In regard to this, matters remain much as they have been for the last two months except that it has become clearer that the administration leasing bill covering coal, oil, and phosphate lands, is unlikely to be passed at this session. There can, therefore, be no sound reason for excluding consideration of the laws governing these lands from among those to be considered by the prosposed com-

mission for studying the whole matter. So long as there was serious expectation of Congress passing the leasing bill in its present form, it was natural to limit the authority of the commission to the consideration of the laws governing metal lands. If congressional opinion was already determined, a report from the proposed commission would not be likely to change it. In fact, however, it appears that opinion is divided, and, this being so, a careful study by the commission should be helpful.

There are many advantages in making the duties of the commission comprehensive. The mining men are tired of piece-meal revision, of patches placed upon patches till the original cloth is all but lost to view. If we are to change our system let us be frank about it —and let it be a consistent change. Any forcible injection of a new and alien method of dealing with one class of mineral lands, injected into the middle of our present system of public land laws, cannot but produce friction and injustice. It must not be forgotten that the body of the law is more than a mere paragraph or two on the statute books and that changes must be made with an eye to the whole. The mining men have many changes that they wish considered, but they want them really considered; there is no demand for a sudden and radical ripping up of the present system to eradicate parts without regard to the whole. There is widespread dissatisfaction, for example, with the apex law, but there is equally widespread, even if less often expressed, recognition that extralateral rights in future claims cannot be abolished without compensation, such as enlargement of the area of the claim. The danger in any revision is that, attack being concentrated on specific abuses, no adequate account will be taken of the relations to the whole body of the law of the right which it is proposed to abolish. The mining men see this, and it is with this in view that they are urging a commission with broad powers to clear the way for congressional action. Final authority would rest with Congress and the commission would be effective or ineffective according as it was careful and sane in its recommendations or the reverse. The mining laws are sure to be amended; the practical matter is to secure a well considered change rather than an ill-balanced one.

One minor difficulty in the road of the proposed legislation is a difference of opinion at Washington as to whether the members of the proposed commission should serve without pay or should receive moderate compensation for their time. To our way of thinking, this is unimportant. Excellent men will be available under either condition. In England it is an honor to serve upon a Royal Commission without pay, and in the United States there are many big men, men who know and have the interest of the industry and the country at heart, who could and would give the time necessary to the work. At the same time there is no good reason why the commissioners should not receive pay, such as it has been customary to give to those serving on other and similar investigations. The amount involved is insignificant compared to the importance of the subject and to the sums appropriated by every Congress for all sorts of projects. Whether the work cost $25,000 or $50,000 is of small concern, provided it be well done. The important thing is that the commission be authorized promptly, that it be adequately financed, and that it be truly representative.

THE EUROPEAN CRISIS

Not many weeks ago the warships of several European nations steamed into the Baltic to take part in the festivities attendant on the opening of the Kaiser Wilhelm canal. A cordial exchange of courtesies took place at Kiel and the ships departed with the bonds of friendship apparently strengthened and the possibility of international complications a trifle more remote. Today the great powers of Europe are at war. An analysis of the situation would be most tedious, as the factors which go to make it up are more deep seated than the assassination of Austria's crown prince and its immediate results; theories are numerous regarding it, but none seem satisfying and commensurable with the disaster, for such it is, which has befallen Europe.

Forty-three years ago on March 1, 1871, the German army, after a five months' seige of Paris, marched through the Champs Elysees and took possession of the French capital. The French empire had fallen, Napoleon III was a prisoner in Germany, and the National Assembly had fled to Versailles. Terms of peace were imposed which forced France to pay $1,000,000,000 indemnity and transferred the provinces of Alsace and Lorraine to German sovereignty. While the disaster to France was gigantic, the Third Republic was a magnificent fact and national progress was quickly restored. For nearly a half century France has made but little secret of her desire to be avenged and other nations have become sympathetic. The result has been a network of alliances and treaties so interwoven that once the delicate fabric was disturbed, the much prepared for war became a reality. Whether it is the last stand of the imperialist element in an effort to unite the many internal factions in a common cause, or a desire for power and governmental aggrandizement; whether it is an outlet to the Mediterranean, or a trial of strength; whether it is the clashing ambitions of the Romanoff with the Hohenzollern and the Hapsburg, or the conflicting aspirations of the Slav and the Teuton; whether it is that the Slavs in central, eastern, and southeastern Europe wish to unite in racial fellowship and the Teutons would block the way—all these are conjectures, but no one can say certainly.

While the reasons for the struggle may seem theoretical to Americans, they are no doubt real to Europeans, and we can only stand aside and hope that the present conflict will be brief and final, and that when the gonfalon of war is lowered it will be to mark the beginning of a lasting peace.

Stock markets continue closed, a wise and necessary

precaution to prevent the wholesale and ill-advised liquidation of sound stocks. This suspension in trading will give shareholders time in which to consider the situation carefully and prevent the unwarranted sale of sound securities. It will conserve present stock values and serve to strengthen the financial situation. It is believed that the suspension of the exchanges will be brief and trading will be resumed as soon as the initial period of uncertainty is past. Holders of mining shares should realize that the depredations of war have no effect upon ore reserves and while markets may be curbed for the time being, the earning power of the mines remain intact, although the production may decline temporarily.

THE FUTURE OF COPPER PRICES

Every owner and operator of copper mines which make only a small margin of profit over working cost has a life and death interest in the average price of copper during the next decade. Will it remain close to the average of the past decade, will it advance, or will it decline? If soothsayers were taken seriously nowadays, they could doubtless do a thriving business. But prognostication is now recognized as a difficult profession. A statement of the principal factors involved, without attempting to draw a conclusion, is, however, within the bounds of caution, and may serve as a basis for individual inferences.

The present output of copper in this country is, roughly, one hundred million pounds per month. The rest of the world combined produces about eight-tenths as much. The cost of production of the leading American producers, in cents per pound, as computed for 1913, was as follows: Nevada Consolidated, 9.51; Utah Copper, 9.25; Miami, 7.9; Anaconda, 12.2 (less gold and silver). These and other companies which it would be tedious to mention individually, are making good operating profits. Many other companies with higher operating costs are either making small profits or struggling to keep going in the hope of higher prices. The consumption of copper has shown a steady growth for many years, and operators hope that consumption will keep far enough ahead of production to maintain prices at or above their present level. But there are new factors in the situation, the influence of which cannot be accurately gauged. Mr. Robert Williams recently predicted that in 1916 the Katanga mines of South Africa will be landing 7,000,000 pounds of copper per month in Europe at a cost of 6½ cents per pound. At the same time the mines at Chuquicamata in Chile will be landing 10,000,000 to 12,000,000 pounds per month in Europe at a cost of 6 cents per pound, according to the estimates of Mr. Pope Yeatman, with the prospect of rapid expansion to three times that monthly output. The two mines alone will add over 10 per cent to the world's output of copper. Other smaller new mines are coming into production, and nearly all the large mines in this country are planning to make a larger output by the use of methods which will recover part of the copper now lost in tailing. Copper consumption in 1913 was roughly 1½ that in 1903, corresponding to an average rate of increase of 6 to 7 per cent per year. It is thus seen that there is room for difference of opinion as to whether production is likely to exceed consumption in the near future, according to the amount of confidence placed in the increases in output which are promised. The cost of production has no direct effect on consumption, but a low cost will increase production, which will tend to decrease the price of copper and so increase consumption. Lower selling prices for copper will cause some producers to cease work, which will tend to decrease consumption and so steady the price, through maintaining the nice adjustment of supply and demand. The point is, however, that the low cost producers are the large companies, and when these increase their output beyond what the market will bear without showing a decrease in copper prices, many smaller organizations will have to go to the wall; the survival of the fittest coinciding in this case with the survival of the biggest.

Other even less definite factors are not without strong influence. The output of aluminum is being greatly increased, and it is known that aluminum can be employed as a substitute for copper in many ways. Whether it will be thus employed or will find new uses of its own is hard to foretell. Most difficult of all to foresee is the influence of present political conditions in Europe. The great war now being waged can hardly fail to extinguish colossal amounts of capital and credit and put the whole world on a new financial footing. One reason for the present business depression is that people the world over have been decreasing their expenditures. The consumption of food by hordes of men who are productive of nothing but death and destruction, and the capital consumed in the destruction of property and the conduct of military operations, is likely to send the cost of food soaring and the sales of merchandise tobogganing. If the war continues long the people of Europe can hardly escape a period of privation which has not been equaled in this century and the effects would inevitably be felt on this side of the ocean as well. All in all, it is hard to see how the consumption of copper during the next decade can maintain enough of a lead over the expected increases of output to cause any advance in the average price of the metal. Indeed it is much more likely that production will outstrip the consumption, and in that case the selling price will not greatly exceed the production cost of the major portion of the supply. What that will be cannot be foreseen, but it is not without the bounds of possibility that in 1925 the average price of copper may be 10 or 12 cents per pound. Even if this possibility should eventuate in fact, we do not expect to see disaster overtaking the copper mining industry. The industry has continued to increase and prosper through many periods of a sharp decrease in the selling price of copper, and it may be quite confidently predicted that it can serenely survive another, in case it should materialize.

GENERAL VIEW OF COLLINSVILLE

Collinsville Smelter of the Bartlesville Company

By E. H. LESLIE

The smelter of the Bartlesville Zinc Co., which is controlled by the American Metal Co. and is situated at Collinsville, Oklahoma, besides being one of the most modern American natural-gas smelters, is the largest zinc smelter in the United States. The smelter site adjoins the right-of-way of the Santa Fe lines and is one-half mile south of the town of Collinsville, Oklahoma. While metallurgically the plant conforms with the general practice throughout the natural-gas belt, the mechanical equipment and scope of operations marks this as one of the foremost of the natural-gas smelters.

The buildings and equipment are characterized by an air of permanency in construction which contrasts strongly with the temporary look of the great majority of natural-gas smelters. Improved mechanical devices, an improved type of construction of the cellar distillation furnace, and a turbine power-plant, are some of the features which evidence a carefully engineered plant and would augur that it will be one of the last gas smelters to follow in the footsteps of those of Iola, Kansas, other conditions being equal.

The smelter site is ideal for the economic smelting and handling of smelter products. The topography is level, with a depression toward the south and at the rear of the furnaces, which affords dumping space for retort residues for years to come and also furnishes ground well adapted to the forming of roasting piles for the clinkering of retort residues from the Butte ores which are treated at this plant. The buildings are of frame and corrugated-iron structure, the general nature of which will be seen in the accompanying halftones. Turn-outs from the main tracks have been laid into the smelter grounds whereby standard-gage cars deliver the concentrate and smelter supplies and remove the smelter products.

Concentrate Treated

The concentrate, which is at the present time being treated, is derived largely from the mines of Butte, Montana, where it is obtained by a flotation process. The well known Joplin 'jack' together with other sulphide and carbonate concentrates from Colorado, Utah, California, and New Mexico are also treated. The different lots of concentrate as received at the plant are stored in separate bins provided for this purpose in the orehouse. The carbonate concentrate, which is derived largely from the mines of Colorado and New Mexico, upon arrival at the smelter is crushed in one of two crushing units, one of which is a Jeffrey hammer crusher and the other a jaw crusher. From the jaw-crusher unit the product is conducted to a trommel screen, the oversize from which is returned to a set of rolls. The combined product from this carbonate-crushing plant is elevated by a bucket-elevator to a belt-conveyor and thence taken to the carbonate storage bins.

The moisture contained in the Butte ores varies from 15 to 20% and is reduced in the dryers to from 4½ to 5% before being roasted. The Butte concentrate is drawn from the storage bins into cars and removed by hand to the dryer room, where it is dumped into the foot of an elevator which raises it to the feed hopper of the dryers. There are two circular dryers, each operated by a 40-hp. Westinghouse motor, and one large beehive dryer in the drying plant equipment. Circular

PLANT OF THE BARTLESVILLE ZINC COMPANY.

type dryers, which were developed in smelters at Iola, Kansas, have come to be standard equipment in the natural-gas smelting belt. The construction of these dryers is simple and their operation efficient. The hearth consists of a circular iron plate, about 12 ft. in diameter, which is heated with the natural gas from underneath. The concentrate is fed into the dryer through a hopper at the centre and moved over the plate to the periphery, by a set of revolving rabbles mounted on radiating arms, where it is discharged. In the ordinary type of circular dryer the hearth is covered with sheet iron, while in the beehive dryer the hearth is covered with a beehive-shaped brickwork. While the relative efficiency of these furnaces is doubtful, it would seem from a thermal standpoint that the beehive dryer presented points of vantage. The losses due to dust are inappreciable. The concentrate as discharged from the dryers is elevated to a 2-mesh screen, and the oversize is returned to a set of 24-in. rolls for re-crushing. Crushing after drying has come to be standard practice through the district. The dried concentrate, which passes two mesh, is then taken by means of a belt-conveyor to the circular steel feed-bins, which are superimposed and situated at the feed ends of the roasting kilns. These storage bins for the dried concentrate are 10 ft. diameter and 15 ft. high, and will store about 50 tons of concentrate each.

Roasting Furnaces

The roasting plant consists of six modified Cappeau furnaces. These furnaces are of the reverberatory type and are 175 ft. long. The hearth is 13 ft. between walls, and the furnaces have a capacity of from 25 to 30 tons per day. The Cappeau furnace is of the general Ropp type, from which the Cappeau and its modifications have sprung. The hearths are supported by columns to permit of the circulation of air underneath and a slotted opening in the centre of the hearth passing through the furnace allows the rabble arm, which is supported on a truck moving under the furnace, to pass through the furnace. The rabbling mechanism is both simple and efficient and consists of a series of plows mounted in rake fashion on a rabble arm. The rabble arm is mounted on an upright post supported on a four-wheel truck. The truck is drawn by a continuous cable passing around two large sheaves at each end of the furnace. When passing through the furnace the truck passes underneath the hearth and the upright post supporting the rabble arm passes through the slotted opening in the centre of the hearth. After passing through the furnace the truck and rabbles move around the large sheave wheel at the discharge end and back to the feed end of the furnace. The truck moves over an ordinary narrow-gage track and the rabbles are air-cooled during their passage outside of the furnace. The ends of the furnace are closed by iron doors which are hinged at the top and opened and closed by the passage of the rabble through the furnace. The truck with the rabbles is pulled through the furnace and returned by a continuous wire cable, which passes under the hearth and around the sheaves at the ends of the furnace. In the operation of these furnaces the rabbles pass over the hearth from 15 to 24 times per hour, depending upon operating conditions. The rabbling mechanisms of the six furnaces are driven by a 50-hp. motor which is belted to a line shaft from which connections are made with each of the furnaces.

The dried concentrate is fed automatically to the hearth of the furnace from the circular steel feed-bins previously mentioned, being dropped upon the feed end of the hearth through a feeder which is tripped by the passage of the rabbles through the furnace. The concentrate is discharged over grizzlies placed on the top of industrial cars into which the roasted product

POTTERY AND ROW OF DISTILLATION FURNACE

fails. Any clinker is thus removed and the concentrate is now ready for the mixing-room and retorts. The method of firing the furnaces is by natural gas and air introduced at intervals along the sides as in the Zellweger furnace.* The gas consumption per furnace amounts to about 250,000 cu. ft. per day. The greater efficiency claimed for this type of furnace over the Zellweger furnaces is due to the lower arch, better reverberatory effect, and a better enclosed and more compact structure. The furnaces at this plant are doing excellent work and reducing the sulphur in the concentrates treated to about one-half of one per cent.

The roasted product from the furnaces, which is discharged into the industrial cars, is trammed to a hydraulic elevator and the cars elevated and dumped into circular steel storage-bins. There are twelve of these bins, each being 20 ft. high and 14 ft. in diameter and having a capacity of about 150 tons.

The mixing-room is conveniently situated with reference to the roasted concentrate storage, carbonate, and fuel bins. The industrial tracks from the bins pass over scales in the mixing-room, where the different components of the charge are weighed and then dumped into a rotary drum concrete mixer. The fuel used consists of 'dead' coal from Pittsburg, Kansas, semi-anthracite from Arkansas, and coke breeze. The coal is crushed in a Jeffrey pulverizer. As the mixed charge which is ready for the retorts emerges from the mixer it is elevated by a bucket-elevator to a belt-conveyor and transferred to the steel charge-bins. The charge is drawn from the bottom of these bins into the steel charge-cars. Here it is slightly dampened as drawn from the bins to prevent dusting and facilitate handling. It is then removed by horses and delivered at the charge-floors of the distillation furnaces.

*'Zinc Smelting at Bartlesville, Oklahoma,' by E. H. Leslie, *Mining and Scientific Press*, July 11, 1914.

Distillation Furnaces

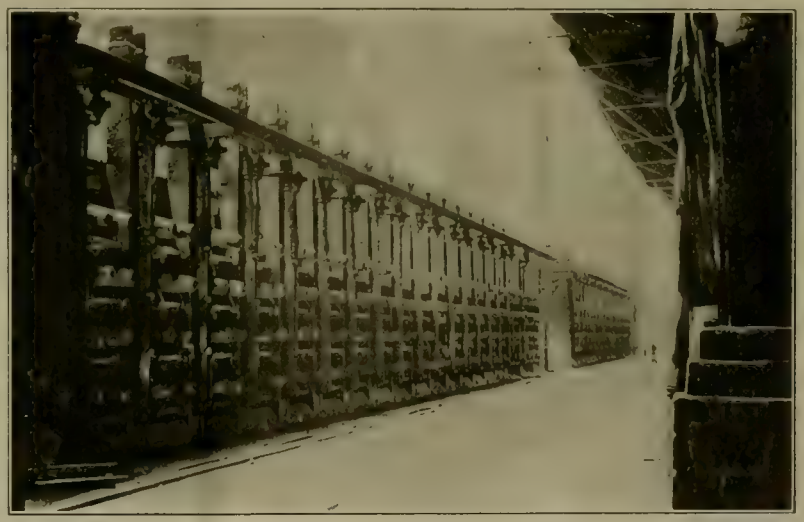
The retort furnaces, of which there are 12 blocks at this plant, are a new development in the district, and present several features which are noteworthy. The furnace blocks are separately housed in frame buildings with sheet-iron roofs, as shown in the halftones of the smelter, and are arranged in parallel as is the general practice in zinc smelting in the United States. An industrial track at the rear of the smelter buildings serves for the delivery of the retorts, condensers, and furnace supplies and for the removal of spelter. It will be seen that the furnaces are of the excavated cellar type, as is common with all the natural-gas furnaces throughout the region. The furnace floor is at ground level. The halftone presented shows an interior view of one of these smelter houses and furnishes a general idea as to the layout and construction of the retort furnaces. It will be seen that the furnaces are built in two separate stoves. Each stove has 10½ sections on a side, or 21 half-sections, and each half-section is made up of 8 retorts, these being arranged in 4 rows as shown. There are thus 336 retorts on one side of the block, or 672 retorts to the block, making the whole plant of 12 blocks comprise 8064 retorts. It will be seen that the furnace is braced with double buck-staves at each half-section, which gives a much more staple structure than the single buck-stave furnace. It is also to be noted that the furnace has an individual blow-box for the injection of the gas and air fuel mixture at each half-section, which has come to be recognized as the best practice. The furnace block is made up of two separate units with individual stacks and equipment. The advantages of this construction are in the furnaces' operation, the dual furnace block with the smaller units making a more flexible plant, and the smaller units are

BUILDINGS AT THE COLLINSVILLE SMELTER.

more wieldy and present structural superiority. The structural details are similar to those of the furnaces at the National Zinc Co.'s Bartlesville smelter.†

The air supply for nine blocks of these furnaces is conducted to the furnaces through one common air main. The air supplied is furnished by two fans connected with this main which are always in operation, and two others which are held in reserve to be used in case of emergency. The three other blocks of furnaces are each fitted with smaller individual blower fans, which is the theoretically proper arrangement. Each half of the furnace block is fitted with a water gauge, and the air pressure is regulated by the furnace fireman. The present practice seems to tend toward an individual blower for each block. The advantage of the individual blower arrangement for each block of furnaces is that when an increased amount of air is drawn from the main for use in one furnace, it does not decrease or cause a variation in the pressure on the other furnaces, as is liable to happen when one blower or fan is used to supply air for a number of blocks.

The retorts are charged by hand in the usual manner, and the metal is drawn three times a day. The drawing of the metal is done by moving the draw-car in front of the retorts, putting the pot in position by means of a hand winch, and collecting the spelter in the pot. The oxidized zinc or 'blue powder' is skimmed from the pot with a shovel and thrown upon the furnace floor, from which it is subsequently charged in the last two sections of the furnace, as is the usual custom. When the pot is full of spelter the draw-car is moved along the track to the molds and the spelter is cast into slabs of the usual weight and stored in a conveniently arranged yard for shipment.



COLLINSVILLE DISTILLATION FURNACE.

In cleaning the retorts, water under pressure is used, the water, of course, being converted into steam as it enters the retort. The residue blown out against the shield falls into the chutes in front of the furnace and thence into the cellar. Here it is collected in pans as shown in the foreground of the general view of this plant, and dragged by horses to the dump.

†'The National Zinc Company, Bartlesville,' by E. H. Leslie, *Mining and Scientific Press*, July 25, 1914.

Treatment of Residue

The residue from the Butte concentrate, which contains silver, is sintered in a similar manner to the practice at Bartlesville.‡ Such residues are removed from the furnace in industrial cars and subsequently clinkered in roasting heaps. The heaps as made at this plant are approximately 45 ft. square. A bed of residues 2 ft. thick is first spread out on the ground, the material being dumped into place from the cars which are brought to the clinkering ground on an elevated tramway. Upon this bed of residues the brickwork channels are then laid. A permanent lateral of brickwork is run across the centre of the bed from one side to the other. This lateral is covered with dirt to prevent the leakage of air through the brickwork. From this permanent lateral there are laid, at right angles to it and connected with it, branch channels on either side. These branch channels are constructed of brick with open interstices to allow the escape of air from them. When the brickwork has been completed and the permanent lateral banked with dirt, the residues are dumped on top and the pile is fired at the point near the permanent lateral. The air is then turned on and the combustion spreads to the limits of the pile. More residues are then added on top until the pile is completed. Smelting operations are on a larger scale at this plant than at Bartlesville No. 2, and a greater amount of silver-bearing residue produced. The clinkering operation of carbon reduction is conducted in somewhat larger heaps than at Bartlesville, but the principle and results obtained are identical. The air for combustion which escapes through the interstices of the brickwork of the channels is supplied by a fan blower, the air being distributed to the various heaps by a system of galvanized iron pipes. The silver-bearing clinker is shipped to the blast-furnaces for further reduction.

Pottery

The clay for pottery purposes is delivered at the pottery in standard freight cars and weathered out of doors for about two months. The pottery crushing equipment for crushing old retorts, adobes, and clay, consists of the standard jaw crusher, Jeffrey pulverizer, and screen, the oversize being returned and recrushed in the Jeffrey crusher. The retort mixture is made of about one-half adobes and one-half clay. The mixture is pugged, cut into convenient blocks, and stored for a few days. It is then re-pugged and molded by means of a hydraulic Mehler press into retorts. The pressure exerted by the press on the retorts is about 1000 lb. per square inch. The capacity of the plant is about 400 retorts per day.

As removed from the press, the retorts are taken to the drying-rooms, where they are kept for about 60 days and here completely dried by exhaust steam coils. They are then taken from the rooms as required for use at the furnaces on flat-bottom cars. At the furnaces the retorts are placed in the pre-heating ovens, which are rectangular in shape and at the rear of the furnace buildings, as shown in the illustration. One of these ovens is supplied for each two blocks of furnaces, and the retorts are kept in these ovens for 12 hours before being used in the furnaces. The condensers are made of one-half clay and one-half crushed old retorts, the material being pugged and the retorts molded in a retort machine. They are then crimped, dried, and burnt in kilns for use at the furnaces.

The power-plant is one of the most modern type. There are two gas-engine units which consist of two Westinghouse, internal-combustion, engines direct connected with two, 135-kw., alternating-current generators. These generators are 440-volt, 177-ampere machines, making 240 r.p.m. There are also three 100-kw. turbine sets. These sets are composed of a Curtis turbine direct-connected with a General Electric, alternating current, 100-kw. generator. These generators operate at 480 volts and 150 amperes rating. The boiler plant consists of three Heine safety boilers, two of which are 370 and one 250 horse-power.

The Collinsville smelter embodies many features which are not common with the other Oklahoma natural-gas smelters, and the beehive dryer, Cappeau type roasting furnaces, and double-stove distillation furnaces are being profitably operated under the management of E. G. Godshalk. The smelter presents a most economic practice in natural-gas smelting and gives promise of a spelter production for many years to come.

‡"Zinc Smelting at Bartlesville, Oklahoma," by E. H. Leslie, *Mining and Scientific Press*, July 11, 1914.

Copper Production of Leading Mines

Copper production of some of the principal mines of the United States is as follows:

Mine.	1913.	Half of 1914.	Estimated for 1914.
Anaconda	241,983,323	124,700,000	249,400,000
Calumet & Arizona	52,987,383	33,257,000	66,000,000
Chino	50,511,661	35,000,000	70,000,000
East Butte	14,401,108	7,413,105	15,000,000
Granby	22,688,614	10,300,000	21,000,000
Greene Cananea	44,480,514	15,000,000	30,000,000
Miami	32,867,666	19,511,950	40,000,000
Nevada	64,972,829	29,920,399	60,000,000
North Butte	28,318,321	15,000,000	30,000,000
Old Dominion	30,293,253	17,879,000	35,000,000
Ray Consolidated	52,341,029	36,478,762	72,000,000
Shannon	18,793,724*	6,048,000	12,000,000
Shattuck-Arizona	13,219,756	7,514,198	15,000,000
Tennessee	13,493,140	7,800,000	15,000,000
Utah Consolidated	7,710,668	3,450,000	6,900,000
Utah Copper	113,942,834	72,865,023	145,000,000

*16 months ended December 31, 1913.

None of the Lake properties have been included, as the strike which continued up to the last of April interrupted production.

The Burma ruby mines, India, produced rubies worth $21,000 in June from washing 110,000 loads (16 cu. ft.) of gravel. Royalties payable were $4900.

Leaching Experiments on the Ajo Ores

By STUART CROASDALE

*Not long ago I was called upon to conduct some experiments on the treatment of ores from the New Cornelia copper mine, Ajo mountains, Arizona, for the Calumet & Arizona Copper Co. The problem was a very interesting one and contained some unusual features. Incidental to this problem was the utilization, if possible, of a large amount of low-grade pyrite in the Bisbee mines of the company.

The New Cornelia mine is 45 miles south of the Gila Bend, the nearest railroad point, on the Southern Pacific railroad, and about 160 miles, almost due west, from Tucson. The region is one of the most arid in the United States, and the normal annual precipitation, as given by the United States Weather Bureau covering a period from 1870 to 1901, is 3 to 5 inches. During June and July, 1913, the records kept by the Company gave the following results, showing the enormous evaporation that can be expected, which may be a factor in leaching operations on a large scale:

	High, °F.	Low, °F.	Average, °F.
June	112	62	84.0
July	115	71	87.8
Evaporation.		June.	July.
Concrete tank, inches		11.7	10.72
Iron tank, inches		14.8	13.07
Rainfall, inches		None	0.77
Cloudy days		None	10.00

Aside from several springs about 10 miles from the property, the nearest known water in quantity at the time these experiments were made, was the Gila river at Gila Bend, 45 miles distant. Part of the development of the property, of course, included drilling for water in the valley, which was in progress at the conclusion of my experiments.

The ore deposit itself is unusual. It consists of an intrusive plug of monzonite or granite porphyry. Chalcopyrite, bornite, and magnetite were finely disseminated throughout the magma in sufficient quantities to make the greater part of the mass commercial ore to a certain depth. Erosion has removed the surrounding country rock and left the plug sticking out at the base of the mountains as two or three cone-shaped buttes, without overburden of any description. Owing to the aridity of the country, there has been no leaching and no secondary enrichment. Instead of following the contour of the surface, as might be expected, the drill records (in the mine model) show oxidation to have taken place quite uniformly downward throughout the mass, and the division between the oxidized and sulphide ores is almost a horizontal plane. The transition zone between the oxidized and sulphide ores is also quite narrow—much narrower than would be expected.

The oxidized ores amount to about one-third of the total ore developed. The greater part of the copper exists as carbonate, although there is some silicate and some oxides, including cuprite. There is also a small amount of sulphide, as residual chalcopyrite and intermediate forms. The oxidized iron exists in both ferrous and ferric condition, both soluble in acid. While the chalcopyrite was very generally disseminated throughout the magma, there seems to have been a tendency for it to segregate in some portions, thus producing a higher-grade ore. The average grade of ore used for experimental purposes was placed between 1.5 and 2% copper. What the ultimate average grade will be will depend upon the cost of treatment.

Methods of Treatment

From the foregoing it will be readily seen that the conditions of the problem demand simplicity of process and large scale of operations. Of course, a railroad will be built to the mine, but whether the ore will be brought to water or water will be brought to the ore are factors yet to be considered and may have their bearing to a certain extent on the method of treatment adopted, when freight and fuel costs are estimated.

Methods of leaching with solutions of reducible salts, like ferric sulphate, ferric chloride, and cupric chloride, have some advantage in their solvent power on cuprite and chalcocite or other intermediate sulphides, but have little action on chalcopyrite. These salts are expensive and their value as commercial solvents depends upon their regeneration by some cheap method of oxidation after the dissolved copper has been precipitated. This difficulty has not yet been overcome, and the results from attempts to use these methods have been disappointing even in the hands of skilled metallurgists. The same may be said of sulphurous acid and ammonia processes. Two methods of treatment, however, are available, and both are entirely reliable and feasible under the conditions involved. One of these is the old Henderson process of roasting with salt, and the other is leaching the raw ore wtih sulphuric acid. A comparison of these two methods may be made briefly as follows:

By using the chloridizing roast, all ores on the property could be treated by the same process—oxidized, sulphide, and intermediate. This would mean the construction of only one plant. The average extraction of the copper would probably be higher than that obtained from acid leaching, and the small amount of silver in the ore would be recovered to a large extent. By mixing the ores, little if any sulphur would have

*Extract from a paper to be presented at the Salt Lake meeting of the American Institute of Mining Engineers and printed in the *Bulletin*, August 1914.

to be added as pyrite. The only chemicals required would be salt, to the extent of 5 to 10% of the ore treated, and possibly a small amount of pyrite. Both of these could be transported in ordinary freight cars. There would be less corrosive solutions to handle. There would be a minimum amount of iron and alumina passing into solution. There would be no appreciable absorption of copper by the slime.

On the other hand, this method would require dry crushing of the ore to 20 or 40 mesh, which would be troublesome if not prohibitive on the oxidized ores on account of the difficulty in controlling the poisonous dust, in addition to the expense of grinding. It would involve a roasting cost. It would mean a more expensive plant, and a more extensive plant for the same capacity, due to the slower percolation of the fine material, which would require a much larger vat area of less depth to hold the tonnage required. It would mean a supply of cheap salt. A chemical precipitant would probably have to be used to recover the copper.

Leaching with Sulphuric Acid

By leaching with sulphuric acid, the oxidized ore can be treated raw and need not be crushed finer than ½ in. or 2-mesh size, or perhaps coarser. Owing to the high oxidation of the surface ores and apparently small zone of partly oxidized ores, a large tonnage can be expected to give a comparatively high extraction by this method. Sulphuric acid can be made as a by-product at the roasting plant of the Calumet & Arizona company at Douglas, or if the calcines are converted into sponge iron and used as a precipitant for copper, the low-grade pyrite from Bisbee can be cheaply transported and acid made at the mine. If electrolytic precipitation can be used, a small percentage of the acid consumed can be regenerated. This method of extraction will permit of less expensive plant construction for the oxidized ores.

On the other hand, sulphuric acid alone will extract none of the copper existing as sulphide, only half of the copper existing as cuprite, and may be indifferent toward the silicate of copper. It will extract none of the precious metals. Owing to the character of the oxidation of the ore, already mentioned, considerable iron and alumina pass into solution as readily as the copper, which will seriously interfere with any form of electrolytic precipitation and render the amount of acid regenerated a doubtful asset when compared with the amount consumed. As an offset to this objection, some of the iron is in the ferric condition, which assists materially in the solution of the minerals mentioned above.

If acid is made at Douglas, it will have to be transported several hundred miles in tank cars, which will have to be returned empty. If acid is made at the mine from low-grade pyrite, a gain will be made in transportation, but the cost of an acid plant will be added to the cost of the leaching plant, and the calcines will have to be utilized. Almost an entirely new plant will have to be constructed for treatment of the intermediate and sulphide ores. The problem is clearly one in arithmetic as well as metallurgy, so laboratory experiments were made on both methods.

Leaching Experiments

These were made only on the raw oxidized ores. The crushing varied from 8 to 2-mesh sizes. The experiments were conducted in glass and stoneware jars provided with small air-lift pumps for circulating the lixiviants. Both standing and circulating lixiviants were tested. The strength of acid solution varied from 3%, or just enough to dissolve the copper in the ore, up to a 10% solution. Sulphuric acid was used. All references to this acid mean 100% H_2SO_4 and not commercial acid. Only enough lixiviant was used in each experiment to cover the ore. The results were as follows on 24-hr. treatment:

8-Mesh Ore

	Standing lixiviant		Circulating lixiviant	
Acid in lixiviant, %	Cu extracted, %	Lb. acid used per lb. Cu dissolved.	Cu extracted, %	Lb. acid used per lb. Cu dissolved.
3.0	46.8	3.2	48.7	3.3
4.0	54.7	3.3	71.0	2.7
4.7	56.1	2.8	85.2	3.2
10.0	81.8	2.8	88.6	3.5
	4-Mesh Ore			
3.0	42.9	2.4	70.4	2.0
4.0	44.3	2.4	74.4	2.3
4.7	48.3	2.3	82.3	2.4
6.3	58.2	2.3	80.8	2.8
10.0	78.4	2.2	85.7	2.8

These experiments showed that circulating the lixiviant increased the extraction of copper without seriously increasing the consumption of acid; that crushing to 8 mesh increased the consumption of acid without materially increasing the extraction of copper; and that increasing the strength of the lixiviant increased the extraction of copper and also the consumption of acid when the lixiviant was circulated through the ore. The fine ore produced in crushing to 8 mesh seriously interfered with the percolation of solutions. Further experiments were made on 4-mesh material by increasing the time of leaching, with the following results:

	5% acid lixiviant		10% acid lixiviant	
Time of leaching, hr.	Cu extracted, %	Lb. acid used per lb. Cu dissolved.	Cu extracted, %	Lb. acid used per lb. Cu dissolved.
24	82.3	2.4	85.7	2.8
48	83.7	2.6	90.1	2.6
72	84.2	2.7	87.6	4.2
96	86.7	..	89.1	4.0

Additional time with 5% acid lixiviant increased the extraction very slowly—probably from the fact that the acid was nearly neutralized. The 10% acid lixiviant always had plenty of free acid remaining after the copper was all dissolved. By referring to the analysis of this ore, it will be seen that the copper soluble in 10% sulphuric acid solution is only 90.6% when the sample is crushed to pass 100-mesh screen, so that a 10% acid lixiviant on a 4-mesh material for 48 hr. extracted about

all of the copper that could be expected. The above experiment was repeated on ore crushed to pass ½ in. or 2 mesh screen. Only a 10% acid lixiviant was used. The results given below, were as good as those obtained from finer crushing:

Time of leaching	Extracted.
48 hr. without change of lixiviant	88.0
48 hr. Lixiviant changed after 24 hr.	87.5
72 hr. Lixiviant changed after 48 hr.	90.0
96 hr. Lixiviant changed after 48 hr.	87.0

As already stated, the oxidized ore contained some cuprite. When clean sulphuric acid is added to this mineral, one half the copper is set free in metallic condition, remaining insoluble in the acid. As nearly as could be determined by averaging a number of analyses, the amount of copper thus set free was about 0.2% of the ore, or say 10% of the total copper.

Analyses of the lixiviants from a number of leaching experiments showed that a certain amount of iron passed into solution simultaneously with the copper. This averaged from one-third to one-half of the amount of copper in solution, or from 0.8 to 1.1% of the solution. Sometimes, with high iron and much kaolinized ores, it amounted to more than this. The iron was about equally divided as ferric and ferrous sulphates. Using 10% acid, the lixiviant passing from a charge of leached ore contained from 4 to 6% free acid in addition to the copper, iron, and alumina.

This combination of circumstances enabled me to use the partly neutralized lixiviant from a leached charge of ore for the first lixiviant on a new charge of ore and thereby not only neutralize the free acid in the lixiviant and at the same time enrich it in copper, but have a solvent for the cuprite (or metallic copper if formed) in the form of ferric sulphate. Since ferric sulphate was always present and the lixiviants were always circulated, it is scarcely possible that any cuprite could escape solution. As soon as the first lixiviant was neutral, it was sent to the precipitating vats. If it was left on the ore beyond the neutral point, some of the copper was reprecipitated in the ore. A new 10% acid lixiviant followed the first and finished leaching the ore, which in turn was neutralized on a new charge of ore.

[The laboratory experiments with chloridizing roasting gave results which did not indicate the advisability of large-scale experiments by that method. For the large-scale experiments on leaching the raw ore, five vats were constructed. A series of tests, utilizing in all 300 tons of ore, were made along the lines indicated above. Reference should be made to the original paper for the details of these tests; the summary follows.]

Summary of Operations

The average grade of this entire quantity of ore was much lower than anticipated and lower than that used for the laboratory experiments. All of the ore treated passed through a 2-mesh screen except the oversize from Test 1, which amounted to 9818 lb. This oversize ranged between 0.5 and 1 inch in size and was treated by itself as a special experiment to conform more closely to the practice of the Arizona Copper Co. at Clifton.

Analysis of a composite sample of the five lots of ore treated gave the following results:

	Sample 3	Calculated from Tests	Composite Sample		Sample 3	Calculated from Tests	Composite Sample
SiO	64.27		63.29	Cu, total	1.44		1.45
Fe	4.18		4.20	Cu, sol. in 10%			
Al_2O_3	14.73		14.30	H_2SO_4	1.31		1.32
CaO, sol. in acid.	0.63		0.90	CO_2	1.30		1.26
MgO			0.80		Oz.		Oz.
MnO			0.14	Au	0.01		0.01
S, total	0.32		0.27	Ag	0.18		0.18
S, as sulphate	0.05		0.10				

The first charge was leached only 20 hr. and gave an extraction of 51.7%. The second charge was leached 39 hr. and gave an extraction of 71%, making an average leaching time of about 30 hr. and yielding an average extraction of 61.3%. If the time of leaching had been prolonged to 70 hr., corresponding to that of the 2-mesh material, the extraction of the whole lot would undoubtedly have been as good as that of the 2-mesh material alone. Therefore in all probability the ore can be leached successfully if not crushed finer than will pass a 0.75-in. screen.

The ore in Test 3, on the other hand, nearly all passed a 4-mesh screen. The fine material produced in crushing to this size very seriously interfered with the percolation of the lixiviants, and washing the ore; consequently it caused loss of time and gave low extractions. Had the entire quantity of ore treated been thoroughly mixed and crushed to a uniform size, the results would have been better than the average of the results obtained by treating each lot separately, so the average results given below are probably not the best obtainable and are certainly on the safe side.

Screen Analysis

Mesh.	Per cent.
2 + 4	19
4 + 8	25
8 + 16	18
−16	38
	100

Results of Tests

Total ore treated, lb.	384,784
Copper in ore, %	1.43
Total copper in ore, lb.	5,526
Available copper in ore (soluble in H_2SO_4 and lixiviant) lb.	5,097
Time of leaching, hours	80
Time of washing, hours	10
Copper in tailing, %	0.32
Total copper in tailing, lb.	1,228
Soluble copper in tailing, %	0.21
Total soluble copper in tailing, lb.	799

Copper in tailing insoluble in H_2SO_4, lb.	429
Total copper extracted from ore, lb.	4,298
Total copper extracted from ore, %	77.8
Copper accounted for in solution, including that from oversize in Test 1, lb.	4,269
Copper accounted for in solution, including that from oversize in Test 1, %	97
Total copper extracted from ore based on weight of tailing at 97% of ore, lb.	4,336
Total copper extracted from ore based on above weight of tailing, %	78.5
Soluble or available copper extracted from the ore, %	84.3
Soluble or available copper extracted from the ore based on above weight of tailing, %	84.7
Copper extracted per ton of ore, lb.	22.34
Copper extracted per ton of ore based on above weight of tailing, lb.	22.50
Average strength of acid used, %	8.9
Acid used (100% H_2SO_4) per pound of copper dissolved, based on the difference in free acid in the lixiviants going on and going off each charge, as found by analyses, lb.	3.6
Acid used (100% H_2SO_4) per ton of ore on above basis, lb.	80
Acid used (100% H_2SO_4) per pound of copper dissolved, based on the total combined acid found by analyses in all the solutions sent to precipitating tanks, wash waters, and lixiviants returned to storage, lb.	3.15
Acid used (100% H_2SO_4) per ton of ore on above basis, lb.	67
Lixiviants used per ton of ore, gal.	128
Wash water used per ton of ore, gal.	268
Solution required to cover 1 ton of ore after saturation, equals one volume, gal.	34
Rate of percolation through ore, inches per hour	78
Rate of percolation per square foot of filter area, gallons per hour	10

(To be Continued)

Ore Treatment at the Junction Mine, New Zealand

This property is next to the Waihi mine, and the annual report for 1913 contains the following notes on mill work, as given by the mill superintendent, J. R. Noble: An average of 36.44 stamps out of a possible 40, worked and crushed 9.2 tons each per day. Screen analyses of stamp pulp was as follows:

Mesh.	Per cent.	Mesh.	Per cent.
+ 5	6.1	+ 80	4.1
+ 10	19.1	+ 100	3.2
+ 20	18.3	+ 150	4.0
+ 40	14.0	+ 200	3.0
+ 60	7.6	— 200	20.6

There were 9.4 tube-mills, out of 10, at work. Fineness of the ore after stamps and tube-mills averaged 1.3% on 100, 5.2% on 150, and 11% on 200 mesh, and 82.5% through 200 mesh. From this product was separated 17,151 tons of sand, of which 4.5% remained on 100, 21.6% on 150, and 33% on 200 mesh, and 40.9% passed through 200 mesh. Although fine, the sand percolated rapidly, thoroughly, and at a low cost compared with vacuum-filter treatment. Cost of tube-mills pebbles was 1.7c., and renewal of liners 1.84c. per ton of ore milled. Cyanide solution strength was 0.07% available, and the consumption was 1.25 lb. per ton of ore.

Recovery of 89.9% of gold and 74.1% of silver from 98,383 tons of ore was done at the following cost:

	Per ton.		Per ton.
Rock-crusher	$0.12	Precipitation and clean up	$0.09
Stamps	0.22	Assaying (985+samples)	0.04
Tube-mills	0.34	General	0.14
Concentrators	0.09		
Percolation and vacuum-filter	0.66	Total	$1.70

Operations of the Tigre Mill

This plant is situated in the district of Moctezuma, Sonora, Mexico, and produced the following results in 1913, according to the report of the general manager, L. R. Budrow: The 20 stamps worked 91.7% of the time and crushed 67,037 tons of ore. An 8-ft. Hardinge mill was installed, increasing the capacity of the stamps from 4 to 11 tons per stamp-day. Additional cone-bottom thickeners, Wilfley sand and Deister slime tables are treating the full tonnage. Treatment of the ore presents several difficulties, concentration with subsequent dewatering being necessary or cyanide consumption becoming excessive. Even after concentration the ore still contains 3.4 lb. copper per ton. Cyanidation was materially improved in 1913 by heating solutions, the extraction of silver being higher and cyanide consumption lower than formerly. Good results and economies have been effected in lower cyanide consumption, and by removing the excess of copper from the solutions. Copper-bearing ores are now treated satisfactorily. Total recovery at the mill and cyanide plant was 92.8%, at the following cost per ton:

Stamp-mill.		Classification, elevating, dewatering	0.217
Crushing	$0.330	Treatment	$1.728
Regrinding	0.176	Filtration	0.242
Concentrating	0.415	Precipitation	0.202
Alterations	0.002	Melting	0.239
Total for 56,511 tons	$0.923	Dam and re-treatment.	0.061
Cyanide plant.		Experimental	0.028
Conveying and screening old tailing	$0.120	Alterations	0.002
Tube-milling	0.540	Total for 86,536 tons	$3.379

IMPORTS of brown coal, coke, hard coal, and briquettes into Hungary in 1913, amounted to 5,200,000 tons, against 4,870,000 tons in 1912. The output of Hungarian coal mines was 10,568,000. The government owned coal mines are worked at a loss, the estimate for 1914 being $300,000. Coal deposits of the country are estimated to contain 350,000,000 tons in sight, also available 1,358,000,000 tons.

SAND AND GRAVEL OUTPUT of the United States in 1913 was 25,367,060 and 54,087,429 tons, worth a total of $24,165,837. The increase over 1912 was 11,099,928 tons and $1,052,629. Glass sand output was 1,791,800, worth about $1 per ton.

Sanitation Work at Cuban Iron Mines

By CHARLES F. RAND

In the conduct of mining operations in Cuba careful attention to the health conditions of employees is necessary at all times. As is well known, the elimination of mosquitoes and flies is of first importance in the prevention of tropical diseases. When the Spanish-American Iron Co. began its operations in Cuba (see accompanying map) mosquitoes were a source of great annoy-

ance, and the examining engineer who first visited Diaquiri reported that the sound of the mosquitoes in his room at night was not unlike the noise made by a swarm of bees. Similarly, at Mayari our consulting engineer was driven out by mosquitoes from what is now the site of the town of Felton, and included in his report a recommendation that provision be made for quartering the men on houseboats during the construction period, fearing that through the resulting loss of sleep and sickness the efficiency of the laborers would otherwise be very low. This was not found necessary, however, as the low spots were filled while dredging the harbor, the mangroves were cut away all around the island, and the necessary preventive precautions taken throughout the vicinity. The resultant effect is shown by the fact that for years mosquito nets over beds have been unnecessary both at Daiquiri and Felton.

During 1908 there was yellow fever in Daiquiri. It was brought there by a man not in the employ of the Company. In combatting this, the government sanitary department, under the direction of the medical corps of the U. S. Army of Occupation, thoroughly disinfected and cleaned all the mining camps. Since that time scientific extermination of mosquitoes has prevailed and all these places have been kept clean, with the result that the mosquito has almost entirely disappeared. The reduction of malaria at Daiquiri due to the absence of the mosquito is shown by the following table:

Year.	Av. men on payroll.	Total cases of malaria.	Per cent.
1907	1315	689	52.0
1908	1292	632	49.0
1909	1391	234	17.0
1910	1448	142	10.0
1911	1480	186	13.0
1912	1294	53	4.0
1913	1301	68	5.0
1914 (first 3 months)	923	3	0.3

The system used for the extermination of the mosquito is as follows: (1) the gathering up of containers that are capable of holding water, such as cans and bottles; (2) the screening of water barrels and other vessels necessary for domestic or other uses; (3) the draining of pools and ditches; (4) the use of petroleum where drainage is not practicable; (5) into large water tanks that cannot be screened to advantage, small fish of the minnow species are put, to destroy the larvae. Attention is also paid to the general sanitary condition of the camps. All garbage, manure from stables, and sweep-

CUBAN GOVERNMENT SANITARY CORPS HANDLING SUPPLIES FOR FUMIGATION.

BUILDINGS COVERED WITH CANVAS WHILE BEING FUMIGATED WITH SULPHUR.

SITE FOR PLAYGROUND IN LABORERS' VILLAGE, FELTON, CUBA.

ings from the roads are gathered and burned daily. Out-closets are limed at frequent intervals.

The following translation of a circular issued to its employees by the Spanish-American Iron Co., Cuba, will serve to illustrate the methods pursued to prevent the growth of mosquitoes. Similar circulars regarding flies are issued, and every effort is made to spread correct information about disease prevention.

The Mosquito

There are more than one hundred kinds of mosquitoes.

Mosquitoes breed only in water. They can breed in any kind of standing water which does not contain matter which is destructive to them.

Mosquitoes generally require from one to three weeks to develop; it takes less time in hot weather than in cold

weather. The female three days after being hatched, lays her eggs, but in some cases more time elapses. Some species of mosquitoes lay from 300 to 400 eggs at a time. Some lay only one.

These are mosquitoes that live several months (as has been proved by hothouse processes or in other ways), but it is probable that few live more than one month.

Mosquitoes do not breed in grass, but they do breed in mud puddles, such places being the favorite haunts of the adults. Lichens contain a sufficient amount of water to breed a rare and small species of mosquito.

The different kinds of mosquitoes have, also, different habits, just as different kinds of birds, flies, etc.; some are domestic, some are found only in woods, and some are migratory.

Some of the domestic mosquitoes breed in clean water, fly a short distance, and usually enter the houses. The majority of migratory mosquitoes breed in salt marshes and fly long distances. They do not transmit malaria.

Careful proofs, direct as well as eliminative, have demonstrated that certain kinds of mosquitoes are the only known means of transmitting malaria and yellow fever. It is known that other diseases are carried by the mosquito.

Of the domestic variety, the dangerous, malaria-carrying mosquitoes (several kinds of the species *Anopheles*) are the most widely distributed. These fly to a distance of only about 500 yards.

One of the most common and most dangerous mosquitoes in the tropics is the *Stegomya fasciata*, which is the true carrier of yellow fever.

It is well known that mosquitoes inoculate more than once, as can be learned from observation and proved by the transmission of disease from one infected person to another.

The mosquito is an unnecessary and dangerous plague. Its propagation can be avoided by such means as drainage, the filling of swamps, changing waters, emptying or covering all receptables for water, sprinkling oil on all stagnant waters when other remedies are impracticable. Much care must be taken with water tanks, house vessels, pools, cisterns, gutters, old cans, holes in trees, swamps, and wells. Since malaria-carrying mosquitoes can breed in springs, their banks should always be kept clean, and *guayacanes* (a small fish similar to the minnow) should be placed in them.

The broods of insect-devouring birds should be protected. All receptacles for water should be carefully covered to keep out mosquitoes in order to prevent the propagation of malaria and yellow fever.

The development of any species of mosquito which has a tendency to threaten the life and public health, therefore, is the result of carelessness or ignorance.

The malaria-carrying mosquito does not sting in the daytime. It comes out at sunset, and all night long works actively.

Everyone ought to protect himself against the malaria-carrying mosquito by sleeping under a mosquito-netting.

Keeping the Towns Clean

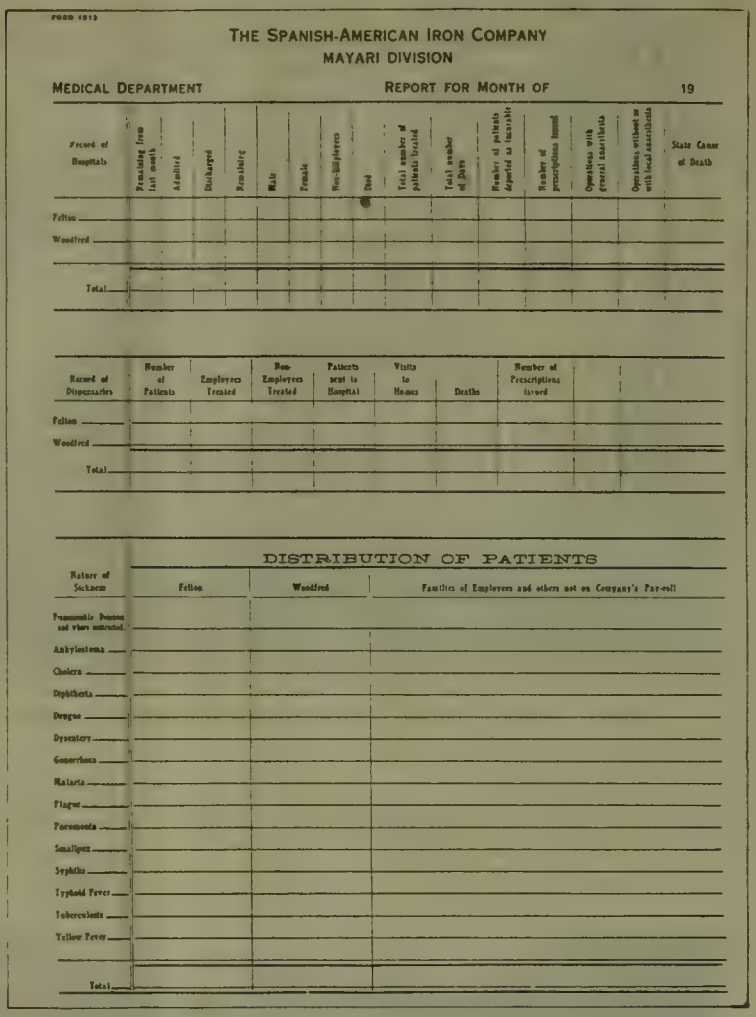
In addition to the elimination of mosquitoes and flies, every attention is given by the foremen and by the sanitary force to maintaining cleanliness and order among the employees as well as around the dwelling houses and

SWIMMING POOL AT DAIQUIRI

in other parts of the towns. Even the most modest dwelling is supplied with a shower bath. A lavatory building with ample shower bath facilities is provided for single men living in the *barracons*. The machine shops has a modern lavatory, also individual metal lockers for clothing form a part of the *barracon* equipment. Each *barracon*, and lavatory, is in charge of an attendant who is held responsible for its sanitary condition.

The siphon condenser at the electric power plant at Felton draws its injection water from the bay and discharges into a 36-in. pipe which forms the main artery of the sewer system. This provides constant and abundant flushing of the sewers and prevents any possibility of stagnation. The outlet of the sewers is carried out to deep water in the *estero* at the rear of the island where there is a strong tidal flow. I have been close to the outlet in a row-boat during both low and high tide on a quiet day and found absolutely no odors. At Woodfred all sewers from the laborers' village are brought together in a sewerage disposal plant in order to avoid any possible contamination of the streams originating in the ore. This plant efficiently takes care of all waste.

Regular inspections are made of the dwelling houses and hotels, and daily inspection of laborers' quarters, hospital, lavatories, butcher shop, and bakery. A daily report is made by the Sanitary Inspector. Any defects in the sewer system or unsanitary conditions are reported by the inspector and means taken immediately to remedy the trouble. Monthly medical reports are also made. Each Saturday, oil and lime are put into the privies connected with the dwellings in the laborers' village where water closets are not supplied. When a laborer's house is vacated it is thoroughly fumigated and cleaned by the sanitary gang.



FORM 1913

THE SPANISH-AMERICAN IRON COMPANY
MAYARI DIVISION

MEDICAL DEPARTMENT — REPORT FOR MONTH OF — 19

Record of Hospitals	Remaining from last month	Admitted	Discharged	Remaining	Male	Female	Non-Employees	Died	Total number of patients treated	Total number of Days	Number of patients deported as desirable	Number of prescriptions issued	Operations with general anaesthetic	Operations without or with local anaesthetic	State Cause of Death
Felton															
Woodfred															
Total															

Record of Dispensaries	Number of Patients	Employees Treated	Non-Employees Treated	Patients sent to Hospital	Visits to Homes	Deaths	Number of Prescriptions issued		
Felton									
Woodfred									
Total									

DISTRIBUTION OF PATIENTS

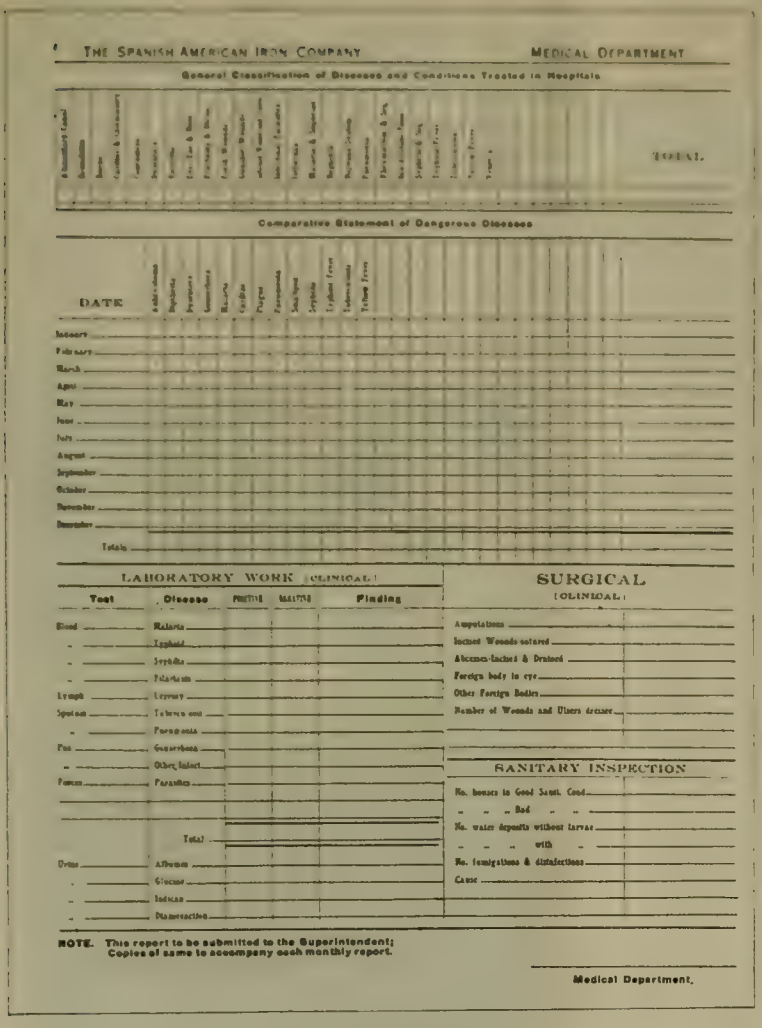
Nature of Sickness	Felton	Woodfred	Families of Employees and others not on Company's Pay-roll
Communicable Diseases and where contracted			
Ankylostoma			
Cholera			
Diphtheria			
Dengue			
Dysentery			
Gonorrhoea			
Malaria			
Plague			
Pneumonia			
Smallpox			
Syphilis			
Typhoid Fever			
Tuberculosis			
Yellow Fever			
Total			

MONTHLY REPORT FORM.

Some time ago it was discovered that the milk supply of one of our villages was being adulterated by *pasta de boniato*, a paste made by grinding up dried sweet potatoes, and of corn starch. This discovery was made after a number of cases of fever among children were reported. To avoid this and insure suitable milk supply, the milk is tested each morning before being distributed. Both Daiquiri and Felton have efficient ice plants. Ice is sold to all families who wish it, at a low price. Also each labor gang is furnished free each day with a sufficient supply of ice for cooling the drinking water supply.

An abundant supply of good water is provided for all dwellings. The Daiquiri water supply comes from a point high up on an adjoining mountain above all dwellings. The Woodfred supply is taken from a small stream originating in the ore where there is absolutely no possibility of pollution. This supply is really remarkable for its purity. Felton water is piped twelve miles from the Mayari river, at a point above which there is only a scattered population. No sickness has ever been traced to the water supply.

Perhaps the most significant fact in showing the satisfactory sanitary conditions of Felton is the size of the present hospital and the number of patients treated as compared with the provisions made originally for taking care of sickness. Based on the experience of other corporations operating in that neighborhood, a large and well appointed hospital was built at Woodfred with the idea that the high elevation and the naturally healthy site would be advantageous in properly taking care of fever cases, the number of which it was expected would be large. After starting, however, these cases proved to be so few that the number of attendants was as a rule



THE SPANISH AMERICAN IRON COMPANY — MEDICAL DEPARTMENT

General Classification of Diseases and Conditions Treated in Hospitals

TOTAL.

Comparative Statement of Dangerous Diseases

DATE

LABORATORY WORK (CLINICAL)

Test — Disease — Positive — Negative — Finding

SURGICAL (CLINICAL)

Amputations
Incised Wounds entered
Abscess-lanced & Drained
Foreign body in eye
Other Foreign Bodies
Number of Wounds and Ulcers dressed

SANITARY INSPECTION

No. houses in Good Sanit. Cond.
" " " Bad " "
No. water deposits without larvae
" " " with "
No. fumigations & disinfections
Cause

NOTE. This report to be submitted to the Superintendent; Copies of same to accompany each monthly report.

Medical Department.

DAILY REPORT FORM.

greater than the number of patients; and a short time ago this large hospital was closed and the small emergency hospital at Felton was made the main headquarters of the medical department.

As Felton is in the centre of a large and prosperous sugar district, many men come to the mine from the sugar companies after the cane-cutting season is over. It has been demonstrated very often that the majority of the fever cases are brought by such recruits. At Daiquiri, the new men as a rule come direct from the north of Spain, and are not so likely to transmit fever. Notwithstanding the above mentioned facts, the proportion of sickness at the Mayari mines is extremely low, as shown by the following list, which does not include patients treated for injuries.

	1910.	1911.	1912.	1913.	1914, 4 mo.
Average number of men on payroll per month.....	729	736	691	757	415
Total sick cases per year..	212	189	138	116	9
Average sick cases, per month	17.66	15.75	11.50	9.66	3
Percentage of sick.....	2.42	2.14	1.67	1.27	0.70

During the past year there were an unusual number of fever cases owing to the fact that a larger number than usual were employed on the railroad on account of reconstruction work. To this a great number of new men were employed. It might be well to speak in this connection of the ever present enemies, the *jejenes* (no see 'ems), which though not a carrier of disease so far as known, are nevertheless a troublesome pest. These will undoubtedly be eliminated sooner or later, but at present no satisfactory means of extermination has been proposed.

Quicksilver Production of the United States

The quicksilver industry of the United States broke a record last year, but not an enviable one, for with the exception of that of 1908, the production last year was the lowest since 1860. Final figures from every producing district, according to H. D. McCaskey, of the U. S. Geological Survey, give a domestic output of quicksilver for 1913 of 20,213 flasks of 75 lb. each, valued at $813,171, against a production of 25,064 flasks, valued at $1,053,941, in 1912. The decline was due partly to the large foreign output for the past few years, a dull market, and a general lowering of prices. Producers report 154,033 short tons of ore mined and available for treatment in 1913, against 166,564 tons in 1912, and the reduction of 136,278 tons against 155,693 tons in 1912. California, as usual, was the largest producer in 1913, with 15,591 flasks, valued at $627,228, a decrease from the output of 1912 of 4933 flasks in quantity and of $235,806 in value. The total value of the production of quicksilver in the state from 1850, the date of the earliest output, to the end of 1913 has been $95,902,923. The quicksilver output of Nevada in 1913 was 1645 flasks, valued at $66,178. The most important producer of quicksilver in the United States is the famous New Almaden mine, of Santa Clara county, California, which contains over 100 miles of underground workings, and which has produced steadily since 1850.

GOLD PRODUCTION of some West African mines in June was as follows:

Mine.	Tons.	Yield.	Profit.
Abontiakoon	11,017	£24,233	£10,232
Ashanti	9,112	37,216	.....
Broomassie	3,774	13,763	3,525
Taquah M. & E.....	5,710	16,904	5,817

Short Tube-Mills

By H. W. HARDINGE

In the *Mining and Scientific Press* and other technical publications there have appeared of late several articles bearing directly upon the probable effect of increasing the diameter and shortening the lengths of pebble-mills. Many allusions have been made to the effect that the Hardinge conical mill has been the forerunner of the innovation. This we must grant is the case, but the effect of the cone on the short mill must not be overlooked any more than the application of the electric current to the motor or the steam to the engine, in order to make these devices serve the purpose for which they are intended. Competitors, but not users, have referred to the cone as addenda of questionable value, and one theorist has suggested a mill of 8 ft. diameter and 3 ft. length to correspond to the cylinder length of the 8 ft. by 36-in. Hardinge mill. Favorable preliminary tests are now being conducted in a Hardinge mill 10 ft. in diameter.

The term 'short' as applied to the tube-mill is relative. In most instances the comparison is made with reference to the standard tube-mills of 20 or more feet in length and of about five feet in diameter, hence a mill of 16 ft. or less is now termed 'short.' The original 'discovery' and use of the short mill is really older than the experience of some of the inventors.

My first experience with short tube-mills was in the construction and operation of one of 8 ft. in length by 6 ft. in diameter in 1903, and another 6 by 6 ft. in 1905. This latter mill was really the progenitor of the conical mill, for it was later lined with fluted cast iron plates forming cones within the mill, in a similar manner to the lining recently placed within a more modern 'short' tube-mill, the dimensions of which were originally 7 by 12 ft. Fig. 1 shows the 6 by 6-ft. mill above mentioned, and Fig. 2 the lining which was fitted within this mill and formed the first working conical mill. Thus a short tube-mill was still further shortened by having its length reduced to a mere surface, forming the base of two cones—if such surface can be considered under the term of length.

As one writer has recently remarked, there must be some critical length for a short tube-mill. In my opinion no exact length can be established owing to the fact that length and diameter must vary in direct relation to size and quality of feed. A very hard ore requires a diameter proportioned to the hardness and necessity for an impactive blow, which likewise applies to coarseness of feed. Lately attention has been directed to one of the innovations in the form of a short tube-mill having the dimensions of 8 ft. in diameter and 6 ft. in length. This excessive diameter (for length) has proved a failure. The mill has been converted into an internal dimension of 6 ft. by filling in the interior of the mill, and our last information is that it is doing better work. The mill with the original dimension was operated on fine jig tailing, the coarse uncrushed feed traveled across the 6 ft. in length without being crushed, and the mill became choked. This choking, however, is liable to occur with any form of pebble-mill when overfed. It was trouble of this character and the necessity of operating a choked mill for periods of several hours before grinding could take place, owing to a 'floating' of the pebbles in the uncrushed mass, that led to the conversion of the 1905, 6 by 6-ft., tube-mill into a conical mill, producing the same result with a reduction of power. When a conical mill is overfed and choking ensues, all that is necessary is to cut off

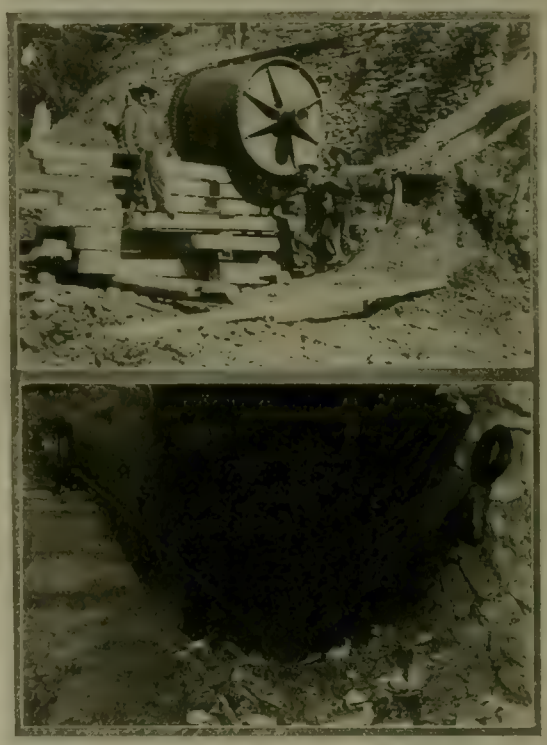


FIG. 1. ORIGINAL 6 BY 6 MILL USED AT CRYSTAL, COLORADO, IN 1905.
FIG. 2. LINING OF FLUTED CAST IRON PLATES.

the feed for a few minutes, when, owing to natural physical migration, the excess of feed is discharged by the crowding and displacing action of the pebbles in the largest diameter. As one millman expressed it, "indigestion is rectified by the mill immediately 'coughing up' its undigested feed." If the feed has assumed the relation of small pebbles of ½ in. or more in size, as has several times occurred in the course of our experience, these excessive sized particles must be removed before normal conditions will obtain, as they become practically a part of the pebble charge, too small and too numerous to be effective.

Referring again to the 'critical length' of a tube-mill, it is my belief that the length should at least exceed the diameter. One writer on this subject has suggested that lengths of 2, 3, or 4 ft. by 8 ft. diameter are pos-

sible. This idea probably emanates from the fact that these dimensions exist in the conical mill—cylindrical length only—while the diameter is 8 ft., and the total length, including cones, is about 12 ft. It is necessary to remember, however, that the diameter is constantly diminishing in fairly direct relation to the mass and size of crushing bodies, as well as size of particles undergoing division performing step reduction. In cylindrical tube-mill construction, designers either do not recognize or ignore the fact that physical laws for adjusting cause to effect must be obeyed. Many circuitous routes are often traveled to reach a point or end. The one in which the metallurgist is interested is that which will produce the greatest economic result. This particularly applies to the pebble-mill wherein forces should be graded to work performed. One would naturally use a sledge-hammer upon a spike and a tack-hammer upon a tack. Then why use an 8-ft. mill-force alike upon a 4-mesh particle and a 20-mesh particle, when the crushing force requirements vary as the cubes of their diameters, or, in the above mentioned division, 1:125? It is true that a short mill of 2 or 3 ft. in length by 8 ft. in diameter might fit the 4-mesh energy requirement, but should its employment be continued on the subsequent 10, 20, or 100-mesh particles returned as oversize for still further reduction? In the cylindrical mill this misapplication of force is necessary, is recognized by the metallurgist, at least to the extent that he is seeking a 'critical length'. In the matter of his crusher, or roll, he is not long in doubt. He adjusts the size to his requirement, possibly because he realizes, by physical observation, the reason for this mechanical adjustment. None the less, the same law should govern his finer divisions, when their relations, instead of being two, four, or eight to one, suddenly jump to hundreds to one.

THE BUREAU OF STANDARDS, Washington, D. C., has been working for some time on safety rules to be observed in the operation and maintenance of electric generating stations and sub-stations, and on the overhead and underground distributing wires in connection therewith, and a set of rules has been prepared for publication by the Bureau. In this work a large number of operating companies have been consulted, workmen actively engaged in the different lines of work covered by the rules, as well as state industrial and public-service commissions. The rules have been formulated so as to be complete and simple, and as easily understood as possible. These rules have been highly commended by a number of competent critics.

MEN EMPLOYED in quarries in the United States numbered 113,105 in 1912, of whom 213 were killed, or 1.88 per 1000 employed. Over 66% of these accidents are about equally divided among falls of quarry material, explosives, and haulage. The value of all quarry products was $78,284,572. The accident rate in France and Great Britain was 1.08 and 1.04 per 1000 employed.

The Norman-Federal Suit

In the Supreme Court of New York, Mr. Justice Philbin rendered the following (in part) opinion after hearing this suit:

This is a derivative action brought by the plaintiffs, Sidney Norman and others, for themselves and other stockholders of the defendant Federal Mining & Smelting Co., a corporation organized under the laws of Delaware (hereinafter called the Federal company), to procure a judgment declaring wholly void an agreement dated October 16, 1905, entered into between it and the defendant American Smelting & Refining Co. (hereinafter called the Smelting company), and requiring the Smelting company to account to the Federal company for the difference between the prices which it had paid for ores, slime, and concentrate delivered under the contract and the market price thereof. There was also joined as defendants the directors of the Federal company individually. The complaint against them was, however, dismissed without costs, upon the trial, and they are no longer in the action.

The contract complained of was an extension of one that had been made two years before, and which was practically upon the same terms. No question has ever been raised as to the propriety or fairness of the first contract. The second contract recited that it was the desire of the Federal company to sell, and of the Smelting company to buy, all of the lead-silver ores, etc., that might be produced from the properties owned or leased by the Federal company for a further period to begin on the day of the expiration of the contract then in force between the two Companies, and to end on August 31, 1930. By the stipulations of this new contract the Federal company agreed to sell all its ores, etc., to the Smelting company during such period. The prices at which such sales were to be made were the same as those mentioned in the contract of 1903, that is to say, for 90% of the lead contents of such ores, 90% of the average price in New York City; for common desilverized lead in lots of fifty tons or more, so long as the selling price should be $4.10 per 100 lb. or under, and when such selling price should exceed $4.10, then 90% of $4.10, plus one-half of the excess over $4.10. The new contract further contained substantially all the other provisions of the then existing contract of 1903, including the provisions authorizing the Smelting company to deduct the freight thereon to Denver or Pueblo, though shipment and delivery should be made to the Smelting company at any other point. It contained, among other things, an additional provision giving to the Smelting company the right to designate deliveries "to any smelting works wherever located and whether said smelting works shall be owned by the Smelting company or by any other persons." A provision requiring the Federal company to deliver to the Smelting company not less than 72,000 tons per year of ore, slime, and concentrate was also omitted. It was not established

that any of the terms of the contract were unfair or disadvantageous to the Federal company, or that there was any detriment because of it suffered by the company. With the exception of two minor differences above referred to and its duration, the contract in question is similar to the one made in the year 1903, when the board of directors were entirely independent and apparently fully competent to protect the interests of said Company. The contract of 1903 terminated in the year 1909; the contract complained of does not terminate until 1930. The extent of the contract's duration does not, however, of itself show any detriment to the Federal company, and the only testimony given on the subject, that of Sweeny, was to the effect that a contract of long duration was highly desirable to the said Company. A ground alleged as showing detriment to the Federal company is in the increase in the average price of lead for the years from and including 1903 to 1905 over that for the period of ten years preceding the year 1903. While it is true that the average price was higher, yet the difference is not so great as to justify the court in finding that any disadvantage suffered by continuing in said contract the figure of $4.10 was not offset by the other advantages gained by the Federal company, as testified to on the trial. In other words, the court would be placed in the position of determining that a fraud had been committed because, according to the court's judgment, on purely a question of business policy, the wisest course had not been adopted. This view, taken with what is hereinafter said concerning the attitude of those other than the plaintiffs, really interested, precludes the court from finding that the said difference in price is sufficient to establish flagrant fraud and thus avoid said contract. In order to justify the court intervening on behalf of the plaintiffs here, it must know that it is doing that which will inure to the protection and furtherance of the interests of the *cestui que* trust, as the minority stockholders of the Federal company must be regarded. They are entitled to demand the aid of the equitable jurisdiction of the court to set aside a voidable contract made by the majority stockholders if it appears that such contract is to their detriment. The plaintiffs own less than 2% of the stock of the Company. That fact, however, does not preclude them from being entitled to raise the question now being considered. It has an important bearing, nevertheless, upon the question, first, as to the desirability of the contract itself, and, secondly, as to whether the court may regard the plaintiffs as adequately representing the will of the minority shareholders. It relates to the desirability of the contract because, so far as the record in this case shows, the plaintiffs are the only minority shareholders who have objected to the agreement. It is therefore to be inferred that those occupying a like position have acquiesced, if not approved. For all that is before the court, they may regard the arrangement as a desirable one. The annual meetings that have taken place since 1905, when the contract was made, so far as appears, have not been characterized by any protest or objection. The plaintiffs themselves apparently found no fault with the contract between the making thereof in 1905 and shortly before the bringing of this action in 1913. It is true that the plaintiff Norman had only held his stock for a comparatively brief period prior to the bringing of the action, but that would entitle him to less consideration than his co-plaintiffs. Circulars were sent out to other stockholders by the plaintiffs calling their attention to the matters of which plaintiffs now complain, and yet there is no evidence that any of said shareholders wished to join in the plaintiffs' protest or were in sympathy with it. Neither must it be lost sight of that said contract was approved at the annual meeting in 1905, at which the shareholders were fully represented. In the face of the attitude taken by the stockholders, as thus briefly described, I think that the court would assume a grave and unwarranted responsibility in setting aside a contract after years of its operation at the demand of only 2% of those interested, on the ground that its continuance is a detriment to all. It does not seem in these circumstances that the court would be responding to a demand from those who were really the *cestui que* trust. In view of the conclusions I have reached, it becomes unnecessary to discuss the other separate defenses raised by the defendants, and the complaint is dismissed.

Dredging in Victoria, Australia

The Briseis Tin & General Mining Co., which produces tin in Tasmania, also has four dredges working in Victoria, and results in 1913 were as follows:

Operation.	No. 1.	No. 2.	No. 3.	No. 4.
Time worked, hours	5,378	2,408	5,381	5,898
Gravel treated, cubic yards	325,300	126,300	376,000	441,200
Gravel per hour, cubic yards	60	52	70	75
Average depth, feet	30	24	37	22.5
Gold recovered, ounces	1,392	542	2,146	1,684
Average per yard, cents	8	8	10.6	7
Cost per yard, cents	6.8	7.64	7.46	4.92
Working profit	$3,700	$390	$11,500	$9,600

No. 1 boat worked in fairly tight gravel overlain by 12 to 16 ft. of clay matter and old logs. The depth of gravel is now 38 ft. The top tumbler shaft broke in February, and 688 hours was lost. Tight ground made necessary renewals to buckets, ladder, and tumblers of No. 2 boat. Gold returns were erratic. The top tumbler spur wheel of No. 3 failed, but little delay was incurred. Tough ground made heavy wear on links and lips of buckets. No. 4 mainly turned over old workings, although in places a very tough clayey overburden was cut out. The resoiling conditions imposed by the Government are a source of considerable expense, and leveling of the soil deposited is likely to become more so.

CEMENT tested by the Bureau of Standards at Washington, D. C., amounts to 6,158,108 bbl., mainly for the Panama canal.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Methods of Testing Placer Gravels

The Editor:

Sir—The paragraph, in my article on 'Methods of Testing Placer Gravels', published in your issue of July 4, relative to the number of pans of gravel contained in a cubic yard, could have been made considerably clearer had I used the words "panable material" instead of "gravel." That is, my figures as given refer entirely to the number of pans of panable material contained in a cubic yard in place. By "panable material" is meant the sand and small stones which may be conveniently thrown into the pan and washed.

It is readily seen that a cubic yard of sand, or very fine gravel, can all be taken into a pan and washed, filling in the neighborhood of 150 to 160 pans. Therefore a cubic yard of fine gravel contains the maximum number of pans of panable material. On the other hand, taking an exaggerated case, a gravel may be of such a degree of coarseness that a cubic yard in place might consist of but five or six large sized boulders, too large to be put into a pan for washing. In this instance the only part of the cubic yard which could be panned, or would be a producer of value, would be such fine material as filled the interstices between the boulders; this might amount to only 9 or 10 full pans. Hence this gravel would contain 10 pans of panable material to the cubic yard.

In sampling by panning, it is very necessary to take into consideration the amount of value-producing, or washable material contained in a cubic yard. For example, a gravel bank is to be sampled, a pan of the material is picked out and washed, from which is obtained, say, 10c. in gold. Were this bank composed entirely of sand or fine gravel all of which could be washed, it would be safe to assume that every pan would contain a like value of 10c. in gold, thus giving the gravel a value of 150 times 10c. or $15 per cubic yard. I have taken it for granted, in order to make the example clearer, that gold is distributed evenly throughout the cubic yard.

On the other hand, suppose the gravel were very coarse, composed chiefly of boulders, and that the sample has been obtained by picking out the fine material filling the spaces between them. In this case, a large proportion of the gravel in the cubic yard being composed entirely of boulders, would not yield any gold or admit of being washed in the pan; therefore consideration must be given the smaller portion from which the 10c. per pan will be obtained. Upon investigation it is found that there are but 30 pans of this panable material, hence the deposit has a value of 30 times 10c. or $3 per cubic yard.

An average gravel contains from 60 to 70 pans of panable material to the cubic yard.

Walter J. Radford.

Breckenridge, Colorado, July 20.

The Editor:

Sir—In your issue of July 4, Mr. Radford, in his interesting article on sampling of placer deposits, refers to the accuracy of the averages of drilling methods, and speaks of such drilling continued so as to give as much as eight holes per acre. Such close drilling is not, I believe, usual, and in most cases not necessary; first, as being too expensive and consuming too much time, and secondly, as not altering sufficiently the first results of the more widely scattered holes. In support of this statement I beg to append three maps of actual drilling on ground of the Yosemite Dredging & Mining Co. here at Snelling.

The tract in question, comprising 30 acres, lay on the opposite side of the river from the general mass of the ground and was left until the last for this reason. It was of importance to us to know whether this area was profitable, as, if so, we would cross the river, and dismantle the boat close to the county road, thus saving much distance in hauling. We therefore drilled the holes as per the first map; 400 ft. apart up and down the stream, by 200 ft. across the flow, making 20 holes in all. The map shows the depth and the value as shown by the samples. The area was in part badly overgrown with brush, and in part in a slough, so we had to drill a few holes rather out of alignment. The top soil, consisting of sandy loam, was about an average of 6 ft. deep; below this was gravel consisting of small cobbles and sand. The bedrock was soft lava ash.

The average of these holes, figured in the regular way, is 5.29c. per yard. We use the '0.01 formula' in our estimates, and for the probable dredge yield, deduct from this 20% for losses. This would make the probable value of the area only 4.32c. Moreover, in this area there are three high holes—25c., 14c., and 20c. If we cut these in half, as being freaks, we get a value for the area of 3.63c. and 2.90c. dredge yield.

To see if there was not a possible area of sufficient value to warrant dredging, we then went over the area a second time, spacing the holes as in map No. 2, and for this prospecting we obtained an average of 4c. per

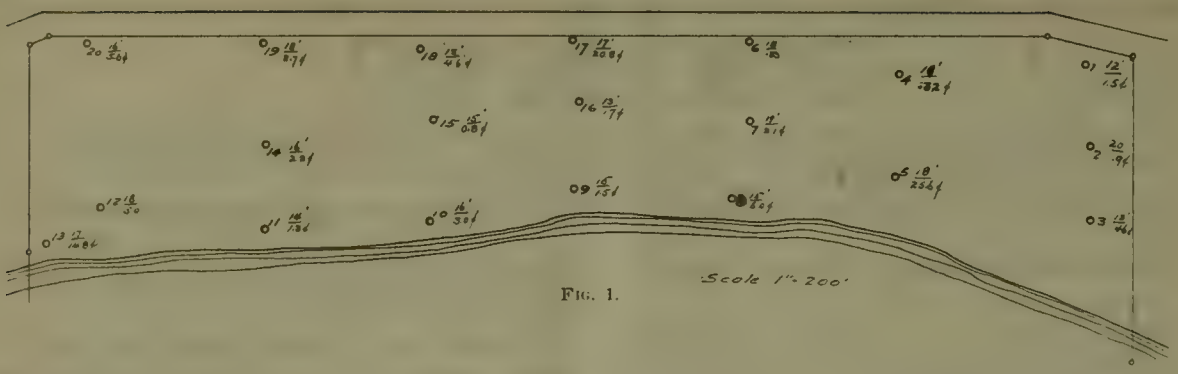


FIG. 1.

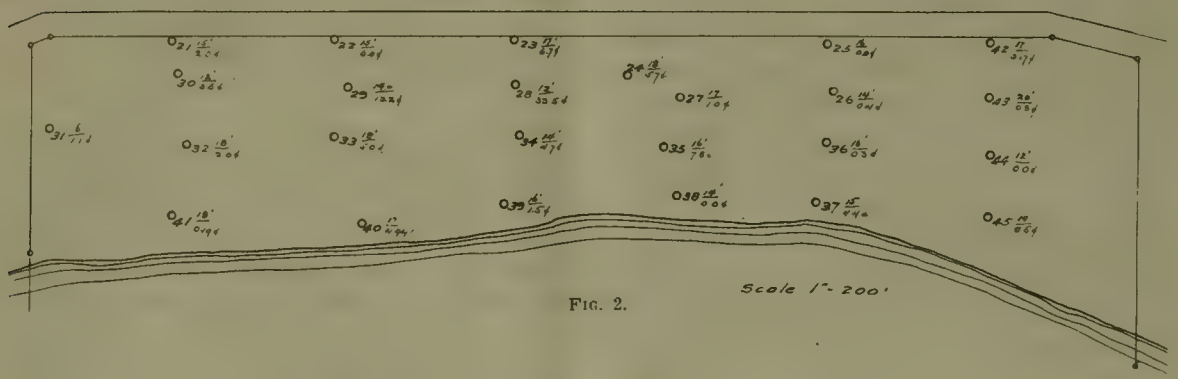


FIG. 2.

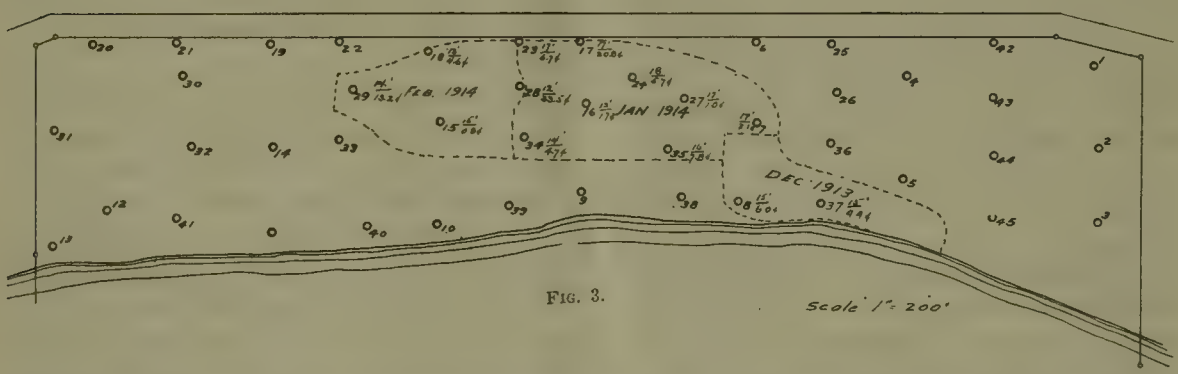


FIG. 3.

yard, drill yield, or 3.2c. dredge yield, including two freaks of 33c. and 13c. If we cut these in two, we have drill value of only 3.27c. and dredge value of 2.61 cents.

These two samplings, therefore, checked within a small fraction of a cent against each other, and the total average of both, which is for 45 holes in 30 acres, 4.57c., including all holes, or 3.42c. if half the freak holes be deducted. The comparison would therefore be: first 20 holes, 3.63c.; second 25, 3.27c.; of all 45, 3.42 cents.

After much discussion we selected a piece of the ground, crossed the river and dredged as shown in map No. 3, seven acres. This dredged area covered 14 drill-holes whose average value was 7.75c., or if we deduct as before the half of three high ones, 20c., 33c., and 13c., we get 5.55c. as the drill value, or an expected dredge yield of 4.44c. The records of our bullion product shows for these three months a yield of average 6.74c. per yard. In other words, we saved by the dredge a little more than 80% of the drill returns of all holes, including the freaks.

On another piece of ground in which we had 66 drill holes, covering the operation of over a year, we recovered the value indicated by all holes, freaks and all, less 80%, less 5%. This was in very loose river wash with no top soil at all. Many holes showed a value of only a cent or less; others ran up to 66c., and the average was approximately 9c. per yard.

Following this experience, we have recently purchased a piece of ground on this river on which we drilled one hole to about 1.5 acres, and we would have considered continuing this work until eight holes to the acre had been drilled, an extravagance not warranted by the difference in final results.

JAMES W. NEILL.

Snelling, California, July 15.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

QUICKSILVER LOSS at the Great Boulder mill, Kalgoorlie, in 1913 was 0.133 oz. per ton of ore treated.

CYANIDE CONSUMPTION at the Great Boulder mill, Kalgoorlie, in 1913 was 0.797 lb. per ton of ore treated.

NET ELECTRIC OUTPUT of the power-plants in the Canal Zone were as follows in May: Balboa, 7302; Empire, 100,840; Gatun, 624,360; and Miraflores, 1,785,260 kilowatt-hours; compressed air, 105 lb. pressure, amounting to 290,388,650 cu. ft. of free air was produced at Balboa, and 85,533,309 cu. ft. at Empire.

A WHITING electrically driven hoist at the Turf mines shaft of the Village Deep mine on the Rand is now successfully run with only one coil of rope around the reels, instead of three coils, as has been the practice where the Whiting is driven by steam. In this instance the efficiency has been increased considerably. The engineers on the mine, B. Gray and J. H. Rider, were responsible for this improvement.

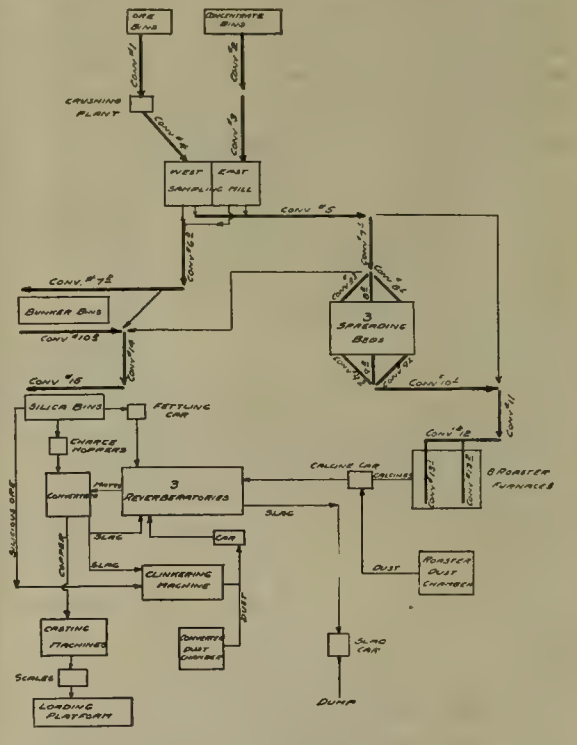
NODULIZING FLUE-DUST at the Chrome, New Jersey, refinery of the United States Metals Refining Co. is done by feeding it into a 6 by 60-ft. oil-fired kiln, standard cement practice size, lined with 6 in. of brick, on inclination of $\frac{3}{8}$ in. per foot to the discharge end, and working at $1\frac{1}{2}$ r.p.m. A granular sand can be made with about 8, a first-class smelting product with 12, and great chunks with 16 gal. of oil per ton. Firing has to be carefully done.

DIAPHRAGM is a word of Greek origin meaning to fence or enclose. A baffle, on the other hand, has been defined as something for deflecting, checking, or otherwise regulating flow. A diaphragm may thus refer to a partition, but never to a deflector, and its use in connection with the baffles sometimes found in cone classifiers is illogical. Diaphragms are used in pressure gauges and aneroid barometers. In this case they are flexible and connected with suitable recording apparatus.

APART from the Homestake, which operates two hydroelectric plants of its own and is building a steam-actuated auxiliary, all but three or four of the mines of the Black Hills district, South Dakota, are operated by electric power purchased from the Consolidated Power & Light Co. This concern operates a steam-driven generating plant at Pluma, and a water-power plant on Redwater river. It also buys all of the surplus power generated by the Dakota Power Co. at the latter's hydroelectric installation on Rapid creek near Pactola.

UNIT CONSTRUCTION COSTS of the new smelter of the Arizona Copper Co., Clifton, Arizona, are discussed in the July *Bulletin* of the A. I. M. E. by E. Horton Jones. A summary of the details is as follows:

Account.	Total.	Account.	Total.
Engineering	$100,650	Roaster dust chamber flue	12,859
Yard tracks, etc.	156,326	Boiler and blacksmith shop	21,449
Receiving bins	44,185	Machine and carpenter shop	27,356
Crushing plant	9,269	General office	1,395
Sampling plant	34,109	Warehouse	13,603
Bedding plant, etc.	150,939	Laboratory	6,144
Roasting plant	136,735	Sample room	2,826
Roaster dust chamber	49,664	Miscellaneous	37,186
Reverberatory plant	328,945	Indirect expense	140,278
Converter plant	216,033	Power plant	434,703
Converter dust chamber	27,814	Oil supply sump, etc.	40,619
Conveying system	45,411		
Chimney	45,471	Total cost	$2,105,020
Reverberatory flue	13,454		
Converter flue	7,602		



FLOW-SHEET OF ARIZONA COPPER CO.'S SMELTER. HEAVY LINES INDICATE CONVEYORS.

This is the latest smelter in Arizona, the Calumet & Arizona starting some time before. The monthly output of copper is about 3,500,000 pounds.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

LONDON

RESUSCITATION OF OLD MINES IN THE RUSSIAN EMPIRE; RESULTS AND PROSPECTS OF THE KYSHTIM, AND OPENING THE GUMESHEVSKY AND SYSSELSKY MINES.

As remarked in a recent editorial paragraph of the *Press*, many of the less important copper mines receive proportionally a large amount of booming. The Russian copper mines certainly receive a lot of notice, but, though comparatively small producers, they are of sufficiently economic importance to attract the attention of the public and of technical men. For one thing, the Russian mines are only just emerging, by the aid of English and American engineers, from the pre-Agricola age of technology; and second, the muddled finance of the local owners has required a tremendous lot of straightening. Another fact that makes the Russian schemes attractive is the high import duty, which enables the home producer to obtain £25 per ton more than the standard price throughout the rest of the world. The Kyshtim presents an excellent example of the transformation of an old-fashioned property into one that can truthfully be called a model. Most of the engineers and scientists come from the United States, such as R. Gilman Brown, Walter G. Perkins, H. W. Turner, and A. W. Stickney; while the financial situation was saved by H. C. Hoover. As regards finance, £250,000 was subscribed in cash as part of the share issue, and subsequently £650,000 was raised by the issue of debentures. The holders of the debentures have already changed into shares, £1 nominal shares being taken for each £2 10s. in debentures. The share capital now stands at £1,253,800, and dividends at the rate of 22½ and 25% have been paid for 1912 and 1913. During the year 1913, 7971 tons of copper was produced, and 7832 tons was sold at an average price of £94, yielding a profit of £525,986. The iron works brought a profit of £42,449, the forest department £27,013, and the sale of pyrite, on sulphur content, £2663. After the payment of all expenses the profit was £311,578, and the Company distributed £314,058 as dividends.

The directors have just issued the report of R. Gilman Brown, the consulting engineer. The amount of ore mined was 351,043 long tons, of which 135,349 tons came from the Koniukhoff, 165,389 tons from the Smirnoff, and 47,371 tons from the Tissoff. The average content was 3% copper, 1.86 dwt. gold, and 1 oz. silver per ton. The total ore treated at the smelter at Karabash was 322,700 tons, together with 20,867 tons of low-grade matte produced by the reverberatory at the old smelter from 17,153 tons of roasted ore, 14,530 tons of fine raw ore, and 26,542 tons of flue-dust. The blister copper produced at Karabash was 8413 tons, averaging 98.85% copper, 3.56 oz. gold, and 33.6 oz. silver per ton. At the refinery, 7371 tons of copper was produced, and precious metals worth £19 per ton of copper. The ore blocked out on December 31 totaled 356,000 tons averaging just under 3% copper; of this, 51,600 tons averaging 2.85% was in the Koniukhoff, 232,300 tons averaging 2.8% in the Smirnoff, and 72,400 tons averaging 3.59% in the Tissoff. The assured reserves as indicated by bore-holes and development are as follows: Koniukhoff, 505,000 tons; Smirnoff, 384,000 tons; Tissoff, 415,000 tons; and Amerikansky, 611,000 tons. In addition, the ore assumed to exist within an average of 50 ft. below bore-holes is: Koniukhoff, 198,00 tons; Smirnoff, 133,000 tons; Tissoff, 141,000 tons; and Amerikansky, 74,000 tons. The total of assured and assumed ore is 2,461,000 tons, estimated to average 2.7 to 3% copper. The average metal content of the ore blocked out appears to be lower than that of the ore hitherto mined. The explanation is that large amounts of lower-grade ore can be extracted profitably during current mining operations that would be otherwise lost. A new orebody has been disclosed two miles south of Tissoff. This has been called the Ivanoff. The oxidized portion, on which development has been done, is high in gold and silver. The diamond-drill has intersected the lode at depth, where it is 9 ft. wide, and averages 2% copper. Since Mr. Brown's report was received, a bore-hole at Koniukhoff has cut the lode at a vertical depth of 1400 ft., where it is 6¼ ft. wide and averages 4.3% copper, 12.4 dwt. gold, and 8.3 oz. silver per ton. This figure for gold is by far the highest yet obtained. The capacity of the electrolytic refinery has been increased to 10,000 tons per year. A reverberatory furnace is being built at Karabash, to take the place of the plant at the old works.

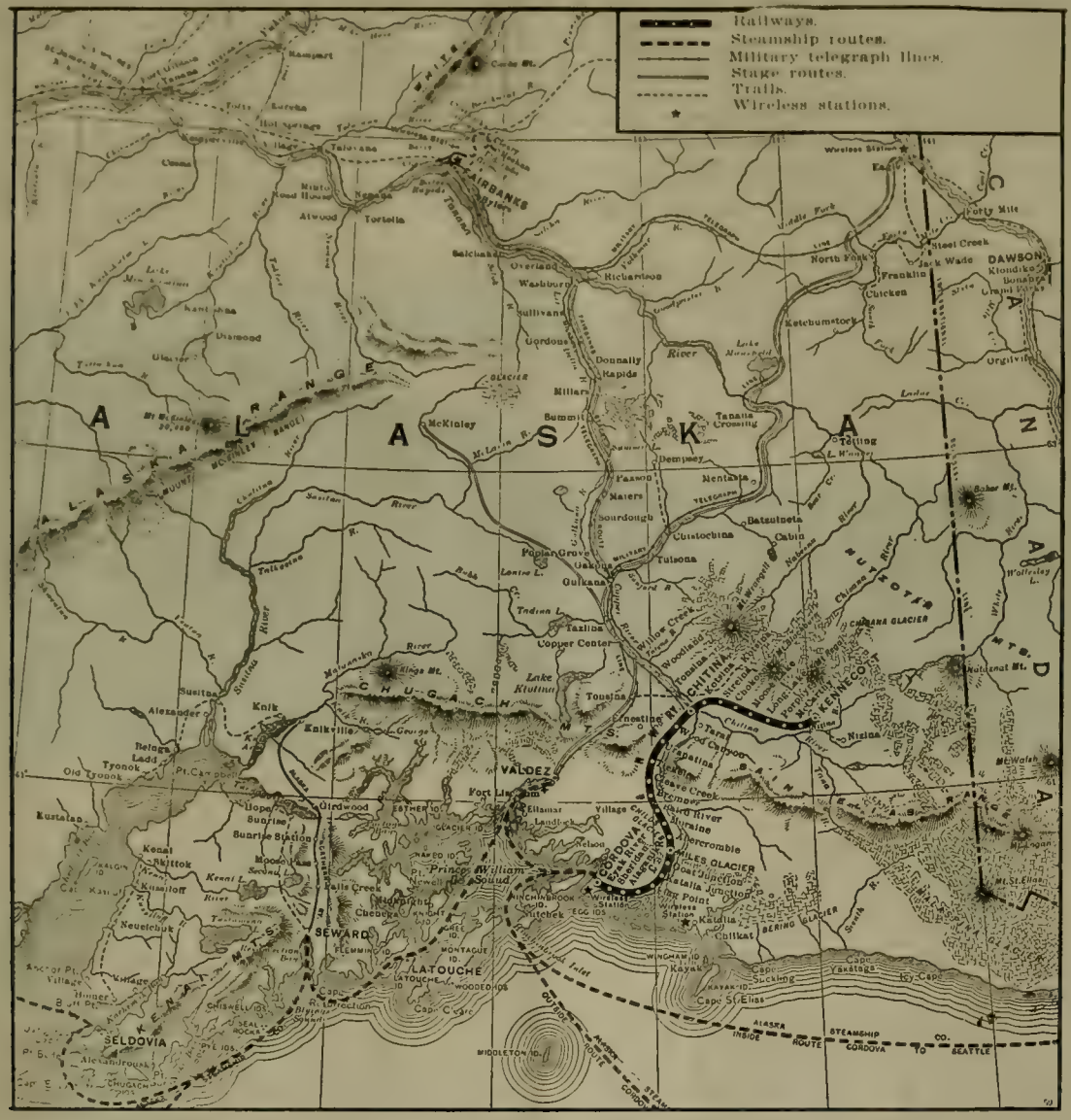
Another group of copper mines in the Urals that is now in the process of transition from old to new methods belongs to the Sissert Estate. This Company owns copper, iron, gold, and platinum mines. Of the mines, the Gumeshevsky is the oldest, and the oxidized ores there have been worked by open-cut for generations. There are also large amounts of oxidized ore on the dumps that are treated by leaching. The other property, the Sysselsky, was opened as recently as 1906. During the past year 26,532 tons of ore was smelted, yielding 1082 tons of copper, and 80,879 tons of ore and dump material was leached, yielding 234 tons of copper. In addition, 3625 tons of cupriferous pyrite was sold for sulphuric acid manufacture containing 4½% copper. At the iron mines, 24,265 tons of ore was raised, averaging 52% metal; and at the smelter and iron works, 17,937 tons of pig, 16,161 tons of ingot steel, and 9972 tons of manufactured iron were produced. The Company also reports a production of 5262 oz. gold and 811 oz. platinum. The Company has just paid a dividend of £37,750, being 5% on the issued capital of £755,000. Additional working capital is being subscribed. An option 173,000 £1 shares at 35s. has been exercised by the promotors, the Russian Trust & Finance Co., and a further option on 166,500 shares at 30s. has been granted. Extensive drilling operations are now in hand. At the Gumeshevsky, drilling is being done to prove the orebody below the open-cut; as the results were promising, a shaft has been sunk, and an oxidized orebody is being developed. Additional ore has been proved in the Sysselsky. At the Krilatofsky gold mine, 158,000 tons of gold-bearing quartz has been blocked out averaging 14s. 4d. per ton; this is to be used as a flux in copper-smelting operations. The most interesting development, however, is at the Degtiarsky, where gossan outcrops are being tested by trenching and drilling. One orebody, as far as proved, is estimated to contain 250,000 tons of ore averaging 3.2% copper, 1 dwt. gold, and 0.53 oz. silver per ton. Other orebodies give promise of excellent development. The smelting plant is being extended and rebuilt on modern lines. In connection with all these modern Russian ventures, it is worth noting that prospecting by the diamond-drill plays an important part, and in fact the value of this method of prospecting is being demonstrated in a remarkable and satisfactory manner.

CORDOVA, ALASKA

SITUATION OF CORDOVA DISTRICT.—BONANZA, RAE'S, AND MOTHER LODE COPPER MINES.—WORK AT COPPER MOUNTAIN, LAKINA RIVER, AND MCKINLEY LAKE PROPERTIES.—GOLD PLACER CLAIMS.—CHISANA, NELCHINA, AND KATALLA DISTRICTS.

The Cordova mining district embraces part of the Copper River valley, some of the mainland, and numerous islands in the southeastern Prince William sound. Tributary to the town, which was located on the southeast shore of Orca bay in 1906, as the coastal terminus of the Copper River & Northwestern railway, then planning to build into the interior, is the entire Chitina and Copper River valleys, together with minor streams on the southern side of the Alaska range. Since the construction of the railway, much more country has been made tributary to it. Copper river long was known to natives as a stream which cut a copper belt, and travelers and geologists reported on it before the town of Cordova or a railroad were thought of.

The Bonanza mine, itself the reason for the construction of the Copper River & Northwestern railroad, and situated on the east side of Kennecott glacier, at the head of Bonanza creek, is the biggest shipper of copper from the Cordova district. It is owned and operated by the Kennecott Mines Co. Shipments aggregate from 100 to 120 tons per day. From 175 to 200 men have been employed, with a monthly payroll aggregating $20,000. Ore now is being taken from the 400-ft. level, transported by aerial tram 3½ miles to the end of the railroad, there concentrated and sacked, and placed on board cars. The most important new developments planned by the Kennecott Mines Co. embrace placing the Jumbo claim, adjacent on the northeast to the Bonanza, on a shipping basis. A tramway will be built to connect the Jumbo workings with the mill, a distance of 4½ miles. Material for the tram, which is the product of the American Steel & Wire



MAP OF PRINCE WILLIAM SOUND COUNTRY, SHOWING DISTRICTS DESCRIBED.

Co., is on the dock at Cordova, and will be shipped to the mine immediately. Work is now in progress. The Jumbo claim has paid all the development work done on it with the ore taken out, though hauled seven miles by teams during the winter. It is being developed from the 750-ft. level with stopes. Eight hundred feet of drifts has been run on the 500-ft. level. A shipment of 2500 tons of ore from the Jumbo was made in June. Fifty men are employed in development work. The Kennecott Mines Co. owns a group of 20 claims in the vicinity of the Bonanza property. W. A. Seagraves is superintendent in charge of the development of the claims.

The Mother Lode property, owned by the Mother Lode Copper Mining Co. of New York, situated across the mountain from the Bonanza, is being developed by two adits. Work soon is to be started on a sawmill, compressor building, and other structures at the mine, according to James J. Godfrey, president of the Company. A three-mile tram to the road will be built from the mine. A shipment of 525 tons of ore made last winter, after being hauled 16 miles over ice, yielded

BONANZA MINE OF KENNECOTT MINES COMPANY.

561,484 lb. copper and 8915 oz. silver, according to the report of the Tacoma Smelting Co. Plans are being considered for an automobile-truck service to the railroad. It is stated that the Copper River & Northwestern railroad will build a spur to the mine if the mining company agrees to furnish a certain amount of tonnage. The spur, if built, would start from Mile 191.

E. F. Gray, president of the Great Northern Development Co., reached Cordova July 6, and planned to visit his properties and arrange for the season's work. One of his properties is at Copper Mountain, at Strelna, 12 miles from Mile 146. The property is a low-grade copper one, and but little work has been done since 1912, when a snowslide swept off the buildings and killed five workmen. Negotiations between Mr. Gray and the Copper River & Northwestern railway for the construction of the spur to the mine are under way. The Regal Mining Co.'s property, situated near the Bonanza claims at Kennecott, said to contain a deposit of high-grade copper ore, will be developed this summer by Mr. Gray, who is chief owner.——James S. Ramage and E. J. Bower recently completed the examination of copper properties on Lakina river, 12 miles from Mile 176, and are planning to erect machinery with a view to further development. Both men are directors of the Lakina Copper Co., holding Company for the Alaska Copper Co.——Three groups of claims owned by the Alaska United Copper Exploration Co., made up of California investors, are undergoing constant development. One property, near Kuskulana glacier, 15 miles from the railroad, has two adits with an aggregate length of 275 ft. Four men have worked there all summer. Another group of claims on Copper mountain is being developed by open-cuts. The third and most important group are the Westover claims, near Dan creek, in the Nizina section. A total of 550 ft. of adits has been driven on an irregular body of copper ore, which smelter tests show contains 25% copper. A tramway 1½ miles long to the mouth of Dan creek is being installed. From there the ore will be hauled 16 miles to McCarthy and shipped by railroad to Cordova.

The Alaska Consolidated Copper Co. owns two properties; one, the Rarus mine, 10 miles north of Mile 152; the other a group on Nugget creek. Alfred B. Iles is manager. A carload shipment of ore from the Rarus mine was made to the Tacoma smelter last winter. Development now under way consists largely of adits. These, too, are being driven on the Hubbard-Elliott copper property on Elliott creek. A. E. Lathrop is chief owner in the claims, which are 15 miles from the railroad near Strelna.——Assessment work is being done on the Yanagita Mines Co.'s property near Mile 121. The property has been bonded. Two hundred feet of drifts has been driven on the orebody. The ore is copper bearing, with 9% nickel content. The Standard Mines Co. is opening up its property at Mile 109, and Frand Sellers is prospecting his claims in the same vicinity.——Mining men of the district look upon the McKinley Lake district, 15 miles from Cordova, as one of promise, although but little development work is being done at the present time. The Lucky Strike company is doing assessment work, as is the McKinley Lake Mining Company.

The placer output of the Nizina district, tributary to Cordova, is conservatively placed at $250,000 by George C. Hazelet. The Dan Creek Mining Co., of which Howard Birch is manager, operates on its claims on Dan creek, 25 miles beyond the end of the railroad. A hydraulic plant was completed in time to take advantage of the first water of the season, and has a daily capacity of 1000 yd. A flood in 1912 swept out the dams and ditches, and the entire year of 1913 was spent in changing the position of the dams. A sawmill, electric light plant, and necessary buildings make up the improvements. Three giants are in operation, one of them

used to stack tailing. The dirt is said to average $2.50 per yard. Forty men are being employed.——On Chittitu creek, George Max Esterly is operating a hydraulic plant, as is Ham Andrus on Rex gulch, each with 40 men employed. Plans for a dredging company to operate on 30 claims owned by J. A. Hazelet on Chisina river are being considered. The claims have been prospected thoroughly with a Keystone drill.——Jack Miller continues to be the principal operator on Slate creek, a tributary of the Chistochina river, which in turn flows into the Copper. The creek was discovered in 1901 and has produced steadily for ten years. Miller took in 150 tons of pipe last spring and has completed the addition to his pipeline. Among the claims being worked are the Tacoma, Four Black Dogs, and Hundinger. The 1914 output is estimated at $150,000 with the increased capacity that the Miller plant will have.

The Chisana district, which is reached by crossing Skolai pass from the end of the Copper River & Northwestern railroad, is not coming up to expectations. Latest information is that sluicing is in progress on ten different creeks, with

JACK MILLER'S OUTFIT ON SLATE CREEK.

500 men in the district. Fletcher Hamshaw, operating the original James holdings on an option, is reported to have been disappointed in his clean-ups. Dan McGuire, working on Dry gulch, two miles below Bonanza, is reported to have found dirt panning from 12 to 15 cents. Wood in the Chisana district is scarce.——Another camp tributary to Chitina, on the Copper River & Northwestern railway, is the Nelchina, discovered during the winter of 1913-14. It can be reached by way of Knik and the Matanuska river, as well as by Chitina and Copper Center. Latest reports from the district are not encouraging. Pay has been discovered on two creeks. Miners are leaving for other fields.

At Katalla, the oil settlement of southwestern Alaska, one well is running, that of the Alaska Oil & Refining Co. Its output is five barrels per day of paraffine-base oil. The output of gasoline, distillate, and crude oil is sold to Prince William Sound ports.

Cordova looks forward to the opening of the Bering River coalfields, so that fuel will be available for smelting purposes. It is declared that the copper of Prince William sound could be smelted readily, as the interior ores, with their iron content, are the natural flux. Two complete surveys to the Bering River fields have been made by the Copper River railway from Mile 38, one by way of Katalla and the other by way of Lake Charlotte.

At present matters in the coal district are at a standstill pending passage by Congress of some legislation whereby the coalfields may be opened. Surveys now being made for a system of government railways to the interior would seem to insure that the present embargo on coal mining will be raised, but so far nothing definite has been accomplished in the direction of actual legislation.

LEAD, SOUTH DAKOTA

Moving the New Homestake Hoist Parts. Recreation Hall Finished, and Taxes. Oro Hondo Work.—Dakota Continental Suspension. New Reliance Mill Working.

To remove the machinery for the new hoisting plant at the B. and M. shaft of the Homestake company, from the railroad to the site of the plant, was a problem of some importance, when it is taken into consideration that the plant was to be erected at a point some 2000 ft. from the nearest railroad track, on a hill fully 200 ft. higher than the track. There was no suitable wagon-road over which to haul heavy loads, the two largest loads would be 25 tons each in single castings, and no good opportunity for building a road, as the ground is quite rough. The engineering department solved the problem by devising a scheme for an inclined railroad, on which a car could be operated by small hoisting engines, air driven, placed on the front end, with their cables attached to a stationary cable, securely anchored. The track is of 6-ft. gage, constructed of heavy wooden cross-ties and standard railway steel. Two bridges and considerable grading were necessary. In some places the grade is fully 20%. The car is constructed of steel, except the bed, in which 12 by 12-in. timber was used. It is designed to handle the maximum load, 25 tons. By its use, the heavy pieces being transferred to it from the railroad cars by means of a crane, the 1,000,000 lb. of iron and steel comprising the big hoisting engine is being delivered without trouble.

In its concrete construction the Homestake company is using Cheyenne river sand, hauled about 100 miles to Lead. Part of it is coming from Edgemont, on the C. B. & Q. railway, and recently 80 cars were contracted for at Oral, on the C. & N. W. railway, to be used in the new work at the B. and M. shaft, boiler plant, etc., which is contiguous to the tracks of the latter-named railway. Recreation Hall is practically completed, and with the installation of the library furniture, which is being received, and the removal of the library from its present location, the building will be dedicated with fitting ceremonies. Last year a complete readjustment of tax matters was ordered by the state tax commission, which ordered that all taxable property be carried on the lists at its full market value. The county assessors returned a low value on the Homestake property, which was promptly raised by the commissioners of Lawrence county. Later the figures were reviewed by the state tax commission, members of which questioned T. J. Grier closely as to his opinion of the value of the Homestake properties. They finally decided that a proper valuation of all of the Homestake property in Lawrence county, which includes the mine, milling plants, hydro-electric plants, water rights, timber lands, moneys, etc., would be $16,610,170. This year the valuation has been returned by the county assessors at $16,864,571, a little more than $250,000 above last year. As the average tax rate is 20 mills on the dollar on the bulk of the property, the combined state, county, school, and city taxes paid by the Company is over $300,000.

Good progress is being made in sinking the three-compartment shaft of the Oro Hondo property, which is being developed by J. T. Milliken of Colorado. The shaft was 1050 ft. deep, with 1500 ft. of cross-cuts on the 1000-ft. level when Mr. Milliken took hold. A steam plant had been erected, and was practically intact, with a hoisting engine and air-compressor sufficient for prospecting. The necessary repairs were made, two 100-hp. boilers added to the two already installed, two steam pumps purchased from the Homestake, the water column repaired and in places renewed, the lateral workings bulkheaded with concrete, and many minor details completed, all of which consumed three months' time. Jack-

hamer drills are being used in sinking, and with three shifts of miners employed, Mr. Milliken hopes to push things to a conclusion at an early date. He proposes to go to the 2500-ft. point, if necessary, to reach the southerly extension of the Homestake orebodies. The Oro Hondo shaft is 2600 ft. southeast of the Ellison shaft of the Homestake company.

Work was suspended by the Dakota Continental Copper Co. on July 15. No future plans have been announced. Starting early this year the workings were unwatered and sinking commenced from the bottom at 813 ft. At a depth of 850 ft. sinking was discontinued and a station cut at 825 ft., from which a cross-cut was advanced 240 ft. through exceedingly hard ground. One quartz vein was found, but it was barren of copper. Previous to sinking, a Rumsey triplex electric-driven pump was installed in the station on the 700-ft. level.

To facilitate mining 'an ore vertical' in the shales, which has an average width of close to 8 ft., Ingersoll-Rand stoping drills are being used at the New Reliance mine. This vertical lately has been developed until there is at present exposed fully 100 ft. of backs over a distance of 1000 ft. It will be put into the mill at a minimum cost, with the aid of the new drills. A small compressor, of Ingersoll-Rand make, driven by a 15-hp. motor, has been installed in a station in the adit near the first stope, which is being carried up in the vertical.

JOHANNESBURG, TRANSVAAL

MEETING OF THE CROWN MINES, LTD., RESULTS OF AMALGAMATION SCHEME, COSTS, DIVIDENDS, AND FUTURE LIFE.

During the second week of June was held the annual meeting of the Crown Mines, Ltd., the most important gold mining concern on the Rand. The chairman of directors set himself the task and quoted figures to prove that the amalgamation represented by the Crown Mines had been a success. There is no doubt that among the different amalgamations on the Rand, this one has been the most successful, but even this Company's dividend has fallen 10% since the merging took place, so that to the ordinary shareholder the advantages of the consolidation do not so readily appeal. Since this happened Rand companies have all had to suffer the disadvantage of higher legislative burdens, and increasing taxation, not to mention labor troubles. It is admitted that the Crown Mines working costs have increased since 1908 to the extent of 60c. per ton, despite the fact that ore reduction costs are 24c. per ton less, and the tonnage mined has increased 50%. Mention was made by the chairman that miner's phthisis insurance and compensation had cost the Company 10c., and attempts to allay the dust another 4c., and ventilation 2c. per ton. These increases, however, are more than met by 24c. decrease in treatment, and 9c. in pumping charges, so that the increase in cost of 60c. per ton still remains unaccounted for. It might in all fairness be expected that with such an increase in the tonnage mined as 50%, the working cost would decline considerably, but such has proved not to be the case, and to most people the position remains unexplainable. As regards the decline of dividends it may be said that while working costs have increased, the same proportionate increase is not apparent either in the yield or working profits. Then the effect of the issue of £1,000,000 of debentures must not be overlooked as consuming some of the profits, the whole of which has been expended in consolidating and concentrating mining operations without adding to the dividend. It is interesting to note that by the increased use of machine-drills for stoping purposes, and may be by the extended use of cheap white labor, the ore mined per native employed has increased from 12.3 tons per month in 1911 to 16.4 tons per month in 1913, working costs in that time being lowered from $4.64 to $3.94 per ton.

NEW YORK

EFFECT OF THE EUROPEAN TROUBLE ON NEW YORK. GOLD MOVEMENTS. COPPER EXPORTS, AND SILVER MINES.—FLOTATION LITIGATION.

Everything in the mining world has been overshadowed during the past week by the European war cloud, and everyone has been so interested in what might happen next, and what its possible and probable effects will be, that only perfunctory attention has been given to routine affairs. The European situation has already had profound effects in New York. The Stock Exchange closed on July 31, for the first time since 1873, after having withstood a flood of selling orders for as long as it seemed safe to do so. Nominally, the doors were only closed until the following Monday, but no one expects them to open for some time, unless there is an immediate marked improvement in the situation. The cotton exchange is also closed, and the German steamers which were to have sailed from New York on July 31 and August 1 remained at their berths, while a steamer which was already some distance at sea was called back by wireless. American gold has been shipped to Europe by the ton, the high exchange rate serving to send it out of this country with great rapidity. The Philadelphia mint sent 45 tons of gold coin to New York in one day, and the Secretary of the Treasury has announced that $500,000,000 of emergency currency will be provided for the use of banks in this country. Many people are wondering whether to deposit their cash in banks, fearing that they may have the same difficulty in getting it out again that was experienced in 1907. Americans in Europe are hustling to get home again and are having the utmost difficulty in doing so, since many of the steamship lines have indefinitely suspended sailings. Exports of copper to Europe have, of course, ceased, and for the time being the copper market is non-existent. For a while at least, producers will have to carry their stocks, and such companies as the Copper Range, Mohawk, and Wolverine, which sell most of their copper abroad, will be most affected. Silver-mining companies ought to boom, as the insistent demand for gold will draw that metal away from India and China, and silver will have to take its place. The situation is altogether decidedly confused, and no one understands very clearly just what may happen. It is certain that the United States will suffer little in comparison with Europe, but even 'comparatively little' may be quite enough.

The beginning of a suit against the Miami Copper Co. by the Minerals Separation, Ltd., and the announcement that users of the Callow process will also be sued, has put a keen edge on the general interest in flotation. The Minerals Separation people believe that they have valid basic patents covering the essential features of successful flotation work, and in order to get them sustained they will have to wage a campaign of suing in the several federal jurisdictions. It is too bad that Minerals Separation, in beginning its operations in this country, exhibited English secretiveness, rather than American frankness. If pains had been taken to secure the confidence and sympathetic coöperation of operators, the latter would have realized in the beginning that it was better business for them to secure the experience and engineering skill of the flotation company, rather than to try to work out methods for themselves, with the danger of an infringement suit always in the background. There seems to be an impression that the English company has been trying to hold up American operators for an undue proportion of the profits accruing from the use of flotation, but there does not seem to be any valid basis of fact for such a belief. It is a pity that there should be so much misunderstanding, for the net result of lawsuits seldom shows a gain to anybody except lawyers and court attendants.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

Chisana

According to Lysle Brown, writing to Fairbanks, the new camp should be good for another year or so. 'Pay' has been found at 70 ft. on Dry Run, a tributary of Bonanza creek, two miles below Johnson City. Bacon is 75c., and nails are $1 per pound.——H. Harnshaw has a good number of men working on his options on 15 claims, which he will probably take up. He has paid about $70,000 to the owners, and has $50,000 more to pay.

ARIZONA

Gila County

(Special Correspondence.)—Less copper ore is being shipped from the Iron Cap mine to El Paso just now, and more development is under way. The orebody at 800 ft. has been opened for about 300 ft. east of the shaft, and a drift driven west at 160 ft. is showing rock containing iron and some copper. ——Seventy tons of 5 to 10% copper ore is being shipped daily to El Paso from the Superior & Boston. Development is resulting satisfactorily.——From the Warrior the daily tonnage sent to El Paso is about 100 tons.——In the Arizona Commercial a drift is being driven at 1200 ft. to connect with the Old Dominion at the same level.

Globe, July 23.

Mohave County

From the Tennessee mine in the Chloride district a large tonnage of ore is being sent to the Needles smelter. A good shoot has been opened at 900 ft.——Twenty miners have been added to the force at the Arabian mines.——The Frisco shaft is to be deepened and the mill started later. The latter may be remodeled and increased to 150-ton capacity.——A 5-stamp mill and concentrator are being erected at Little and Garnier's claim in the Wallapai mountains to treat gold-silver-lead ore.——The Union Basin company is shipping two cars per day of 46% zinc ore, containing a little gold and silver, to the Bartlesville, Oklahoma, smelter.——The Golden Gem gold mine has been unwatered to 350 ft., but timbers below 300 ft. are in bad order.——J. C. Hoffman is now manager for the Arizona Southwestern Copper Co. A shaft is to be sunk to 500 ft., and the mill remodeled.

Santa Cruz County

(Special Correspondence.)—The World's Fair mine is sending two cars of rich ore per week, and the Three R mine from 35 to 50 tons of copper ore per day. Both lots go to Douglas for treatment.

Patagonia, July 23.

Yavapai County

(Special Correspondence.)—California men have acquired 1600 acres of ground about Antelope Creek, near Stanton and Rich Hill, and nine miles west of Congress Junction. Coarse gold has been found nearby.

Congress Junction, July 23.

CALIFORNIA

According to the state mineralogist, F. McN. Hamilton, the more important field work on the mines and mineral resources of the state is all but completed, a year after the work was undertaken. Preliminary work on the report was started on August 1, and manuscript should be with the printer in the near future. A separate volume will cover the oil industry. In the general report all properties mentioned were personally visited by members of the staff of the State Mining Bureau. The work is the most complete ever attempted in the state.

Amador County

A large deposit of good talc has been cut in the pits of the Ione Clay Refinery.——The new 30-stamp mill at the Plymouth mine has been started, and 25 stamps are dropping.

Butte County

According to M. J. Cooney, president of the Forbestown Consolidated Mines, an important Canadian company has acquired its property at Forbestown.——Both Tokay and Muscat grapes have been sent East from J. H. Leggett's vineyard grown on old dredge tailing at Oroville. These grapes are of fine quality and much earlier than others in the state.

Calaveras County

The Calaveras Copper Co. is to be reorganized in Boston, and it is proposed to issue 60,000 preferred shares at $5 each par value, to bear non-cumulative dividends at 7% per year. The purchaser of this stock is to receive two shares of common stock of the present Company, which is 500,000 at $5, of which 373,750 have been issued. At the same time of this issue of preferred shares and payment of overdue interest, the mortgage of the Company is to be renewed for five years on the present terms. The $300,000 so raised is to be used as follows: immediate liabilities, accounts payable, $55,000; due for cash advanced to Company, $40,000; interest on unpaid coupons to July 1, 1914, $7700; interest on bonds due and unpaid to and including March 1, 1914, $81,000; making a total immediate liability of $183,700. Bond interest due on September 1, 1914, and March 1, 1915, amounts to $27,000. Probable bills receivable is placed at $28,000.

After paying everything there will be $117,000 available for general Company purposes. The property is to be placed in charge of a new manager, with for the present a consulting engineer approved by John Hays Hammond. Both favorable and unfavorable reports have been made about the mine, but the directors think that it has not been properly opened to prove what it is capable of producing. It was examined last February by S. M. Levy of Salt Lake City, who made the following statements: The property consists of 2835 acres of mineral, agricultural, and flowage land at Copperopolis. The mineral-bearing zone traverses the mineral land for about 13,200 ft., and in about 8000 ft. of this 15 shafts have been sunk from 50 to 1000 ft. deep. The last ore shipments made by the Company were from the latter depth, in the Union shaft. Fourteen shafts aggregate 4000 ft., and underground work totals nearly 26,400 ft. Water for irrigation and other purposes could be stored on the 1215 acres of flowage lands. On the property is a concentrating plant, which could treat 500 tons per day with certain improvements; sampling works; a blast and a reverberatory furnace to treat current concentrate and 100 tons per day of mine ore; a Nordberg compressor; hoist and head-frame at the Keystone shaft of 1000-ton capacity per day from 2000 ft.; dam for water supply costing $31,430; shops, offices, dwellings, etc. A total of about $1,950,000 has been spent to date on the property. Because of trouble with the smelter and lack of funds, work was suspended in June, 1913. Charles A. Stoneham, of the firm of Charles A. Stoneham & Co., has advanced the necessary com-

mon stock for the plan of reorganization from his own private resources. The directors are as follows: president, Charles M. Hayden; Oliver Ames, F. Lothrop Ames, James S. Ames, Samuel Carr, Gilmer Clap, and William J. Maloney; and secretary-treasurer, Herbert Goff.

The Royal Gold Mines Co. is being formed in Boston with a capital of $300,000 shares at $5 each par value. A large tonnage of $3 ore is opened in the mine. It was examined during the last few weeks by E. P. Jennings, of Salt Lake City, and Frank W. Page, of Boston. There is a 120-stamp mill on the property. Ore worth $2.50 per ton should yield a profit of $1 per ton.

Eldorado County

Owners of the Mt. Pleasant mine near Grizzly Flat hope soon to re-start work. As the ore is somewhat refractory, it is probable that a new mill and cyanide plant will be erected. ——A diamond-drill is working at the Pacific mine controlled by English interests.

Inyo County

Utah men who are leasing the Cerro Gordo mine near Keeler are said to be doing well. An ore-shoot has been opened for 150 ft. and 3 ft. wide, and has also been cut at 200, 400, 500, and 700 ft. depth. The present output is 20 tons of $50 silver ore per day. L. D. Gordon is in charge.

Nevada County

A temporary restraining order has been issued by the court prohibiting the Jerry Goodwin hydraulic mine at You Bet from being worked, on account of dirty water in the Bear river.

Placer County

A large dredge is to be constructed by L. Gardella, of Oroville, on property bonded by the Newcastle Mining Co. at Gold Hill, and bought by Mr. Gardella. The area is between Auburn and Lincoln.

Riverside County

In the Ironwood mining district, the Assets Realizing Mines Corporation of Los Angeles is developing about 300 acres at an altitude of 1800 ft. The claims include the Arica, Big Butte, Crescent, Eldorado, and January 1, 2, 3, 4, 5, 6, and others. Six veins run through the property having dolomite hanging and schistose foot-walls. About 18,100 tons of gold-silver ore worth $362,000 is ready for stoping, and dumps contain $60,000. There is a fair equipment at the mines. A 20-stamp mill lies at Blythe Junction, ready for hauling and installation. J. V. Priest is general manager for the Company.

Shasta County

On August 2 the Victor Power & Mining Co. paid at Red Bluff, Tehama county, $25,000 in cash to the Midas Mining Co. as a first payment of $175,000 for the Midas mine in Harrison gulch, Shasta county. W. H. Roberts, of San Francisco, is one of the largest shareholders in the Midas. R. D. Jackson is to manage the combined properties, and H. S. Waiste is to be superintendent of the Midas.

Additions to the Mammoth company's bag-house at the smelter at Kennett are practically finished. Three blast-furnaces are working.

Sierra County

The Great Henk, Bull Moose, Squires, and other mines, in Secret cañon, have been sold by George W. Henk to the Western States Mining & Development Co. for about $100,000.—— Some lead-silver ore has been cut in the Tippecanoe mine above Pike City by J. A. McKenzie.

YUBA No. 14 DREDGE, NEAR MARYSVILLE.

Yuba County

With a capital of $250,000 and a mine in Esmeralda county, Nevada, the Congress Consolidated Mining Co. has been incorporated at Marysville. The president is I. Sanford; vice-president, M. V. Oschewski; secretary, George Richards; and treasurer, C. M. Honey——Dredge No. 4 of the Yuba Consolidated Goldfields Co. at Hammonton is being remodeled, a steel hull replacing the present wooden one. No. 3 boat is to be overhauled.

A first payment of $10,000 has been made by Guggenheim interests for 300 acres of dredging ground on the Yuba river near Hammond. The full price is $209,500. It is reported also in Marysville that the Natomas Consolidated is acquiring 600 acres adjoining. These properties extend from Yuba No. 14 boat to Park's Bar bridge, and then to the Narrows. Local people owned the land.

COLORADO

Colorado's mine output of the principal metals in 1913 showed a decrease in value of $1,871,668 compared with 1912, according to Charles W. Henderson, of the U. S. Geological Survey. The total gross value of recovered metals in 1913 was $35,449,298, $18,146,916 in gold, 9,325,255 oz. of silver, 87,620,364 lb. of lead, 7,298,269 lb. of copper, and 119,346,429 lb. of zinc (in terms of spelter and zinc in zinc oxide). There were decreases of $441,646 in gold and 12,876,383 lb. in zinc and increases of 1,113,185 oz. in silver, 12,378,097 lb. in lead, and 190,966 lb. in copper. The heaviest decrease in value was $2,439,974 for zinc, but there were increases of $582,031 for silver and $469,394 for lead.

The number of mines producing metals in 1913 was 858, of which 29 were placers, against 856 mines, of which 33 were placers, in 1912. In 1913 the ore mined or treated in the state of Colorado totaled 2,727,316 short tons (mostly measured dry weight), an increase of 150,690 tons over the output of 1912. Of this total, 1,602,785 short tons went to gold and silver mills, 459,533 tons went to mills for concentration only, and 664,998 dry tons went crude to smelters; 217,865 dry tons of concentrate was treated at the smelters.

Boulder County

Rich sulpho-telluride ore has been opened by C. L. Neilson near Sunset. The discovery is similar to the Orphan Boy ore in 1894.

Gilpin County

According to the *Weekly Register-Call*, of Central City, reliable mining news from this county's mines is scarce, as the majority of operators refuse to give any details of work or production.

Lake County (Leadville)

A contract for power to pump water from the 'downtown' mines has been let by Jesse F. McDonald to the Colorado Power Co., the total being 1000 hp. The Down Town Mines Co. has purchased electric centrifugal pumps in Switzerland. ——A great deal of the zinc carbonate ore produced in the district comes from the Fryer Hill area.——The Siwatch Leasing Co. has secured a lease on the Siwatch tunnel and included properties in the Sugar Loaf district.——The new zinc smelter is now in full blast.——Another patch of two tons of gold ore in the Pat Connors lease of the Little Jonny assayed 303 oz. per ton.——Electric machinery is being installed in the Walker tunnel.

Ouray County

Profit of the Camp Bird mine for June is estimated at £9819.

San Miguel County

The Tomboy mill treated 11,500 tons of ore in June, yielding bullion worth $43,000, and 1150 tons of concentrate worth $47,000. Including the tramway profit of $1000, the total profit was $42,000.

Teller County (Cripple Creek)

An aerial tramway is to be erected to carry ore from the Midget mine to the Moon Anchor loading station on the high line electric road. There are 15 sets of lessees at the property.——With the 3c. dividend paid on July 25 by the Vindicator company was a circular from the president, Adolph J. Zang, covering the past quarter's work. No. 1 shaft was sunk to 1820 ft. and a station prepared at 1780 ft. This is equal to 1650 ft. in the Golden Cycle, and drainage is improved thereby. Shaft-sinking is again under way. Development at 1600 ft. was good, and No. 1 south vein is from 6 to 35 ft. wide for 600 ft. long, and of good grade. Work on No. 2, 3, and 4 veins opened several hundred feet of ore. No. 1 north vein, on this level, is 640 ft. long and 6 ft. wide of good grade. A spur or shoot from this is 20 by 80 feet. The steel frame of the concentrating plant is being erected, and machinery is ready for installation. A compressor which has worked for 15 years is to be replaced by an electrically driven machine costing $10,000. Extension of the Roosevelt drainage tunnel will greatly help the property, and $40,000 is to be contributed to the work by this Company. The output of the mine for the first half of 1914 was 12,000 tons, worth $250,000 net on Company account, and 8000 tons worth $160,000 on lessees' account. The latter produced $38,000 in royalties. The Company's total profit was $150,000.

Earnings of the Mary McKinney company for the first half of 1914 were $111,137, and expenditure $80,156. Three dividends, totaling $78,585, have been paid this year. The cash balance is $75,810.——A shipment from the Caley lease on the Jerry Johnson ground brought 96.55 oz. gold per ton.

Owing to continuous rain and subsequent seepage water, surface prospecting, ore haulage, and underground work in the district is being hampered. Both the deep levels of some mines and shallow shafts of others have been flooded. The main shaft of the Gold Dollar company has been temporarily shut down.——The output of the district is estimated by local authorities as follows, a railroad strike, floods, and bad roads reducing the yield:

Plants.	Tons.	Av. val.	Total val.
Golden Cycle	24,500	$20.00	$490,000
Portland (Colorado City)	7,500	20.00	150,000
Smelters	3,800	55.00	209,000
Portland (Cripple Creek)	18,000	2.44	43,920
Stratton's Independence	11,600	2.80	32,480
Colburn-Ajax	3,723	5.00	18,615
Kavanaugh-Jo Dandy	1,500	2.00	3,000
Gaylord-Dante	1,400	2.20	3,080
Wild Horse	1,100	3.60	3,960
Isabella	1,000	2.00	2,000
Total	74,123		$956,055

Dividends totaled $253,807.

Work has been actually started in extending the Roosevelt drainage tunnel, and good progress is expected.

IDAHO

The mine output of gold, silver, copper, lead, and zinc in Idaho, according to C. N. Gerry, of the U. S. Geological Survey, increased in value from $21,466,521 in 1912 to $24,149,049 in 1913. The production of all the metals except gold increased. The Coeur d'Alene region, the main producing area of the state, had a greatly increased production, especially in silver, lead, and zinc. The gold output had a value of $1,344,559, or $36,655 less than that of 1912. The production of silver increased from 8,294,745 oz., valued at $5,101,268, in 1912, to 9,989,193 oz., valued at $6,033,473, in 1913. There was an increase in the copper output from 7,492,152 lb., valued at $1,236,205, in 1912, to 9,592,966 lb., valued at $1,486,910, in 1913. All records were broken in the production of lead, which increased from 284,185,657 lb., valued at $12,788,355, in 1912, to 317,871,945 lb., valued at $13,986,366, in 1913. An unusual production of zinc ore increased the spelter output from 13,905,502 lb., valued at $959,479, in 1912, to 23,173,953 lb., valued at $1,297,741, in 1913. There were 384 producing mines in the state in 1913, against 408 in 1912. The total quantity of ore shipped and treated in 1913 was 2,451,592 tons, against 2,266,334 tons in 1912.

Shoshone County

The Bunker Hill & Sullivan company paid dividend No. 203 on August 4, amounting to $81,750. The total to date is $15,383,250.——Milling is to be resumed at the National Copper mine in a few weeks. Development was said to be a year behind shipping and mill requirements.——Affairs of the Idora Hill company are being settled, and work has been resumed at the mine.

MICHIGAN

Houghton County

The various mining companies have 17,205 names on their payrolls, and wages payable in July were $1,341,990, more than ever before. Details of men employed are as follows, according to *The Daily Mining Gazette* of Houghton:

Mine.	July 1914.	July 1913.
Calumet & Hecla	5,747	4,107
Ahmeek	818	830
Allouez	461	308
Osceola	1,230	1,143
Centennial	245	118
Tamarack	532	610
La Salle	106	43
Isle Royale	742	709
Superior	205	162
Winona	472	300
Wolverine	410	387
Mohawk	750	851
Quincy	1,561	1,483
Hancock	200	161
Copper Range	2,958	2,716
Franklin	68	322
Total	16,505	14,250

Others employed at small properties bring the present total to 17,205. Last year's figures are those of the day before the strike, July 22. The Calumet & Hecla and subsidiaries are employing over 10,000 men.

MISSOURI

Jasper County

The Granby Mining & Smelting Co. has put down 34 drill-holes during the past few months, cutting 6% blende at 200 to 250 ft. The ore is disseminated through flint, which underlies a hard cap of limestone. The Company has started shaft-sinking near the Mascot mine at Granby.——At the Golden Rule mine nearby, four drill-holes have cut 20% blende at 90 to 105 ft., and a shaft is to be sunk to open this ore.

Discussing the Joplin district recently, the *Joplin News Herald* gave the following opinion: As the year advances it becomes more and more certain that the immediate Joplin camp is losing in importance so far as productiveness is concerned. The passing years see strange changes in the relative positions of the various camps of the district. Some 10 or 12 years ago Galena, Kansas, was the heaviest producing camp of the entire district, which at that time took in the corners of only two states, Missouri and Kansas. Since then Oklahoma has been added to the list of producing states. After Galena had been crowded out of first position by the Joplin camp, the Missouri district was in the lead for several years. Later Webb City, Missouri, took the lead, the heavy production from the sheet-ground mines putting this camp in first place, with Joplin second, while Galena last year was crowded down to fifth place. It now seems that Joplin is no longer destined to occupy even second place, the new Miami, Oklahoma, district having gained so rapidly in the last few years that this field, which even now is second in production of lead ore, promises to be advanced in zinc-ore production very shortly. The Alba-Neck City, Missouri, district, which ranked well up toward the top of the list five or six years ago, dropped to as low as sixth place last year, but this year will probably show a much larger output, due to the opening of a number of heavy producing mines in that field. Lawton, Kansas, is a new camp that is showing remarkable gains. The Badger-Peacock district, in Kansas, which ranked near the top of the list several years ago, is today producing nothing, and all the rich old mines are filled to the surface with water.

MONTANA

Fergus County

Considerable ore has been opened in the Piegan-Gloster claims of the Barnes-King Development Co., and it is proposed to erect a stamp-mill and cyanide plant with a large capacity.

Silverbow County

The second quarter's report of the North Butte Mining Co. contains the following: Development totaled 3450 ft. The Granite Mountain shaft was sunk to 40 ft. below the 3000-ft. station. Stations were finished at 2200 and 2800 ft., and connection made between this and the Speculator shaft on the 2200-ft. level. Work on the Edith May and Snowball veins was satisfactory, while the Jessie vein was found faulted considerably. Production was 102,292 dry tons of ore and 6 tons of precipitate yielding 5,446,097 lb. copper, 331,359 oz. silver, and 336 oz. gold. On June 30, 1914, assets included cash, $282,978; supplies at mine, $51,766; and copper and silver on hand, $1,630,372; while liabilities included accounts payable, $145,947; advances on metals, $825,801; unpaid treatment charges (not due), $167,279; and surplus and reserves, $3,283,-142.

A quarterly report from the Davis-Daly Copper Co. shows that the Colorado shaft is down 2208 ft., in spite of high temperatures and a heavy flow of water. Work was done at 1450 ft., totaling 364 ft., and cross-cutting at 1750 ft. is under way. The level has caved a good deal. The shaft is to be sunk to 2600 feet.

Extraction at the new Elm Orlu plant at Butte is from 96 to 97% of the zinc content of the ore. The Minerals Separation process is used.

In order to curtail copper production, the Great Falls smelter and seven mines at Anaconda have been shut down.

NEVADA

Churchill County

The Nevada Hills mill treated 5540 tons of ore worth $7.27 per ton in June, with a net profit of $6904. Development totaled 547 ft., and 2059 cu. ft. at a cost of $1.04 per ton. The Company's resources are $228,847.

Esmeralda County

The estimated production of the Goldfield Consolidated mine in July is as follows: Ore mined, 24,575 tons; gross extraction, $314,000; operating expenses, $155,000; and net realization, $159,000.

Lander County

McCoy is a new mining district situated 30 miles south of Battle Mountain, on the Southern Pacific railroad, and promises to be a fair gold-lead-copper area. Rocks of the district are granite, basalt, limestone, sandstone, and quartzite. Gold ores are found in porphyry, while the other two ores are in limestone.

Lyon County

No. 2 furnace at the Mason Valley smelter has been repaired. During the last week of July the whole plant treated 4519 tons of ore.

Nye County

The West End Consolidated Mining Co. has declared a dividend of 5c. per share, or $89,424. The total to date is $357,696. ——A rich shoot of ore has been opened in the Extension at 950 ft.——The Tonopah Mining Co.'s second quarterly report shows that the yield was $612,290, at an expense of $315,759. Adding sundry income, and deducting exploration, and Brown patent suit ($4716), the net income was $351,404. A dividend of $250,000 was paid on July 21. The surplus is $1,638,-222.—Nine mines at Tonopah produced 11,998 tons of ore worth $228,650 during the past week.

The Round Mountain and Round Mountain Sphinx companies have been consolidated under the name of the Round Mountain Mining Co., thus ending years of litigation over extralateral rights in Las Gazabo claim. The Sphinx company was paid 175,000 shares and $20,000 cash for its property. The area now controlled by the new Company is nearly 800 acres. From about 110 ft. depth the Sphinx has produced $75,000. The Round Mountain is producing 5000 tons of ore per month, the June profit being $21,000. The Keane vein is 5 ft. wide at 700 and 800 feet.

NEW MEXICO

Santa Fe County

(Special Correspondence.)—The Santa Fe Dredging Co. is installing a new plant on its 600 acres near Golden, 15 miles south of Cerillos. It will be driven by electricity.——The old gold mine at Dolores is idle. It has produced over $1,000,000 from down to 500 ft.——A large company has been organized to construct a dam across the Rio Grande in White Rock cañon, 16 miles west of Cerillos, and about the same distance from Santa Fe. Electric power will be generated from a head of 500 ft. to supply nearby towns and mines.

Cerillos, July 31.

UTAH

Juab County

It is stated that mills using the Christensen process are to be erected at the Grand Central and Central Eureka mines.

Salt Lake County

Eight new prospecting drill-holes have been put down this year by the Utah Copper Co., proving ore to a depth of 450 ft. so far. The mines and mills of the Company will not be operated on Sundays until further notice. This will reduce the copper output by 1,500,000 lb. per month.

Summit County

At 700, 800, 900, and 1000 ft. the American Flag mine at Park City is opening well. About 100,000 tons of $15 ore is ready for the new mill, which is almost completed.——Ore has been opened in a raise from 1700 ft. in the Silver King Consolidated.

WASHINGTON

Ferry County

(Special Correspondence.)—In 1908 this county made an agreement and contract with Richard Mulray, of Republic, to lease the Republic and Cecelia quartz lode mining claims for two years, and give him the right to purchase them for $40,000 on or before March 3, 1910, the royalties agreed on to be applied to the purchase price. He and friends formed the Republic Leasing Co., which assigned its rights to the New Republic company. Some payments were made, and an extension of time given. On July 22, 1914, the county delivered a quit-claim deed to the Republic mine on the final payment of $16,949 by Frank A. Babcock, John T. Hollis, and Fred Kienbaum, parties of the second part of the deed and interested in the New Republic company. The rights of the latter passed to the Rathfon Reduction Works Co. In the quit-claim deed, Ferry county, as the party of the first part, for the sum of $40,000 paid by Richard Mulray and associates, as the Republic Leasing Co., the New Republic company, the Rathfon Reduction Works and the said parties of the second part, conveys to them the mining claims, subject to all rights of any person or corporation under the agreement, and without the party of the first part being responsible for any failure in title in the county to said property, etc.

In order to borrow money for its corporate purposes, the British Columbia Copper Co. has mortgaged its lands, mines, and other property in British Columbia and in Ferry and Stevens counties of Washington. On July 1, 1914, a mortgage or trust deed was recorded in Ferry county in which the Company, incorporated in West Virginia, conveyed to the Canadian Copper Corporation, Limited, of Virginia, the above properties so as to secure the issue of notes amounting to $1,000,000, finally maturing on April 1, 1923.

Republic, July 25.

CANADA

British Columbia

From March 1 to June 30 the Granby company's smelter at Hidden Creek produced 2,163,863 lb. of copper from 63,255 tons of ore.——A good deal of work is being done by the Quatsino company in the Elk Mountain district of Vancouver Island, where it bought a copper property from Conrad Wolfe and other Spokane men for $500,000 last January. Ore production will start in a few months.——The quarterly statement of the chief inspector of mines, Thomas Graham, covering coal and metal mine fatalities in British Columbia, shows that there was one and nine men respectively killed, making eight and fourteen for the half-year.

Ontario

The Buffalo mill treated 6950 tons of 22.83-oz. silver ore in June, the recovery being 124,262 oz. No silver was sold during the month.——According to the president of the Nipissing Mines Co., E. P. Earle, the property is in good order despite rumors to the contrary. Net earnings for the first half of 1914 were $900,000, or 50% in excess of dividend requirements. The next period will equal this figure. Recovery at the low-grade mill is 90%, and at the high-grade mill certain alterations will eliminate the use of mercury. This Company is to develop the Teck-Hughes mine at Kirkland Lake on a working option basis. Ore worth $42 has been opened for 120 ft. at the 75-ft. level.——A recent shipment of 51 tons from the Tough-Oakes, in the same district, averaged about $500 gold per ton. At No. 7 level the shoot is 180 ft. long, averaging $100 per ton over 22 in. Excavating for the new mill is in progress.

Yukon

At the Treadgold property on Dominion creek operations are along usual lines, that of washing muck from the surface by sluicing. A new machine known as the Lubecker dredge and excavator is to be tried this season. This is a German invention and weighs about 70 tons. Digging is done by a series of buckets which drag gravel toward the machine. A depth of 70 ft. or a similar height can be dug. A washing plant will be placed near the excavator. Charles P. Dolan and David Elliot, of the Treadgold company, have been in England investigating the machine.

KOREA

The Oriental Consolidated reports as follows for May:

Stamps Working	240
Ore crushed, tons	28,065
Bullion from 9 plants (a record)	$169,038
Net profit	82,076

The Taracol cyanide plant treated a product worth $69,000, with 80% recovery. The Kuk San Dong mill was to be shut down for June, but will run in July or August.

MEXICO

Sonora

The mine-rescue helmet men who came to Cananea to put out fires in the Veta Grande and Oversight mines have returned to Bisbee, Arizona, with J. P. Hodgson, superintendent of the Copper Queen mines, and Wallace E. McKeehan, safety-first supervisor at the mines. Two stopes in each of the Cananea properties were burned out, between 400 and 500 ft. of timbered drifts, and No. 11 shaft of the Oversight. The latter fire was a difficult one to control.

PERSONAL

J. P. SMITH is in Alberta.

A. P. BUSEY was in San Francisco.

HENRY TSCHETSCHOTT is at Dawson.

H. S. GALE left Berkeley for Reno, Friday.

THOMAS T. READ has returned to New York.

W. H. LOVELETT is at Kanwa, Belgian Congo.

R. S. RAINSFORD has gone to Detroit, Michigan.

E. O. ULRICH is at Madison, Wisconsin, for the summer.

J. KOJIMA will attend the Salt Lake meeting of the Institute.

A. W. JENKS is up from the Argentine and will live at Berkeley.

ELMER E. FICKERT, of the University of North Dakota, is in San Francisco.

ALBION S. HOWE is at Minas Matahambre, Cabezas, Pinar del Rio, Cuba.

J. V. N. DORR is planning to attend the Salt Lake City meeting of the Institute.

H. C. HOOVER is taking an active part in the relief of Americans stranded in Europe.

NORMAN C. STINES has recently been in Sweden, but has returned to the Sissert mine in Russia.

THEO. C. NAEDELE has left the employ of the Braden Copper Co., and is now at Norwich, Connecticut.

THOMAS W. LAWSON has been for some time at the ranch of his son-in-law, in Creek county, Oregon.

ROSS HOFFMANN and KARL HOFFMANN are among Americans caught in Germany by the outbreak of the war.

JOSEPH RALPH is in Salt Lake City, where he will remain for an indefinite period, owing to business connected with liquidation of the Glasgow & Western Exploration Co., Ltd.

The SAN FRANCISCO SECTION of the American Institute of Mining Engineers held a dinner and meeting at the Engineers' Club, Thursday evening. Mr. C. E. van Barneveld discussed plans for the mining and metallurgical exhibit at the Exposition in 1915, and the general subject of Institute headquarters on the ground was also up. Arrangements were made for a party to attend the Salt Lake meeting of the Institute as representatives of the local section. Among those going will be C. W. MERRILL, F. G. COTTRELL, JAMES M. HYDE, J. C. RAY, H. FOSTER BAIN, WILLIAM HAGUE, and ROBERT H. BEDFORD.

The A. I. M. E. Salt Lake Meeting.

The program for this, August 10 to 14, includes the following: Headquarters will be at the Hotel Utah, and members and guests will register on the first day at Room C-38 and receive badges, booklets, and programs of the meeting. There will be an organ recital at the Mormon Tabernacle at 2:30 p.m., after which sight-seeing cars will convey the visitors around Salt Lake City. At 8:30 p.m. a technical session will be held in the ballroom of the hotel. On the second day the party will leave by special trains for the mines at Bingham, the Magna and Arthur concentrating plants, and the smelter at Garfield. The evening technical session will be held at 8:30 p.m., in the hotel. On the third day the party will leave by special train at 8:30 a.m. for a trip to the smelters at Murray, Midvale, and Tooele. The evening session for discussion of papers will be at the usual hour. On August 13 a technical session will start at 9:30 a.m. Members who do not care to attend this session will have the option of a trip to the mines at Park City, and some bathing in Great Salt Lake. On the last day, automobiles will convey everybody to Big Cottonwood cañon, while if desired members have the option of going to the Tintic district. A banquet will be held in the evening.

SOCIETY MEETINGS

AUGUST	
American Institute of Mining Engineers, Salt Lake City	10-14
British Association, Adelaide, South Australia	8
Canadian Mining Institute, Rocky Mountain branch, Banff.	
Lake Superior Mining Institute, Ishpeming, Michigan	31 to Sept. 3
SEPTEMBER	
American Chemical Society, Montreal	15-18
American Institute of Electrical Engineers	not fixed
Colorado Scientific Society, Denver	3
Illuminating Engineering Society, Cleveland	21-25
OCTOBER	
American Institute of Electrical Engineers	9
American Iron and Steel Institute	23-24
Colorado Scientific Society, Denver	3
NOVEMBER	
American Institute of Electrical Engineers	13
Colorado Scientific Society, Denver	7
DECEMBER	
American Institute of Electrical Engineers	11
American Museum of Safety	11-20
American Society of Mechanical Engineers	7-8

SCHOOLS AND SOCIETIES

The Institute of Metals will hold its autumn conference at Portsmouth, England, on September 10.

The University of California reports that it has 9000 correspondence students, of whom 1000 are taking extension courses in various subjects of university grade, and 8000 are taking free courses in agriculture.

At the American Institute of Mining Engineers' meeting at Salt Lake City next week, will be read 50 papers, which have already been published in the July and August *Transactions* of the Society. Among the papers are the following: 'Biographical Notice of Louis Janin,' by R. W. Raymond; 'Losses of Zinc in Mining, Milling, and Smelting,' by Dorsey A. Lyon and Samuel S. Arentz; 'Smelting Lead Ores in the Blast-Furnace,' by Irving A. Palmer; 'The Mill and Metallurgical Practice of the Nipissing Mining Co., Ltd., Cobalt, Ontario, Canada,' by G. H. Clevenger; 'Unit Construction Costs from the New Smelter of the Arizona Copper Co., Ltd.,' by E. Horton Jones (a most valuable article of 154 pages, a recapitulation of which appears on the 'Concentrates' page of this issue); 'Nodulizing Blast-Furnace Flue-Dust,' by Lawrance Addicks; 'Effects of the Bag-House on the Metallurgy of Lead,' by L. Douglas Anderson; 'Ancient Auriferous Gravel Channels of Sierra County, California,' by Mark N. Alling; 'The Descriptive Technology of Gold and Silver Metallurgy,' by A. W. Allen; 'Dip Chart,' by Howland Bancroft; 'Basic-Lined Converter Practice at the Old Dominion Plant,' by L. O. Howard; 'Tests of Rock-Drills at North Star Mine,' by Robert H. Bedford and William Hague; 'Mining Methods of the Copper Queen Mines,' by Joseph P. Hodgson; 'The Design, Construction, and Cost of Two Mine Bulkheads,' by Sidney L. Wise and Walter Strache; 'Leaching Experiments on the Ajo Ores,' by Stuart Croasdale; 'The Dorr Hydro-Metallurgical Apparatus,' by John Van N. Dorr; and 'Methods and Economies in Mining,' by Carl A. Allen.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

Metal markets are badly upset as a first result of the war in Europe. The Copper Producers' Association found it impossible to make a report for July, and cessation of European demand has already been reflected in the closing of the Great Falls plant and a number of Butte mines. As noted elsewhere, the Utah and other big companies are hereafter to observe Sunday as a holiday and, in general, production is certain to decrease, at least temporarily. The tin market is even more sensitive. The Banca sale of July 30 was indefinitely postponed, and tin shipments by way of Europe are likely to cease altogether for the present. While they can easily be re-established by way of Panama, any such readjustment is not easy to make, and higher prices are probable for some time. Lead and zinc markets depend less on Europe, and are less likely to be affected, except as all business is likely to stagnate.

LOCAL METAL PRICES

San Francisco, August 6.

Antimony	No quotes
Electrolytic copper	" "
Pig lead	3.90
Quicksilver (flask)	No quotes
Tin	" "
Spelter	" "

Zinc dust, 100 kg. zinc-lined cases, 7½ to 8c. per pound.

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, August 6.—The copper market is at a complete standstill, and there are no quotations to be had. Dealers in London quote £70 per ton, or 15.30c. per lb. There is good demand for both lead and spelter. Between St. Louis and New York prices for lead there is a difference of 0.15c. No quotes are available for silver either here or in London. Samuel Montagu & Co., of the latter centre, on July 23 stated that the market was likely to remain sensitive to the daily attitude of Indian and Chinese operators. But with the present war nothing can be predicted regarding this metal. The American Smelting & Refining Co. has announced that it will buy silver ore at its smelters at 25c. per oz. cash for actual silver content, and the difference at a future date between that figure and whatever the market quotations may be. The Selby smelter will apply this new regulation. In the recent great sales of stocks in New York, copper and gold mining shares suffered less than other issues. Copper exports in July were 34,141 tons.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.		Average week ending	
July 30	52.25	June 24	56.24
" 31	No quotes	July 1	56.58
Aug. 1	" "	" 8	56.42
" 2 Sunday		" 15	55.60
" 3	" "	" 22	54.14
" 4	" "	" 29	53.42
" 5	" "	Aug. 5	No quotes

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per pound more. Prices are in cents per pound.

Date.		Average week ending	
July 30	No quotes	June 24	13.55
" 31	" "	July 1	13.28
Aug. 1	" "	" 8	13.44
" 2 Sunday		" 15	13.47
" 3	" "	" 22	13.25
" 4	" "	" 29	12.87
" 5	" "	Aug. 5	No quotes

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	13.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
July 30	3.85	June 24	3.90
" 31	3.85	July 1	3.90
Aug. 1	3.85	" 8	3.90
" 2 Sunday		" 15	3.90
" 3	3.85	" 22	3.90
" 4	3.85	" 29	3.85
" 5	3.85	Aug. 5	3.85

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	....
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
July 9	37.50	July 23	37.50
" 16	37.50	" 30	37.50
		Aug. 6	No quotes

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

Owing to the war there is no quotation made in San Francisco for quicksilver. The principal dealers in the market here state that New York quotes $60 per flask. Supplies from Austria, Italy, and Spain, which countries produce about 94,000 flasks per year, against 20,213 flasks in the United States, are cut off for the present.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
July 30	4.75	June 24	4.85
" 31	4.75	July 1	4.75
Aug. 1	4.75	" 8	4.75
" 2 Sunday		" 15	4.75
" 3	4.75	" 22	4.75
" 4	4.75	" 29	4.75
" 5	4.75	Aug. 5	4.75

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	....
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per pound higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	....
Mch.	46.95	38.10	Sept.	42.45	....
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

MINERAL STATISTICS

The following data, covering the year 1913, is from the U. S. Geological Survey:

TRIPOLI AND DIATOMACEOUS EARTH

The production of tripoli and of diatomaceous earth in 1913 was the largest in the history of the industry, being valued at $285,821, more than twice as much as that of the year previous, when it amounted to $125,446. The amount of tripoli produced in 1913 was 20,797 short tons, valued at $216,581, and that of diatomaceous earth, 6586 short tons, valued at $69,240. Tripoli is used as an abrasive and for other purposes, but much of it is used in the manufacture of filters. It is also used as a paint, wood filler, metal polish, in soaps, in cleansers, and for making glass and facing foundry molds. Diatomaceous earth is used as an abrasive in the form of polishing powders and scouring soaps. Lately it has been found to be valuable in the manufacture of dynamite, as an insulating packing material for safes, steam pipes, and boilers, and as a fireproof building material.

COAL OUTPUT OF MARYLAND

Coal mined in Maryland in 1913 amounted to 4,779,839 short tons, valued at $5,927,046, according to figures compiled by E. W. Parker in coöperation with the State Geological Survey. This was less than the amount mined in 1912 by 184,199 short tons, but the value showed a gain of $87,967 and exceeded that of any other year since 1907.

The record of individual efficiency by the miners of Maryland is high. In 1913 the 5645 men employed in the coal mines of the state worked an average of 248 days, with a production per man of 847 tons. This is an exceptionally good average when it is considered that 4,373,920 tons, or 91.5% of the total, was mined by hand. The quantity of coal shot off the solid was only 293,950 tons.

POTTERY PRODUCTION

The value of pottery products of the United States in 1913, according to Jefferson Middleton, was $37,992,375, the largest yet reported, exceeding that of 1912 by $1,488,211. In 1913, as in 1912, only one variety decreased in value, namely, stoneware, which declined $236,211. The value of white ware, including china but excluding sanitary ware and porcelain electrical supplies, was $17,490,871 in 1913, compared with $17,006,736 in 1912, an increase of $484,135. If the value of sanitary ware and porcelain electrical supplies is added, the total for 1913 is $31,443,450. Chinaware showed an increase in value of $246,755. This product has increased in value almost steadily since 1902, the value in 1913, the highest recorded, being nearly twice as great as it was eleven years ago. Red earthenware showed an increase of $42,259 over 1912, white ware $237,380, and sanitary ware $312,583.

Ohio is the leading pottery-producing state in the Union, reporting for 1913 wares valued at $16,519,889, or more than 43% of the total, an increase of $1,011,154. Her principal pottery product is white ware, which constituted nearly 64% of the value of Ohio's entire pottery output in 1913. The second in importance is porcelain electrical supplies. New Jersey is the second largest pottery-producing state, producing wares valued at $8,838,545, or more than 23% of the total. West Virginia is the third in rank among the pottery-producing states, reporting for 1913 ware valued at $3,424,887. Pottery imported into the United States in 1913 was valued at $10,177,451, and this added to the domestic production made a total of $48,169,826. After deducting exports, domestic $559,163 and foreign $34,816, the net apparent consumption was valued at $47,575,847, of which the domestic production was nearly 80 per cent.

COMPANY REPORTS

ENGLISH CROWN SPELTER COMPANY, LTD.

This Company operates zinc mines in Bergamo province, Italy, and smelting works in Wales. In 1913 there was mined 4728 tons of carbonate and 2130 tons of blende, all high grade; also 13,229 tons of low-grade ore was concentrated. Calcined carbonate and raw blende shipped to Swansea averaged 41% zinc. The retorts treated this with other ores and yielded 7194 tons of spelter. The year's profit was £4044, and adding the last balance there was available £9375, of which £8400 was paid in dividends, equal to 10 per cent.

SNOWSTORM MINING COMPANY

This Company operates a property near Larson, in the Coeur d'Alene district of Idaho, and the report of the president and general manager, Leo Greenough, for the past year includes the following information: Shaft-sinking, cross-cutting, driving, and raising above and below the 1600-ft. level cost $50,150. There was mined 99,501 tons of ore, of which 20,108 tons assaying 4.16% copper and 5.41 oz. silver per ton was shipped, and 79,393 tons of 3.13% copper and 4.52 oz. silver was concentrated. Revenue from ore and concentrate was $505,224, and $53,775 from the boarding-house. Operating expenses were $257,069, including $50,784 for the boarding-house. Development, installation of flotation plant, acquisition of the Ada claims, and lease on the Missoula property cost $152,904. Net earnings were $156,045, and $22,492 was paid in dividends. Cash in bank on July 1, 1914, was $54,039, and total net surplus $226,647.

GREAT BOULDER PROPRIETARY GOLD MINES, LTD.

In the heart of the 'Golden Mile' at Kalgoorlie, Western Australia, this Company has 85 acres of ground, surrounded by the Perseverance, Lake View, Chaffers, Horse-Shoe, Ivanhoe, and Boulder No. 1 properties. The 1913 report of the general manager, Richard Hamilton, contains the following information on the various departments, in charge of the following, mine, J. Warwick; engineer, G. Ridgway; and metallurgist, A. Fraser. Development amounted to 2525 ft., a total of 113,013 ft. to date. Diamond-drilling, for which this mine is so noted, was actively continued without important results. A total of 2053 ft. was bored, making 50,125 ft. to date. Ore reserves are as follows:

Shaft.	Depth, feet.	Tons.	Av. content.
Main	200 to 2500	534,645	$14.61
Lane	200 to 500	22,644	19.30
Hamilton	800 to 1500	57,825	12.33
Total		615,114	$14.57

This is satisfactory considering that the lode is now in Horse-Shoe ground below 2650 ft. At 2800 ft. the Horse-Shoe was connected with the Main and Edwards shafts, improving ventilation. At a suitable time drilling is to be done between these shafts to test the area at a depth of 350 ft. below the 2800-ft. level. An interesting table is shown in the report giving the length, width, and value of the orebodies ready for extraction at the various levels. This shows that from 300 to 2500 ft. depth, inclusive, there is from 145 to 1398 ft. in length of ore remaining in backs, from 6.4 to 17.2 ft. wide, and averaging from $5.20 to $34 per ton in gold, at the Main and Edwards shafts.

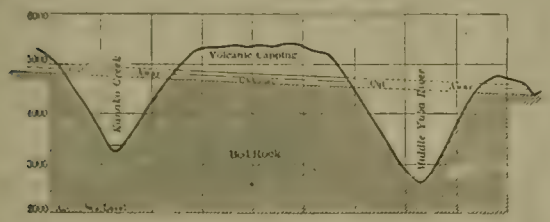
The dry-crushing, roasting, pan-grinding, agitating, and filter-pressing plant treated 189,469 tons of sulpho-telluride ore

yielding 54,319 oz. bullion by amalgamation and 99,052 oz. by cyanidation; also 37,934 tons of tailing for 3001 oz., making a total of 156,372 oz. worth £564,684. Residue averaged $1.59 per ton. Cost of development was 70c.; mining, $2.44; crushing and reduction $1.72; cyanidation, 70c., and general and sundry, 30c.; a total of $5.86 per ton. The year's profit was £301,657, of which £262,500 was paid in dividends. After paying all other accounts, £1881 was carried forward to 1914. At the end of 1913 there were stores, livestock, shares in other companies, bullion on special deposit and in transit, and cash, worth over £220,000.

BRISEIS TIN & GENERAL MINING COMPANY, LTD.

Tin is recovered by this Company by sluicing in Tasmania, and gold by dredging in Victoria, Australia. The fourteenth annual report, covering the year 1913, contains the following information, from the reports of the consulting engineers, Messrs. Lake & Currie, and general manager, Lindesay C. Clark.

The tin property consists of tin drifts or gravels lying on what is called 'reef', and overlain by hard columnar and sometimes decomposed basalt. The drift is sluiced, and a good deal of the overburden undermined breaks down and is washed away, while the remainder is trammed to a dump. A total of 91,900 cu. yd. of overburden was moved in 1913 from the Ringarooma area, a total of 1,860,400 cu. yd. to date at a cost of 13.52c. per yard, and 560,000 cu. yd. of drift sluiced from the Briseis and Ringarooma areas. The drift



CROSS-SECTION OF BRISEIS MINE, LOOKING DOWN THE LEAD.

yielded 515 tons of black tin (SnO_2) averaging 74.6% metal. This was smelted at the Mt. Bischoff company's works at Launceston, and produced, after deducting the two units allowed for smelting losses, 374 tons of metal, realizing £69,428 net. This is equal to £186 per ton against £216 per ton in 1912. The cost was £35 per ton of black tin produced in 1913. The rainfall was low during the year, and hampered development and production, the total being 38.91 in., compared with 50.14 inches in 1912. The average quantity of water available was 116 sluiceheads, one Tasmanian sluicehead being 24 cu. ft. per minute. Estimates of reserves in the Ringarooma sections show 1,527,800 cu. yd. of overburden and 7,419,500 cu. yd. of drift, containing 4569 tons of black tin, at an average cost of £85 per ton of metal produced. Further details of mining operations will be given in another issue of this journal. The four dredges in Victoria handled 1,461,200 cu. yd. of gravel, yielding 8.24c. per yard at an average cost of 6.4c. per yard. Higher wages, increased price for firewood, and resoiling and leveling regulations imposed by the state government have resulted in higher costs.

Tin, gold, and sundry revenue made a total of £96,337 for the year. The profit was £37,728, and adding £21,447 from 1912, there was available £59,175. Of this, £30,000 was paid in dividends, £17,100 to 1914, and the balance for taxes, payments, and depreciation.

During the first quarter of 1914 there was treated 99,000 cu. yd. of overburden and drift, yielding 100 tons of black tin, containing 74.05 tons of metal. This was sold for £159 per ton.

BOOK REVIEWS

CRYSTALLOGRAPHY. An outline of the geometrical properties of crystals. By T. L. Walker. P. 204. Ill., Index. McGraw-Hill Book Co., Inc., New York, 1914. For sale by the *Mining and Scientific Press*. Price $2.

While crystallization from solutions, sublimation, and fusion is important to various industries, the subject is fairly complex when the different systems of crystallization are considered. The shape of crystals is characteristic and more or less distinctive for each chemical substance. The author, professor of mineralogy and petrography at the University of Toronto, has used the Goldschmidt methods in his classes with good results, and prepared this work to have in the English language a connected elementary statement of crystallography from this point of view. Crystallographic investigations written by Victor Goldschmidt and William Nicol, John E. Wolff and Charles Palache, Victor Goldschmidt and A. L. Parsons, and Arthur S. Eakle are reprinted from various journals in this book.

USEFUL MINERALS AND RARE ORES. By Alexander McLeod. P. 114. Index. John Wiley & Sons, Inc., New York, 1914. For sale by the *Mining and Scientific Press*. Price, $1.25.

Several books have been published giving practical instructions in the search for and determination of useful minerals, yet this one is the result of 35 years' experience in active field work, and seems to be quite dependable for the prospector, miner, and others interested in mines. A cheap outfit and no skill is required in making the tests given. Instructions are given on panning, hardness, weight, and streak of minerals, prospecting hints, sampling veins, and testing for metals in the field. Forty-four pages are devoted to tabulated matter describing many minerals, their composition, color, weight, hardness, and the reaction on heating and acid treatment. Rare ores are more and more sought, and such ores as tellurium, monazite, uranium, vanadium, and others are explained, and means of identification given. Bound in leather and only 4½ by 6 in. in size, it is a handy book to carry about.

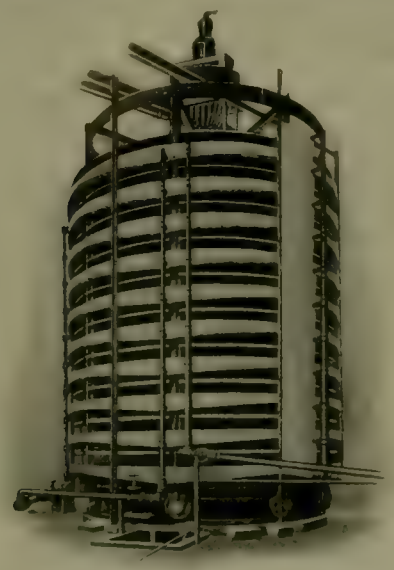
SUB-AQUEOUS FOUNDATIONS. A practical treatise including notes on the coffer-dam process for piers, and dredges and dredging. By Charles Evan Fowler. P. 814. Ill., plans, index. John Wiley & Sons, Inc., New York, 1914. For sale by the *Mining and Scientific Press*. Price $7.50.

In these days when foundations for buildings, power dams, machinery, and wharves are of such importance, and there are so many types of foundations used, such a compilation and discussion is especially valuable. Therefore, we find this work in its third edition, considerably revised and enlarged. The continued increase in weight of structures and loads to be carried necessitates great care in their foundations, yet collapses of buildings, bridges, and dams occur far too frequently, showing either a want of knowledge in construction or faulty work somewhere. The chapters cover such information as historical development, construction and practice, crib coffer-dams, pile-driving and sheet-piles, metal construction, cylinders and caissons, divers and diving, removing old piers, pumping and dredging, clam-shell dredges, drill scows and rock-breakers, dredges of all types, foundations, pier construction, cement and concrete, timber preservation, forms for concrete, and estimating costs. Sixty-nine tables give details of apparatus and material used in erecting structures, and 477 illustrations show more than many pages of description. Altogether, this work should be found valuable to architects, engineers, and contractors.

New Machines and Devices

Anaconda Slime Concentrator

The Anaconda slime concentrator, shown in the accompanying halftone, is a multiple-deck circular concentrator, the decks being conical in shape with a slope suited to the pulp to be treated. The decks are constructed of steel and concrete with a ladderway through the centre permitting easy access to all the decks and feed launders. This table is the result of five years' experimental work in the treatment of slime and is the nucleus of the 2500-ton slime plant being erected at Anaconda. The decks are placed one foot apart, vertically, and are carried on 8 steel columns at the periphery,



ANACONDA SLIME CONCENTRATOR

supported on a steel ring, which in turn is supported on wheels which run over a circular track. Thus the entire framework is free to revolve at a suitable speed, which is generally at the rate of one revolution every 3 to 10 minutes. The degree of roughness of the concrete surface depends upon the work to be done. The decks may also be made in concoidal shape or fitted with any form of riffling arrangement. The concentrator may be constructed with any number of decks from 5 to 20, as installed at Anaconda. For automatically feeding the proper amount of pulp to each deck, there is furnished a distributor which gives to each deck a proportionate amount of the total feed to the concentrator. The entire table is composed of steel and concrete which gives the machine a long life. The machine requires a comparatively low density of feed pulp, from 8 to 12% solids, and it is claimed will treat from 5 to 10 tons (dry) of slime per deck per 24 hours, or from 100 to 200 tons for the 20-deck machine, depending upon the character of the material treated. The concentrator requires a floor space, including walkways, of about 500 sq. ft. This machine is manufactured by the Traylor Engineering & Manufacturing Co., of Allentown, Pennsylvania.

Spanish Catalogs

In a campaign for business in the Latin-American countries there is one feature of publicity which has been generally overlooked by the manufacturers of machinery, and that is the class of literature for distribution among the native buyers in those countries. American manufacturers have spent thousands of dollars in the preparation of detailed catalogs in English for distribution in Spanish-American countries, which have been regularly consigned to the waste-paper basket, and expect to obtain a wide publicity and a market for their products by this means. While the majority of the large operators in these countries are English-speaking people, there is also a large percentage of smaller operators who are in the market for American machinery and on the mailing list of American manufacturers, to whom English catalogs and bulletins are as Sanskrit would be to the American operator. A catalog entitled 'Milling Machinery' is intelligible to English-speaking operators, but one entitled '*Maquinaria para Beneficiar Metales*' is intelligible to both English and Spanish-speaking operators in Latin-America. In anticipation of an expansion in Latin-American trade, the Allis-Chalmers Manufacturing Co., Milwaukee, Wisconsin, has prepared two attractive Spanish catalogs devoted to smelter equipment and milling machinery. The catalogs are illustrated and contain a large amount of descriptive material regarding the various products.

Commercial Paragraphs

THE U. S. ELECTRICAL MFG. CO., Los Angeles, Cal., has for distribution literature regarding the Type 'FR' motor manufactured by this Company. The motors are manufactured in sizes ranging from ¼ to 30 hp. and are guaranteed by the Company for two years.

POMONA MANUFACTURING CO., Pomona, California, has for distribution catalogue No. 1914 which describes in detail the construction and use of the deep well pumps manufactured by this Company. The pumps are especially adapted to lifts up to 300 ft. and have a wide variety of uses.

The DODGE MANUFACTURING CO., Mishawaka, Indiana, recently supplied the Presidio Mining Co., Shafter, Texas; Ahmeek Mining Co., Houghton, Michigan; Old Dominion Mining Co., Globe, Arizona; Calumet & Arizona Mining Co., Bisbee, Arizona; and the Alaska Gastineau Mining Co., Juneau, Alaska, with power transmission equipment.

BUSCH-SULZER BROS.-DIESEL ENGINE CO., St. Louis, Missouri, has for distribution an attractive illustrated bulletin which contains a discussion by Gordon Kribs entitled 'Cost of Generating Power with Diesel Oil Engines.' The article presents the actual operating results obtained under every-day operating conditions at the plants of the Texas Light & Power Co. The data presented are both interesting and instructive.

THE DENVER QUARTZ MILL & CRUSHER CO., Denver, Colorado, has recently received a contract to equip a complete 50-ton mill for the Crystal River Mining, Milling & Power Co. The equipment includes a 50-ton Denver quartz mill, Isabell concentrator, crusher, rolls, and accessories, all machinery to be shipped by August 10 to the property near Aspen, Colorado. The Company is also supplying a 25-ton Denver quartz mill, Denver crusher, and ore feeder for the property of W. H. Temme near Prescott, Arizona.

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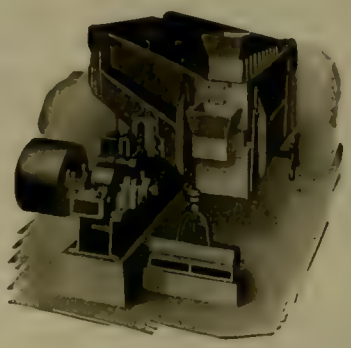

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MINING AND SCIENTIFIC PRESS

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EDITORIAL

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DOGMOBILES have come to be recognized as standard equipment for travel in Alaska between Nome and Lane's landing over the abandoned narrow-gage railway. With pulling on the up grades and coasting on the downs, the dog's lot in Alaska has been bettered somewhat at the expense of illogical railway investment.

PEACE IN MEXICO, which now seems at least a possibility before many months, will be more than welcome to those Mexican operators who have been taking a holiday on this side of the Rio Grande for the past year. While Carranza and Carbajal are reported as embracing in true Mexican fashion on one day and to be at sword's points on the next, the Constitutionalists and Federalists are at least nearer an agreement today than they were a month ago and the miners are optimistic.

SAD commentary upon the uncertainties of modern life is the fact that as we read war news from Germany, a belated mail brings the prospectus of an exposition planned to be held at Düsseldorf, May to November, 1915, commemorating one hundred years of art and culture. The program of the exposition is most attractive and we wish we might hope that the war would be sufficiently short to permit the plan being carried through. Miners are more concerned with the peaceful arts and industries than the glories of war.

ANNOUNCEMENT is made that a Johnson electric zinc smelting furnace will soon be in operation at Keokuk, Iowa, utilizing the cheap power supply of the Mississippi River Power Co. The furnace which has been in operation at Hartford, Connecticut, for several months will be moved to Keokuk and enlarged to 150 kilowatts capacity, or 5000 pounds per day. Meanwhile contracts have been let for the construction of a new 10-ton furnace at Keokuk. Negotiations with the provincial officials of British Columbia for the construction of an experimental furnace in the West Kootenay district have been dropped, for the time being at least, and the experimental tests on British Columbia ores which have been made at Hartford will be continued at Keokuk. The 30-ton shipment of zinc ore from the Burma Mines, Ltd., has been smelted at Hartford, and while the expected difficulties of treatment did not fail to materialize, it is stated that the results indicate that the ore can probably be successfully handled.

THE RADIUM bill providing for the conservation of radium resources by the Government will be considered next week. While its friends are optimistic as to its passing the House, it has met with a deadlock in the Senate and the possibility of it being given a hearing in the Upper House during the present session seems hopeless.

CALIFORNIA Industrial Accident Commission is receiving excellent coöperation from the employers in furthering the 'Safety First' movement. Preparations are being made by the Commission to hold public hearings for the purpose of discussing this timely subject and standardizing safety rules and regulations. It is gratifying to record that the work of the Commission is beginning to show results in the safeguarding of hazardous occupations and in many instances a reduction in insurance rates.

MEETING of the American Institute of Mining Engineers at Salt Lake City during the past week has been most successful, and the three hundred members who were in attendance left with the feeling of having spent a most profitable and enjoyable week as the guests of the Mormon city. From the opening address by Mr. D. C. Jackling to the closing banquet the meeting was divided between interesting technical discussion and visits to the neighboring mines and metallurgical plants. The high standard of technical papers presented at the Butte meeting last year was maintained in the present meeting and the diversity of discussion presented in the papers on mining and metallurgical subjects afforded a most interesting and excellently arranged program. In a succeeding issue we will present a detailed report of this meeting.

THE report of the Bureau of Domestic and Foreign Commerce for the fiscal year ended June 30, 1914, presents many interesting statistics relative to the nation's foreign trade for this period. The exports totaled $2,364,626,555, a decrease of over $100,000,000 from the previous year and the imports amounted to $1,894,169,180, which is the largest recorded and an increase of $81,160,946 over the imports of the previous year. The gold exports of the year totaled $112,038,529, while the imports were valued at $66,538,659, as compared with $77,762,622 exports and $69,194,025 imports for the preceding year. The foreign trade in silver showed a

general decline, the exports being $54,965,023 and imports $30,326,604 for the present fiscal year as compared with $71,614,311 exports and $41,268,516 imports for the previous year. It is indeed significant in light of recent European events to note that during the month of June the exports of gold to Europe totaled $48,107,064, as compared with $569,315 for the same period of the previous year and an average of about $4,000,000 for June for the past five years. The June imports for the past five years has been practically stationary at from four to five million dollars. It would seem that Europe's need for gold was anticipated. The return of the *Kronprinzessin Cecile* recently with $10,000,000 gold aboard for England and France, the second largest shipment ever made, lends a dramatic touch to the subject of gold exports.

STATUS OF THE METAL MARKET

Unsettled market conditions and the lack of quotations have resulted in smelters making provisional settlements on shipments of ore. According to the agreement reached by the smelters of Utah, gold will be paid for as heretofore and silver at the rate of 25 cents per ounce until further notice. The smelters will give to the shippers of silver ore their pro rata proportion of the first sales of silver made at the prices then obtaining in final settlement for the shipment, or on some other fair and equitable basis, which may be agreed upon between the shippers and the smelters. Advances on the copper content of ore will be made at the rate of 10 cents per pound and final settlement will be made with producers when market conditions again become settled. For the present no change will be made in the method of arriving at the price of domestic lead. In that from 25 to 35 per cent of the lead production of the United States has been exported during the past six months, there is reason to believe that a curtailment in production will be in order. In the general readjustment of production, markets, and prices, it seems reasonable that the curtailment in production of copper, lead, and zinc to meet the market's demand will cause little fluctuation in the price of these metals, and the markets will be influenced to some extent by the transportation facilities which are available.

At the present time the copper producers are curtailing production to the extent of about 30,000,000 pounds per month, and there is reason to believe that this figure will be exceeded before long, as copper being a contraband of war is liable to seizure if consigned to the ports of belligerent countries and producers can look to no market for the present in this direction. The magnitude of the European market is evidenced by the fact that the present copper exports are valued at over one hundred and twenty-five millions dollars annually, a large part of which being exported to the present warring nations. The shipments of copper from America to Europe for the first six months of the present year averaged 81,700,000 per month, as compared with an average of 72,400,000 pounds per month for the whole of last year.

Lead and zinc are of an extremely secondary importance, and the total exports of about $2,500,000 will have a comparatively small effect upon American production and markets. The advances made in the prices of quicksilver and tin are interesting at this time and are steadily increasing under the influence of European troubles. The Banca sale in Holland which was to take place on July 30 has been indefinitely postponed and an unwillingness has developed on the part of the tin consumers to buy on the sterling basis because of the advancing rate of foreign exchange. Fear is expressed in some quarters that tin shipments may cease as a result of the present crisis.

The withdrawal of foreign vessels from the merchant marine to meet the calls of the belligerent governments of Europe has curtailed the export trade in steel, as this country is practically dependent upon foreign bottoms for this trade. The export business of the United States Steel Corporation amounts to about fifteen per cent of its total sales and this Corporation handles about seventy-five per cent of the export business in steel products. Although the United States government has taken steps to permit the transfer of foreign built ships to American register, there is much misgiving in shipping circles that this may become effective. The Steel company's vessels, which are under the British flag, will of course be transferred at once to American register. The Pacific coast demand for rolled steel products, which for many months has been supplied with foreign made steel, is now being met in the Eastern markets. This increase in demand from the West will have an ameliorating effect upon present conditions. The tin-plate situation is most precarious in that the American manufacturer is so dependent upon England and foreign boats for his tin supply. The Steel Corporation uses from 1000 to 1200 tons of pig tin per month, sixty per cent of which comes from the Straits Settlements by way of London, there being but few direct shipments to America. War risks will greatly curtail shipments from the Straits, with the result that the tin plate manufacturers are in a quandary as to how the demand is to be met. There is but one or two months' supply on hand at the present time, and with tin quoted at 62 cents per pound, the tin-plate manufacturer will be forced to suspend until a supply is again made available. The transfer of foreign built ships to American register would undoubtedly simplify matters somewhat and the manufacturers are hopeful that a solution of the present difficulty will soon be possible.

The general effect of the war on the metal market will be to weaken the metals which we export and strengthen those which we import, and while the balance of production and consumption will be temporarily disturbed, it is to be hoped that in the readjustment which is to follow mining will not experience the reverses anticipated in some quarters and the present situation will soon be replaced by a stability of markets and prices.

THE INDUSTRY OF THE WITWATERSRAND

By T. A. Rickard

The economic relation of the Rand mining industry to the Union of South Africa is made vividly clear by a recent report of the Dominions Royal Commission, which was appointed by the British Parliament to inquire into "the natural resources, trade, and legislation of certain portions of His Majesty's dominions." This Commission has just returned from a visit to South Africa, where voluminous evidence was taken. That evidence proves that the Union of South Africa is unique among civilized countries in the extent of its dependence upon the produce of its mines for its purchases of imported goods. Of the revenues of the Union, by direct and indirect taxation, 60 per cent comes from the mining industry; of this 60 per cent, fully three-quarters, or 45 per cent of the total revenue, is drawn from the gold-mining industry in the Transvaal. Out of a total Government revenue amounting to $135,000,000 derived from taxation and railway receipts, the Witwatersrand contributes $60,000,000. This last sum compares with $40,000,000 paid to the shareholders in the mining companies operating the mines, and with $40,000,000 paid to the white employees at these mines. Thus the financial interest of the Union Government is 50 per cent greater than that of either the shareholders or the white employees. These facts, thus emphasized, suggest that the purchasing power of South Africa is peculiarly dependent on the produce of its mines, and that there is urgent need to assist the scientific development of agricultural resources to take the place of the mineral wealth, which is essentially a wasting asset. The Commission, however, concludes wisely that the most immediate problem is the efficient development of the assured mineral resources. Coal exists extensively, and may prove of great value in the exploitation of known iron deposits. The diamond mines are yielding about $56,000,000 per annum, so that the Union produces about 80 per cent of the world's supply of this precious stone. This produce is important, but the basic industry of the country is gold mining. Within 30 years the Transvaal has contributed $2,000,000,000 to the world's stock of gold, and at the present time it is responsible for 40 per cent of the world's total output. The salient feature of this prolific production is the fact that the gold is won from a low-grade ore exploited on a narrow margin of profit. At once the cost of labor becomes a crucial consideration. In mining generally that human item represents two-thirds of the total expense of mining. In the Transvaal it is a vital factor to an unusual degree on account of the lack of an adequate supply and the various efforts necessary to import labor from the outside. Of the Chinese experiment, begun in 1904 and ended in 1909, we need only say that it was an economic success but a political failure. It was killed by being made the subject of a sentimental outcry in England. Of the white workers, from Europe, America, and Australia, it is fair to state that they have proved unsatisfactory, their duty as supervisors over the natives having led not only to gradual inefficiency but to political agitation, terminating in a murderous riot. The natives in the Transvaal are quite insufficient for the great industry of the Rand; they have been recruited from all over South Africa, and have been taught to do the work required. But they are nomadic and uncertain; they migrate to their homes periodically; they cease from labor (like their white associates) when they have made enough money; their needs are small, therefore they are able to retire to their kraals soon after they have learned to do their work well. Their wages have increased steadily, largely by reason of the competition between mines, now abated by joint recruiting. The labor factor has pressed upon the managers increasingly. Taking the capacity of two white workers as equal to that of three natives, it is estimated that if the natives at their present cost of 75 cents per shift had to be replaced by whites at $2.50, this being the possible minimum, out of the 52 productive mines, one-half would cease to be profitable. If the whites were to receive $3 per shift, this being the rate current in Australia and America, then out of the 52 mines only 17 could continue in operation. The cost of 75 cents per native includes wages, food, housing, and recruiting. In 1913 a sum of $60,000,000 was paid in salaries and wages by the mining companies of the Rand. The white employee, excluding the technical and clerical staff, received an average of $1580 per annum, while the native received $150, allowing $50 for board and lodging. Meanwhile white labor has become inefficient and unruly. The idea of using only white men has been followed by the proposal to remove the color bar, thereby permitting intelligent natives to act as supervisors. As the native is as much an economic asset of the country as the golden ore itself, it appears a sound proposal. The future of the industry must depend upon the training of the native, with concurrent discipline, so that excessive demands may be checked. It is a reasonable expectation that the wants of the Kaffir will increase as he becomes 'civilized' and that his new needs will drive him to learn how to earn more money by greater efficiency.

In order to obtain data concerning the probable future of the industry, the Chamber of Mines recently commissioned four engineers to prepare a report. They found that 550,000,000 tons of ore were available in the producing mines, which are now crushing at the rate of 28,000,000 tons per annum; this rate, it is believed, can be maintained for five years, after which the annual output is expected to decrease at such a rate that in 1930 it will have fallen to one-half, or 14,000,000 tons per annum. This general estimate assumes no decrease in cost; but it does assume that the remaining undeveloped ground down to a vertical depth of 7500 feet will yield ore of a tonnage and grade equal to that of the last 1000 feet in the respective mines. No allowance is made for a flattening of the lode or an impoverishment of the

ore, although both are likely. Mr. R. N. Kotzé, the Government Mining Engineer, estimates that by 1924 twenty-five mines now producing $50,000,000 annually will have been exhausted; by 1934 a further 13 mines, now producing $52,500,000, will be compulsorily idle; and by 1944 nine more, now yielding $37,500,000, will have ceased operations. Thus, he estimates that within 30 years the Rand's output of gold will have fallen from $180,000,000 to $40,000,000 per annum. It only remains to say concerning these estimates that the industry will not contract as rapidly as the gold production, for the tonnage will diminish much less slowly than the yield per ton and large-scale operations will be maintained long after the shareholders will have ceased to derive benefit therefrom. This is the story of all big mining districts, in which mining performs a beneficent economic function to the community and to the state long after the mine owner has ceased to be enriched thereby.

There remain possibilities. Large undeveloped areas of gold-bearing property are known to exist on the outskirts of the tracts already exploited. Mr. Kotzé estimates that 114,000 claims remain intact; out of these 31,400 may prove to be profitable ground. This unexploited area should contain 600,000,000 tons, or about as much possible ore as is estimated to remain in the present producing mines. Thus to the 230,000,000 tons of ore extracted to the end of 1913, we may add 550,000,000 in the developed mines, and 600,000,000 in the undeveloped area, making altogether 1380 million tons as the ultimate total production of the Rand. While the profit to the shareholders from the 1100 million tons may not equal that derived from the 230 million tons already crushed, it is certain that to the state, and to the community immediately dependent on the mines, it will prove the mainstay of another generation at least.

To those living in South Africa it may appear immaterial whether a particular mine is operated at a profit or not, so long as it continues to employ workmen and consume supplies. Indeed, the money that goes out of the country to absentee shareholders is regarded as an economic loss. This, of course, is a one-eyed way of looking at the problem. The government's profit-tax is diminished and the incentive to open new mines is checked. Hence has come the idea that all the mines should be consolidated into one vast enterprise, to be operated either by the Government itself or by an amalgamation of the existing companies. Such a step would minimize competition for labor and for capital, because the individual mines or companies would be merged in the one super-mining unit. The total capital involved, including debentures, would be about $450,000,000, as compared with the United States Steel Corporation, capitalized at $900,000,000, the Canadian Pacific Railroad, at $800,000,000, and the Pennsylvania Railroad, at $640,000,000, not to mention a half dozen others in America involving at least as much money as the sum representing the capitalization of the Rand; with this difference, however, that a mine is a wasting asset and a railroad is not. The advantages of such a consolidation are obvious, namely, the reduction of overhead expense, the cessation of competition for labor, the facilitation of collective bargaining between labor and capital, the unification of technical effort toward improved mining and metallurgical methods, and the extinction of numerous counters for gambling by the substitution of one real investment. The objections are less obvious: the diminution of individual effort as between members of different staffs, the creation of a power that would overshadow the state itself, and the lack of men of calibre big enough to manage so huge an enterprise. As to the last, it is fairly clear that the combinations already effected, such as the East Rand Proprietary, Randfontein Central, and Crown Mines have already taxed the ability of their managers. The Crown Mines has met the demand for a wide grasp of affairs, but the other two amalgamations have made repeated blunders, due to the fact that super-mining undertakings are easier to create than the super-men to run them efficiently. That, to our mind, is the chief obstacle. It may also be suggested that a consolidation of all the companies would lead inevitably to a de-watering of the shares, for the merging of interests would deprive the shares of their purely speculative value and pull them down to the dreary basis of a quiet investment. That would mean an immediate and heavy loss to the present shareholders, who now have the benefit of a quotation which is enhanced by the speculative feature.

The dewatering will come in the course of events, of course, but it will come so slowly as to permit the loss to be widely distributed. On the other hand, the interest of the Government being already so large, it seems a relatively easy step to further participation. To the Government of South Africa it is desirable to perpetuate this basic industry long after it has ceased to interest the shareholder or the laborer, of whom the first is a nonresident and the second migratory. Undoubtedly the waning of speculative interest will enhance the industrial importance of the Rand to South Africa, and warrant the Government in devising methods whereby the continuity of operations can be safeguarded. The report of the Royal Commission suggests the employment of a world-wide authority, or authorities, on mining matters with a view to obtaining reliable advice, the cost of which would be insignificant compared to the interests involved. A beginning has been made in the employment of Surgeon-General W. G. Gorgas to report on sanitary conditions, and in the retaining of four engineers to assist the Economic Commission. In both instances, the result was highly satisfactory. Assuredly the worst of all waste is the waste of experience. The modern world is remarkable for nothing more than the ability to enlist the help of specialists from every department of human progress. In the Transvaal the economic relation of a special industry to the welfare of the state is so clearly defined as to offer unusual scope for wise treatment.

Origin of the Sudbury Ore Deposits

By STUART ST. CLAIR

No attempt will be made to outline the general geology of the Sudbury district for such information regarding the region has already been published in reports by A. P. Coleman[1], of the Ontario Bureau of Mines, and A. E. Barlow[2], of the Canadian Geological Survey. The discussion in this paper is limited to a consideration of the methods of occurrence and origin of these most interesting sulphide deposits.

CREIGHTON PIT AT COPPER CLIFF, SHOWING OREBODY FROM FOOT-WALL TO HANGING. THE LOOSE ROCK IS MAINLY FROM SLIDES OF THE HANGING WALL.

A resumé of the two views held in regard to the origin of the Sudbury ore deposits may be briefly stated as follows: (1) that the sulphides are primarily of igneous origin, having separated from a molten norite magma by a slow process of differentiation, the ores having segregated at the bottom of the eruptive and at the margin of a synclinal basin in obedience to the laws of magmatic solutions; (2) that the sulphides are entirely of secondary origin, having been deposited along the brecciated margin of the eruptive by aqueous solutions. The sulphides replaced the rock and also acted as a cement, the ore-bearing solutions having been introduced some time after the intrusive had cooled and had been fractured.

All geologists who have advocated the igneous theory concede that there has been solution and redeposition subsequent to the formation of the ores, resulting gen-

[1]Coleman, A. P., 'The Sudbury Nickel Field.' Ontario Bureau of Mines, 1905, Vol. 14, Pt. 3.

[2]Barlow, A. E., 'Origin, Geological Relations, and Composition of the Nickel and Copper Deposits of the Sudbury District.' Can. Geol. Sur., Vol. 14, Pt. H, 1904. Revised and reprinted in 1907.

erally in enrichment of the sulphides and alteration of the original norite rock; that the greatest amount of such alteration has taken place in the 'offset' deposits and that many of the marginal deposits remain today nearly as they were formed, very little change having taken place through aqueous agencies since the time of formation. On the other hand, the advocates of a secondary origin for these sulphide deposits fail to recognize any factor other than circulating waters for their deposition. The men who have done the most detailed geological work in the region are A. E. Barlow and A. P. Coleman. Both are strong advocates of the igneous theory of origin for the orebodies. Their conclusions are based principally upon field evidence. Opposed to their views, and a strong advocate of an aqueous origin for the sulphide deposits, is C. W. Dickson. His conclusions are based principally upon laboratory study of polished surfaces of the ores.

Dickson's Studies

The metallographic methods used by Dickson are intensely interesting, but they show only the present condition of the ores and not necessarily the primary conditions under which the sulphides were formed. In his paper Dickson clearly and strongly presents his arguments to prove the secondary character of the ores, but that conclusions based principally upon laboratory studies may lead to error in solving the origin of the Sudbury ores, is forcibly expressed by Coleman[3]. He says, "Dickson seems to have been singularly unfortunate in the choice of his material for study since he has selected almost without exception the brecciated rock material enclosed in the ore, and judging from his photomicrographs and descriptions, has not studied the opposite phase in which the norite is thickly speckled with the ore particles. Many of his examples are from 'offset' deposits and naturally enough for one who had but a short time for field work in the region, he does not distinguish their characters from those of the marginal deposits, which point more clearly to an origin from the molten norite."

The brecciation of the contact of the nickel-eruptive and the country rock, which consists of greenstones, granite, gneiss, and other rocks, is as one would expect as a result of an igneous intrusion. The deep-seated magma spreading out beneath the overlying Animikean sediments would have to stope its way, and many fragments of the intruded rocks would be broken off, some probably being assimilated in the norite magma. The enclosed rock fragments are both angular and rounded, the latter probably being the earlier fragments broken off, while the former may be referred to stoping action of a later stage when the magma had lost much of its heat and could no longer fuse the edges of the fragments.

The orebodies are found in intimate relation with the norite, and this association is so persistent that one is forced to conclude that there must be some genetic relation between the sulphides and the norite magma. The orebodies occur at the margin of the eruptive rock and are of finer grain immediately at the contact than at some distance away. The rock in immediate association with the ore is much more basic in composition and finer in texture than the rock farther removed from the contact. As one proceeds from the margin toward the inner basin, the eruptive rock gradually becomes more acid and coarser grained until the norite has changed to micropegmatite. At the same time the sulphides, which often occur in masses at the basic edge, change to pyrrhotite-norite with the sulphides disseminated throughout the rock. This in turn grades insensibly into norite practically free from sulphides, and in less than a mile from the basic edge of the southern range thin sections, in my collection, show no sulphides at all in the eruptive rock. The transition between the normal norite and the pyrrhotite-norite furnishes unmistakable evidence that the sulphides were formed during the cooling and crystallization of the norite magma. The norite is unquestionably the original source of the ore.

Just when the synclinal basin was formed is unknown, but more evidence points to the sinking of the Archean basement and consequently the upper sediments into the space formerly occupied by the magma during the time of eruption and during its slow cooling than to formation after the magma had solidified. From a consideration of this structure, the abrupt change from massive sulphides to barren country rock is as would be expected in the case of segregation of the orebodies from a liquid magma. Through fractional crystallization, gravity, convection currents, and probably other factors, the heavy parts of the magma would settle to the bottom and the basic constituents would collect at the cooler parts, which would be at the contacts. The contemporaneous or subsequent formation of the synclinal basin, and the long period of erosion to which the edges were subjected, would cause just such structural conditions and ore occurrences as are found in the field today.

Basic Border and Acid Core

The differentiation of magmas into a basic border zone and an acid core has been recognized and studied in many cases. The factors producing this separation and concentration are not agreed upon by petrologists, but that such conditions obtain in solidifying magmas is indisputable. The Sudbury laccolithic intrusion was subjected to this process of differentiation. If the magma separated into diverse parts, the acid being concentrated at the centre and the basic segregating in the outer portions, would it not be reasonable to suppose that the heavy sulphides in a like manner separated from the basic portion of the magma? A magma rich in dissolved metals and sulphur is all that would have to be presupposed.

The conditions under which the Sudbury laccolithic intrusion began to differentiate into an acid and a basic phase were those of considerable depth. The intrusion spread out between the Archean rocks below the Animi-

[3]Coleman, A. P., 'The Sudbury Nickel Field.' Ontario Bureau Mines, 1905, Vol. 14, Pt. 3.

kean sediments above. These sediments, it is estimated, had a thickness of nearly two miles, and, at such depth and under such conditions of pressure, the magma would cool very slowly, and there would be ample time for a complete separation. In such a case gravity would undoubtedly be an important factor in the settling of the heavy sulphides to the bottom and the collecting of the lighter acidic constituents at the top. The action of fluid mineralizers, according to Michel Levy's theory, would aid in the concentration of the lighter or more acid substances above the basic below. The basic constituents would also tend to concentrate at the edges of the intrusive sheet, probably in accordance with Soret's principle, which states, "If different portions of a homogeneous solution of a salt are kept at different temperatures for any considerable length of time, the salt will concentrate in the cooler portion of the solution." Both Vogt and Kemp favor this principle in the differentiation of a magma, and although many scientists have discarded this principle when applied to magmas, on the basis that such a process of molecular diffusion would require too long a time, it is considered to be a possible factor. Under such conditions of depth and of temperature as existed in the case of the Sudbury laccolith, the time required for differentiation by Soret's principle may not be a very serious objection to its application as one of the factors of differentiation of the Sudbury ores.

Primary Ores and Magmatic Waters

The magmatic waters which usually follow extensive volcanism were, I think, of primary importance in the concentration of the large orebodies. After the sulphides had undergone a process of segregation by gravity, and the magma was still in a molten condition, such concentrating action by the magmatic waters would be simply one of the factors of the magmatic differentiation process, and could not be classed as 'after action.' There was, very probably, after action also that caused further concentration of the ores by solution and redeposition in fractures produced by cooling and contraction of the magma, and probably by a certain degree of further settling of the synclinal basin. The action of the magmatic waters during cooling, which would cause a greater fluidity of the basic portion at the margin, would aid in explaining the great distances to which some of the apophyses extend into the country rock.

The richest deposits, many of which are almost pure sulphides, are found in embayments which extend into the Archean substratum. The most important deposit of this character so far worked is at the Creighton mine. At this point an enormous body of sulphides rich in nickel and copper has been opened up. This deposit seems to afford an excellent example of concentration due primarily to gravity, the heavy sulphides having evidently settled into the depression and solidified as pure ore. That aqueous alterations and enrichment were of great importance in concentration seems hardly possible, as the ore and rocks are singularly free from fracturing.

Another factor which would probably aid in the differentiation of the magma is redistribution by convection currents, resulting from unequal temperatures. The magma spreading out between the rocks would become cooler at the points of contact with the country rock. The upper and outer edges would, therefore, be the coolest parts of the sheet, the outer margin especially, and a circulation would start between these points and the highly heated centre. This process, combined with chemical affinity, would possibly constitute a factor well worth considering in the discussion of the relative importance of the various factors in connection with the magmatic differentiation of the Sudbury ores.

Paragenesis of Sulphides

The paragenesis of the sulphides is largely a matter of speculation, but a few orders of crystallization will be given. According to Fournet, in a molten magma of silicates in which sulphur has been dissolved, the sulphur shows affinity for the metals in the following order: copper, nickel, cobalt, iron, tin, zinc, lead, silver, antimony, and arsenic. From this one would expect to find that the ore minerals had crystallized in the following order: chalcopyrite, pentlandite, and pyrrhotite. The copper, nickel, and cobalt sulphides, which constitute but a small part when compared with the amount of pyrrhotite, should be found concentrated in the pyrrhotite, and in many cases such relations are found, but more often the reverse occurs. In other places the intimate relation between the sulphides themselves and with the norite, points to a nearly contemporaneous solidification. Again, the relations show that the pyrrhotite antedated the pentlandite and the chalcopyrite since the pyrrhotite is often surrounded by the chalcopyrite. In consideration of the last described condition of occurrence it would seem that the chief factors controlling the solidification of the metals were the viscosity of the magma and the fusing points of the sulphides.

Effect of Mass Action

Another factor which must be considered in the crystallization of the Sudbury intrusive is the law governing mass-action. Mass-action as recognized operates to produce many irregularities in the crystallization of the magma. The chemical equilibrium of a complex solution is very unstable and is easily unbalanced by such influences as temperature and concentration. To what extent mass-action influenced the order of crystallization in this magma cannot be stated, but it may have reversed Fournet's order to begin with, and later the magma may have reached the proportions of a eutectiferous solution, and subsequently crystallized according to the laws governing such a solution. Since the pyrrhotite is so much more abundant than the other sulphides, this law of mass-action may have been of primary importance in determining the order of crystallization of the ore minerals.

The metallographic studies of the orebodies by Camp-

bell and Knight[1] showed the order of formation of the sulphides to be, 1, pyrrhotite; 2, pentlandite; 3, chalcopyrite. But their work cannot be used in determining the order of primary deposition of the ores for their specimens show three periods of deposition of the sulphides, two at least of which are secondary since they occur in veins and along fractures in the pyrrhotite.

The men who favor most strongly the aqueous origin of the ores consider that there may have been a slight primary concentration of the metals with the intrusion of norite, but they consider such a concentration unimportant. Dickson does not attribute the source of the metals to the norite, but favors a more distant source. The metals it is thought may probably have been minutely disseminated in the rocks through which the depositing solutions passed.

Ores from the Eruptives

However, from a consideration of all the facts it seems clear that the source of the ore must be sought within the eruptive itself. It will be remembered that, (1) sulphides are known to be primary rock-forming minerals; (2) magmas tend to differentiate into chemically and mineralogically diverse parts, the acid rocks forming the inner zone or core, the basic rocks the outer or border zone, this splitting up being due to fractional crystallization, action of mineralizers, variations in temperature and pressure, convection, or a combination of any or all of these and probably many other factors; (3) the sulphides are found at the borders of the basic border-zone, in embayments, and disseminated through the norite, the amount of ore being inversely proportional to the distance from the basic edge; (4) the sulphides are very intimately associated with the norite of the basin type, and with norite only; (5) the conditions were those of great heat and pressure, and there was present in all probability a large amount of magmatic water; (6) the ores throughout the district are remarkably uniform, consisting as they do of pyrrhotite, chalcopyrite, and pentlandite. If the ores had been formed by deposition from aqueous solutions, it seems hardly possible that such uniformity should exist. Replacement minerals such as are found in other copper and nickel fields are almost entirely lacking, and there is a marked absence of crystals of metallic minerals and drusy-covered cavities so typical of water action; (7) in some places the rocks close to the orebodies are greatly altered, the pyroxene having changed to hornblende. Such a condition would show secondary aqueous action. Again, in many places the rocks close to the orebodies show no alteration at all. Such a condition would show that the ores could not have been formed on such an extensive scale, as they are at present found, by aqueous solutions. Many specimens obtained in the immediate vicinity of the various mines show fresh and unaltered material. Some containing as much as 10% sulphides have undergone so little metamorphism as to permit of the positive identification of all the prevailing minerals, including hypersthene, enstatite, diallage, olivine, and labradorite. Sulphides frequently occur in portions of the norite which have suffered little or no dynamic metamorphism, and practically no hydro-chemical alterations.

[1]Campbell and Knight, 'On the Microstructure of Nickeliferous Pyrrhotite.' *Econ. Geol.*, Vol. 2, p. 350.

Conclusions

In drawing a conclusion as to the origin of the Sudbury ores, precedence must be given to the views of such men as Coleman, Barlow, and others who have studied deposits of copper-nickel sulphides both practically and theoretically, the relations shown in the field and the associations found to exist between ore and rock from laboratory studies. These men have shown in their reports evidence to uphold the igneous theory, and most other geologists who have studied the deposits in the field have agreed with these pioneers of the theory of ore deposits formed by magmatic segregation. While much credit must be given to Dickson for his attempt to prove an aqueous origin for the ores, consideration of all the facts seems to forbid the belief that these ore deposits could have been formed primarily by any action other than a direct segregation from a molten magma.

Large Platinum Nuggets

Three interesting platinum nuggets of remarkable size recently passed into the possession of a large platinum refiner at Hanau. These nuggets, or 'samorodki,' as they are called in Russia, are great rarities, and were found in the river sand of the Iss, near Nishne-Tagil, in the Ural mountains. They have a total weight of 17.122 kg. or 550 oz., the individual weights being 7.782, 4.775, and 4.565 kg. They are valued at about $25,000. The large nugget was found 25 and the two smaller ones about 20 years ago. Since that time no further pieces of such size have been discovered.

The largest single lump of platinum ore that has ever been found was discovered about 100 years ago in the same vicinity, and is still to be seen, as the rarest natural curiosity of its kind, in the Demidoff Museum, St. Petersburg. The largest of the three nuggets referred to is, therefore, probably the second largest that has come to light so far. The nuggets contain 86.5% of pure platinum, about 3% iridium, and small quantities of other metals. It may be thought that in localities where such large and heavy lumps of pure platinum occur there should be frequent finds of valuable pieces, but this is not the case. Even pieces weighing 20 to 50 grams are rarely found.—*The Jewelers' Circular.*

A new 'centipede' locomotive, weighing 410 tons, having 24 driving wheels, was recently tested on the Erie railroad. A train of 250 cars of coal, the whole weighing 21,000 tons, was pulled by this engine for 40 miles at 15 miles per hour. This is a world's record, and 10,000 tons over the best previous performance.

Titration Results in Cyanidation

By A. W. ALLEN

The accompanying diagrams are illustrative of a number of tests which were made for the purpose of obtaining a better understanding of the distribution, and also the loss, of cyanide at various points in a 'milling in cyanide' plant, and in the hope that the results might throw some light on the question of the disappearance of zinc from plant solutions. The tests were made by the method described in the *Mining and Scientific Press*, September 20, 1913. Twelve separate samples in all were tested, the complete series of estimations taking an hour and a quarter. The latter point is mentioned since in some quarters it is thought that solution control by scientific methods is too lengthy and tedious an operation to merit the attention it undoubtedly deserves. Stock solution used at various points in the mill was only tested for once. It was assumed that no material alteration in composition would occur during conveyance in piping.

In practice lime is added at the batteries, but the addition was temporarily suspended while these samples were being taken. Unnecessary complications in solution composition were thus avoided. The addition of make-up water was also temporarily suspended for a similar reason.

Fig. 1 gives free cyanide content. It is noticeable that no reduction in free cyanide content occurs in the solution passing through the batteries. This is due, in all probability, to the high alkalinity being maintained, coupled with the fact that the flow of solution through the batteries is so rapid and the dilution so high that no appreciable alteration is likely to be recognized by the ordinary methods of testing. There is a loss of free cyanide in the tube-mills and also in the agitation vats. This might be expected. The greatest loss, however, occurs in the zinc-boxes as a result of the necessary maintenance of an ample free cyanide content to ensure satisfactory precipitation. Whether this disappearance of free cyanide means a total loss of all the contained cyanogen is very doubtful. It is probable that, as regards further solution of metal, the double cyanide formed is at least partly available. As regards subsequent precipitation with zinc it is wholly unavailable.

Fig. 2 deals with the protective alkali content, which is estimated in terms of potassium hydrate. The results are, therefore, higher than they would be if recorded in terms of sodium hydrate.

It is noticeable that there is a decrease in protective

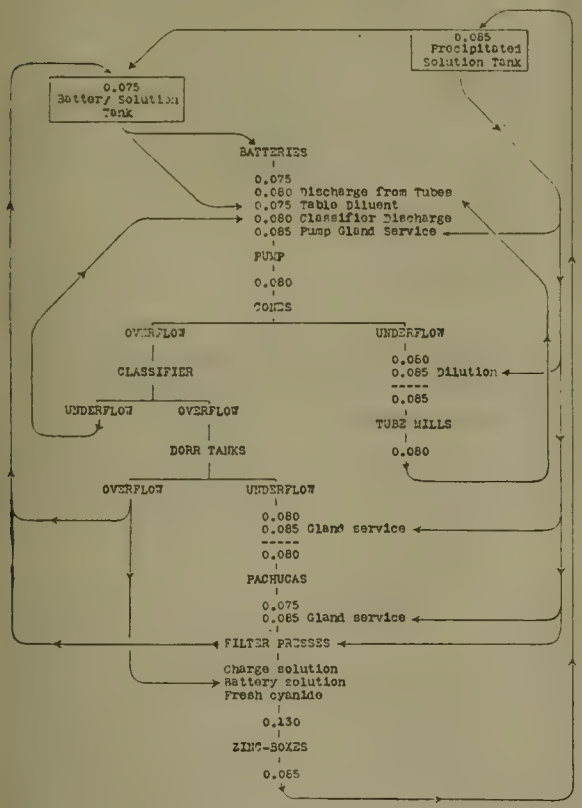


FIG. 1. FREE CYANIDE AS KCN.

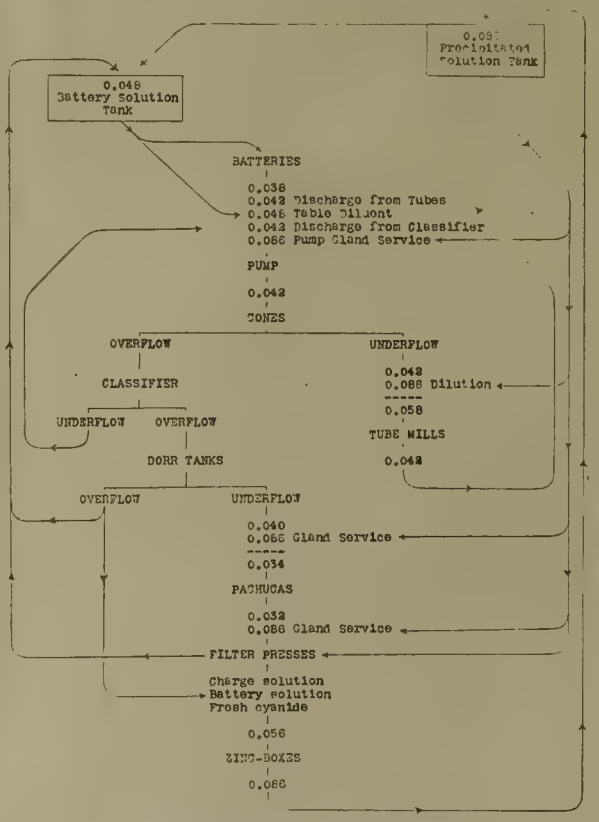


FIG. 2. PROTECTIVE ALKALINITY AS KOH.

alkalinity in the batteries, which is indicative of an acid reaction in the ore. A further reduction in alkalinity occurs in the tube-mills where the ore is still further reduced and additional acidity exposed. There is a further reduction in alkalinity as the pulp passes to the filtration department, a somewhat inexplicable drop occurring after the ground pulp comes in contact with precipitated solution in the pumps elevating to the Pachuca vats. There is a considerable rise in protective alkalinity after zinc precipitation due to the solution of

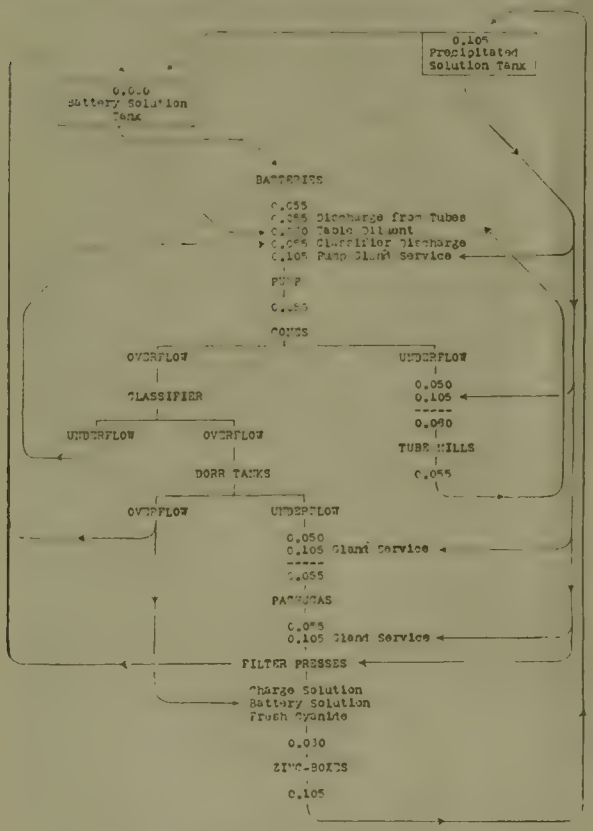


FIG. 3. ZINC DOUBLE CYANIDE IN TERMS OF KCN.

excess zinc, and the consequent formation of free caustic alkali.

Fig. 3 gives details of the content of zinc double cyanide, in terms of potassium cyanide. It is interesting to note that there is a loss of double cyanide, as indicated by this method of testing, from the time the reduction of the ore commences until it is completed. It may therefore be put forward as a tentative explanation that the double cyanide is locally decomposed by the acidity of the ore resulting in the formation of hydrocyanic acid, and an insoluble zinc cyanide. This would involve an ultimate loss of zinc and cyanogen. It may be further assumed that the hydrocyanic acid so liberated might attack the gold forming hydrogen-gold-cyanide which in its turn might be acted on by the free alkali present to result in the formation of the normal potassium-gold-cyanide compound. This explanation is not in accord with the results of laboratory experiments and is opposed to the generally accepted ideas with regard to the stability of hydrocyanic acid in the presence of excess alkali. It cannot be used to account for the loss of zinc from plant solutions in the case where the ore is milled in alkaline water. In the present instance it is the only explanation that suggests itself.

The addition of zinc to the solution is indicated by a considerable rise in double cyanide content after zinc precipitation.

Tin Mining at the Briseis, Tasmania

As explained in the Company's report, to be published in this journal later, operations at this property consist in removing a hard and sometimes decomposed basalt overburden, and sluicing the layers of tin drift beneath. The work generally presents some difficulties, one being the tailing disposal and the proximity of the Ringarooma river, which is now being diverted. In 1913 the following was done:

Briseis drift and overburden sluiced, cubic yards	275,000
Black tin recovered, tons (74.6% metal)	464.1
Average black tin, pounds per yard	3.78
Ringarooma or upper drift sluiced, cubic yards	286,000
Black tin recovered, tons	38.9
Average black tin, pounds per yard	0.3
Ringarooma overburden removed, cubic yards	91,900
Total ground moved, cubic yards	652,900
Total black tin output, tons (74.6% metal)	515

Cost of recovering black tin and dressing it ready for smelters was as follows:

	Per ton of black tin.
Sluicing, cleaning bottom, overburden cost, etc.	$53.85
Pipes, ditches, elevators, etc.	25.90
Clean-up, dressing, etc.	6.70
Electric light	4.80
Head ditches upkeep	12.96
Stores, timbers, explosives	2.06
Dumping overburden, etc.	40.46
Salaries and office	22.80
Total	$169.53

The cost per ton of metal was $233.50, and the price received for the metal was $875.40 per ton. To this cost of $233.50, should be added $38.60 for freight, smelting, etc., making a total of $272.10 per ton of metal. Moving the hard columnar basalt overburden cost 34.67c. per cubic yard. From the sluice-boxes was recovered 56 oz. of gold worth $760.

COAL MINED IN KENTUCKY in 1913 was 19,616,600 short tons, valued at $20,516,749, according to Edward W. Parker, of the U. S. Geological Survey. The increase over 1912 in quantity mined amounted to 3,126,079 short tons, or 19%, and the value increased $3,662,542, or 21.7%. The number of men employed in the coal mines increased from 24,304 in 1912 to 26,332 in 1913, and the average working time from 201 to 212 days. The average production by each man employed was 745 tons in 1913, against 679 tons in 1912 and 640 tons in 1911.

Gold Mining on the Amur

By W. H. SHOCKLEY

*It is perfectly true that "Siberian butter gives twice as much gold as Siberian gold mines," and equally true that other industries—coal, petroleum, cotton, iron—may have, from a governmental standpoint, no less importance than the production of gold. Nevertheless, for the economic life of the region, especially for eastern Siberia, gold-mining plays a very important rôle. A large portion of the gold output remains in the country for the purchase of supplies and labor, and a portion of the profit is employed for the development of trade and industry. As yet this important industry is only in the preliminary stage, and, with the exception of a small amount of vein gold, produced by working the most important deposits on an insignificant scale, only alluvial gold is produced.

According to official statistics, the production of gold in the Amur and the Transbaikal was: 1905, 320,321 oz.; 1906, 349,703 oz.; 1907, 380,282 oz.; 1908, 406,048 oz.; 1909, 422,448 oz. But A. N. Mitinsky, the representative of the Minister of Trade and Industry, says that "the greater part of the statistics regarding gold mining is questionable, because of the incomplete registration of the gold; the figures do not correspond with the truth, even in the case of honest operators who do not report a smaller amount of gold than is won, for the purpose of paying a smaller royalty or a less tax on the profits." In a word, "there are no accurate statistics of such an easily concealed and universally desired metal as gold, and cannot be, and for this reason the analysis of the gold production must be carried on rather qualitatively than quantitatively."

The greater part of the gold deposits of the Transbaikal, in itself so rich in minerals, is in the hands of private *concessionaires* of the Cabinet of the Czar.

The legal situation of Transbaikal in relation to gold is complicated: the western, and poorest portion, is open; but the richer eastern portion is closed to private operators. The Cabinet has exclusive right to the precious metals in Transbaikal; in the part that is open to private operators it has the same right by law as ordinary individuals, but at the same time it may close separate districts by special instructions. On all the gold produced in Transbaikal a tax of 5% is levied for use of the Cabinet. Besides this, the Cabinet takes a further tax of about 20 cents per acre for each mining claim.

In the area closed to private operators (the Cabinet gives the right of working gold mines to special *concessionaires*), the largest holder is the Nerchinsk Gold Co., Ltd. Although trading in gold is forbidden in the Transbaikal, it is only by a fortunate accident that poachers can be caught; for it is impossible to stop trading in gold from other districts open to its circulation, and it is practically impossible to prove that the gold comes from a designated mine in Transbaikal. According to Mitinsky, only the extension of the free trade in gold throughout the Transbaikal and the replacing of the income from the 5% tax by some other income for the use of the Cabinet can radically clear up the demoralized 'poacher atmosphere.' This is the method by which other portions of Russia were freed.

In that part of the Transbaikal that is open to private mining there are four sorts of land titles: (1) Cabinet, (2) non-Russian natives, (3) peasant, (4) Cossack. On the open Cabinet lands in the western portion, everyone can mine for gold in exactly the same manner as on the open Cabinet lands in the rest of Russia. For obtaining mines under the other categories it is essen-

GOLD MINING REGIONS ALONG THE SIBERIA-MONGOLIA BORDER.

*Translated from *Zoloto i Platina*, Jan. 15, 1914.

tial for the would-be miner to come to an arrangement with the owner of the ground; such agreement must be confirmed by the local authority: by the agent of the natives, the administration of the Cossacks, and the special council of the peasants. The development of gold mining is much retarded because there is no normal price for the surface rights. This absence of a normal price repels responsible capitalists, and it is highly desirable that such normal price should be established.

Outside of the Cabinet, practically the only large companies working in the Transbaikal are the Russian Gold Mining Co. and the Nechinsk Gold Co., Ltd., which companies are working concessions. The other private operators are financially weak. Up to the present, alluvials are worked by preference; the richest deposits have already been exhausted, and, by official statistics, the tenor of the ground is now about 6c. per cubic yard. This is the value on which the taxes to the Cabinet are paid; the real value is about 15c. Vein gold mining is in a bad way, for not a single mine has been properly developed.

Cabinet Operations

The principal operator is the Cabinet itself; according to the reports, its production in the Nerchinsk district was:

	1907.	1908.	1909.
Total output, troy oz....	63,455	66,302	80,236
Value .....$	1,155,174	$1,210,123	$1,449,766
Value per ounce	$18.20	$18.25	$18.07

As stated above, there is but little work on the concessions in that part of the Transbaikal that is closed to private miners. The gold obtained from these concessions was, in 1908, $27,500, and in 1909, $86,000. A very small portion of the concessions is worked.

The gold production of the Transbaikal was, in 1907, 28,544 oz., in 1908, 33,416 oz., and in 1909, 47,727 ounces.

The production of vein gold in the western Transbaikal during the three years was only 5727 oz. The 5% tax paid to the Cabinet by miners working without concessions was: 1907, $17,952; 1908, $10,738; and 1909, $7092. Since the receipts of the Cabinet from this 5% tax are so insignificant, it seems superfluous to prove clearly the advantage of its abolition; for this 5% tax, payable in cash, is a restraint on legal gold mining in that part of the region open to gold mining, and is an encouragement to illegal mining, and encourages the flow of gold to China, and thus touches the general interests of the country.

There are very strong hopes of further developing gold mining in this region for the reasons given above, but there is little private exploration. In the eastern Transbaikal the Cabinet spends about $50,000 yearly in prospecting, a sum large in itself but very small in comparison with the extent of the country. The amount of gold which has been fully developed during the last few years is between 236,990 and 289,655 oz. Rich placers assaying 60c. per cubic yard have been opened within the last few years on the Cossack mines: Garimur, Borzya, Kasakovka, and Novotropok, which lie in a comparatively settled country and have been worked for a long time. In the deep virgin forest of eastern Siberia are the renowned penal mines of Kariosk, and, still farther to the north, Gorbichansky. The first of these produced 473,981 oz., and the second 315,987 oz. of gold.

Gold mining has recently begun on the zone of the Amur railway. The gravel here is very rich, and the bed of the river is worked by freezing. At present, in this region, which only a short time ago was practically inaccessible, there is being developed a semi-illegal gold mining, which brings on the market the so-called 'voluntary' gold, which is sent to the Blagovestchensk assay office.

The output of gold during the past few years has increased by legal and illegal working of the Cabinet lands, and also by the extensive employment of Chinese on the partly worked out claims of the Cabinet.

The gold of the Amur is divided into seven classes:

1. Gold produced by means of machinery excavators on the Titova mines on the Jalinda, Aksenta dredge on the Unak, etc., without help of Chinese labor.

2. Company work, preferably by Russian workmen. Five companies produced 79,000 to 92,163 ounces.

3. Working under supervision, systematic working with company machines, but with payment of royalty producing 52,664 to 63,197 ounces.

4. Ordinary leasing work.

5. Working "with regulation," which is the widest spread and is increasing. The holder of a mining claim puts Chinese to work, under their own management, with whatever apparatus they wish, under the condition that they sell him a fixed amount of gold at a fictitiously low price for every Chinese who works.

6. Work "without regulation," whereby the owner of the mine builds a warehouse and allows the Chinese to work as they please, under the condition that they buy not less than a fixed amount of goods per man per month; the price, naturally, being exorbitant.

7. Gold stolen from the first three classes. Included in this is the Chinese gold from the right bank of the Amur. According to the data of the government assay offices, the greater part of the gold received from the district is called 'voluntary.' An insignificant part of this is mine gold escaping registration, the greater part being produced by men working under the 'with regulation' system, but of this gold no small part is 'poached' or stolen.

Incidental Profits

The amount of gold won by regular mining diminishes yearly, and the mine owner derives most of his profit from selling goods to the Chinese at high prices or by charging them for the right to work on his claims. Irregular working by hand produces gold cheaper than dredging and mining under legal restrictions. This cheaper production is due to the irregular worker escaping the cost of company administration, taxes, medical care, and also because he handles only pay ground and

disposes of his tailing by covering ground too poor to work and thus avoids expense of transportation. The irregular worker can fairly be compared to a smuggler, and the miner on a large scale with all the advantages of science and machinery to a wholesale merchant.

The thinly settled nature of the country and the consequent expense of bringing in Russian workmen has led to the employment of Chinese. The flood of Chinese was partly caused by the result of the experiment of bringing Chinese to the Crown lands in the Primorsk for the account of the Government. And the destruction of the so-called 'Jeltuginsk Republic' in 1887, led to the flight of experienced Chinese gold miners into Russian territory. The great influx of the Chinese, however, was caused by the building of the Chinese Eastern railway. The movement increased in 1905 and was connected with a general trend of the Chinese from Chefoo to Manchuria. The change in employment is shown by this illustration:

Workmen.	1900.	1909.
Russian	89%	13%
Chinese	11%	87%

After 1905 the Russian movement into Siberia increased, and work in mines could have been carried on by Russian workmen had it not been for the demand for Russians by the Amur railway; for example, the Suchansky coal mines had only 200 Chinese out of 1000 workmen in 1911.

However, Russian workmen are expensive in all parts of the Priamur, for the population is scanty and comparatively wealthy. Chinese, though but little cheaper, are preferred to Russians on account of the many Russian holidays and because, although the Chinese work slower, yet they do not get drunk regularly. In addition, the Chinese, fearing death but slightly, do not demand medical aid.

A fair estimate of labor in Transbaikal is 2000 Russians annually and 25,000 to 30,000 Chinese, coming during the summer months. Mitinsky speaks of the abnormal condition on the Amur railway, where only Russians are allowed to work, but 100 ft. from the roadbed begins the dominion of the Chinese. In 1906 there were 15,000 Chinese in the Amur district; in 1907, 40,000; in 1908, 60,000; and in 1913, more than 120,000.

Living Conditions

Mitinsky gives a picture of the life and work of the Chinese in the mines, which attests their immense capabilities for combination and organization. Their camps are built lengthwise of the mines and contain from 700 to 1200 men; most of them work on leases; a portion are merchants who import Chinese wares. The Chinese gang consists of from 100 to 150 men and acts as a unit. In case of a serious quarrel between the gangs it is difficult to reconcile them. In the winter the Chinese go home.

The working of the Chinese 'with regulation' is very simple. The head of the gang must sell the mine management a stated weight of gold per month at a fixed low price for each man employed; for example, 0.55 oz. at $10.50 per ounce; this practically amounts to paying about $4 per month for each Chinese employed; taking gold at $18 an ounce. The working 'without regulation,' or by the 'warehouse' system, is very attractive to the Chinese, for the goods are sold at a lower price than by the regular mine owner. To render the employment of Russian workmen possible, the illegal 'warehouse-poaching' methods must be changed to hydraulic mining and dredging; this will require capital and science and will not be as easy as selling merchandise.

As it is now, every mine owner has yielded to the seduction of yellow labor, and has been delivered from the need of putting capital and science into his business. But in case of an outbreak of war in the Far East the mining population will find itself entirely under Chinese domination. To combat the influx of Chinese the mining law should be strictly enforced and the complete extraction of gold from the mines insisted on.

In conclusion, it may be said that the future of gold mining in Siberia will be brilliant. In the Amur district alone there is a vast store of gold, a conservative estimate is 145,000,000 oz. of alluvial gold. The Amur province can produce for each of the next hundred years more gold than the entire present annual production of the rest of Russia, which is 1,395,609 ounces.

San Francisco Mint Operations

During July this institution received 306,740 fine ounces gold and 89,485 oz. silver worth a total of $6,390,759. The coinage executed was $2,500,000. Coin, bullion, etc., on hand on July 31 was:

Gold coin	$ 13,058,070.00
Silver coin	61,692,734.20
Nickel coin	25,104.95
Bronze coin	31,130.63
Checking balance, Treasurer United States	2,012,791.15
Gold certificate bars	127,354,014.91
Gold bullion	42,640,396.18
Silver bullion	528,017.35
Total	$247,342,259.37

Gold output of Rhodesia during the first half of 1914 and 1913 is as follows, in fine ounces:

Month.	1914.	1913.
January	59,212	52,455
February	61,748	49,596
March	64,393	61,274
April	70,336	57,295
May	68,983	57,866
June	72,645	56,991

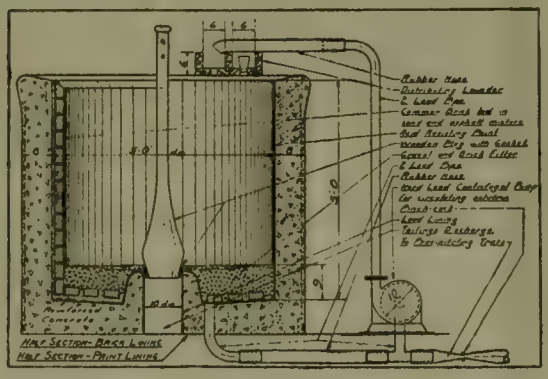
The new mines are now making their yields apparent in the totals.

Gravel mined at the Lena Goldfields property, Siberia, from October 1, 1913, to June 10, 1914, was 558,772 cu. yd., of which 253,477 yd. was washed, yielding 121,316 oz. gold worth £455,946. There were 6987 men employed.

Leaching Experiments on the Ajo Ores—II

By STUART CROASDALE

*Of the two methods recommended [see original paper] for waterproofing concrete, the use of 'Toxement' and by crude oil, the concrete mixed with crude oil appeared to be less attacked by the acid solutions at the end of two months' service than that mixed with Toxement, although the difference was scarcely noticeable. Both methods require a much longer time for the concrete to set than when neither is used. So far as could be observed, the acid-resisting qualities of concrete and plaster prepared with either Toxement or oil were not any better than those of ordinary concrete and cement plaster made with silicious sand and gravel. Acid-resisting paint known as 'R. I. W. No. 89', prepared especially for this work, was of no value whatever in protecting the concrete vats from the 10% sulphuric solutions, the weaker lixiviants in the leaching vats, or the neutralized copper sulphate solutions in the precipitating tanks. Asphalt applied hot or as a paint was likewise useless as a protective covering for the cement plaster under any of the above conditions. One difficulty in retaining this on the walls of the vats was the high temperature of the water used for washing the ore, which averaged 100°F. or more.



STRUCTURE OF VAT USED.

The use of such warm wash water may be criticized and would have been changed under ordinary conditions, but there was a possibility of the water supply coming from hot springs or wells, if developed near the mine, so it was thought best to put the asphalt coverings to the severest test. Besides, a glance at the atmospheric temperatures during the summer months, as given in the beginning of this article, is sufficient to show that even this part of the experimental work required some care in manipulation. Asphalt that would soften and run from joints between bricks or from walls under the heat of the sun, might be brittle enough to crack at night and allow the acid solutions to get at the cement behind it.

With the exception of Vat *A*, all the leaching vats, acid, and precipitating tanks may be considered as operated for the entire two months on the cement plaster alone, for at no time did the protective covering last more than 24 to 48 hr. on the leaching vats, and on the acid and precipitating tanks the paint would come off in patches after a few hours' or a few days' exposure to the solutions. At the end of two months the Toxement plaster, ½ in. thick, was disintegrated to the concrete in places on Vat *B*, and the oil-mixed plaster of the same thickness was disintegrated nearly to the concrete on Vat *C*. In the acid storage tanks both the Toxement and oil-mixed plaster were dissolved in patches by the 10% acid solutions, and the solutions leaked through the 8-in. concrete walls. These holes were patched with ordinary cement and sand plaster and also with neat cement, both of which held the solutions successfully for several weeks. One of the storage tanks was replastered with cement and sand and thoroughly coated with paraffin, which was forced into the plaster with a hot iron. When filled with dilute acid lixiviant, the paraffin came off immediately and was of no value whatever as a protective covering. A plaster, recommended by the Standard Oil Co., was also tried on the acid storage tanks. It was composed, by weight, of 10% litharge, 20% short-fibre asbestos, and 70% sand. These were mixed into a mortar with 40% silicate of soda and applied in the usual manner. This plaster immediately disintegrated on filling the tank with water. The tank was then replastered with the same materials and filled with dilute acid. So long as the plaster remained covered with acid, it was satisfactory protection, but on exposure to air it began to disintegrate and crumble away.

Character of Lining

Some of the leaching vats were plastered with ordinary cement and sand mortar and painted with several coats of crude petroleum. Each application of oil was allowed to soak into the cement and become perfectly dry before another coat was applied. This was done at the close of my experiments and I had no opportunity to test its merits. The brick lining in Vat *A* proved to be very satisfactory. With the exception of where the asphalt was melted from the joints by the hot wash water, no deterioration could be noticed. This was due to the irregular size and shape of the common brick used for the lining and could be avoided by using pressed brick of uniform size which would permit of thin joints. In a large vat the brick would also be laid flat instead of on edge. The sand and asphalt bottoms were entirely

*Extract from a paper to be presented at the Salt Lake meeting of the American Institute of Mining Engineers and printed in the *Bulletin*, August 1914.

satisfactory when they were pressed solid with a heavy hot iron muller like that used in street paving. If this was not done, they were porous and spongy and no protection against the solutions.

As now developed by the limited operation of the experimental plant, ordinary or oil-mixed concrete will be entirely satisfactory for leaching vats, wash water, and neutralized copper sulphate solution tanks. These can be made tight and acid resisting by lining with pressed brick of uniform size, laid in asphalt and backed with hot asphalt poured between the brick and concrete. Vitrified brick would be less porous and preferable if they can be obtained straight and uniform in size. The vats should be plastered inside with cement and sand mortar before putting in the brick lining.

Character of Cement

The cement used in construction work came from the regular run of the mill at El Paso and contained variable amounts of free lime. It is my belief that with cement and other materials containing no free lime, a concrete vat can be built and lined with brick, laid with thin joints of cement and sand mortar, that will be entirely satisfactory for acid leaching. After the bricks soak full of mineral salts, there is very little if any transfusion of the corrosive solutions to the concrete back of the lining, and they form a protective coating for both ore and solutions. Oil-mixed cement plaster will last two or three months without patching or renewal. A brick lining laid in oil-mixed cement mortar would probably last longer than plaster, but the asphalt and brick lining is recommended if it can be held in place.

The cracks that form after construction are the most serious, if not a fatal defect in concrete for leaching vats. These are often so small that they are scarcely noticeable and yet are sufficient to start a leak that is almost impossible to stop, even with asphalt itself. The shape of the vats is immaterial, although for economy of construction and operation a rectangular concrete vat is preferable. The tailing can then be removed from the top, and the bottom of the vat made solid with no openings. The bottoms of the vats should be paved with sand and asphalt, thoroughly pressed down with hot iron mullers or otherwise to make a compact covering. On top of this should be a brick paving laid in asphalt. The storage or acid mixing tanks for the 5 to 10% acid solutions should be made of steel or wood and lined with lead.

Protection of Pumps

The hard-lead centrifugal pumps used for circulating the solutions showed no wear except the steel shafts. It was difficult to keep packing tight enough around the shafts to prevent the leakage of solutions, and at the same time not crack the lead casing or stuffing gland. The shafts on all the pumps were worn out in two months and were replaced with bronze. The wear on the bronze shafts is undetermined. The repairs on the pumps will not be a serious matter, since new casings, runners, and shafts are easily made. Low pressure air-lift pumps offer more advantages, on account of freedom from moving parts in the corrosive solutions, and are recommended.

The pure rubber acid-proof hose used for the transfer of solutions showed no deterioration at the end of two months. While the initial cost is high, it is the only hose that will resist the corrosive solutions, and it is indispensable for handling solutions from the pumps on top of the vats. Lead-lined iron pipe is recommended for the rigid pipe connections, and wooden, lead-lined, or concrete launders provide the simplest means for the transfer of solutions from one leaching vat to another.

The tailing will have to be removed from the vats by machinery. No portion will run out by gravity unless it contains a high percentage of water. Since the tailing will be discharged containing small amounts of free acid and copper sulphate, the kind of metal used for discs, plows, or buckets in the excavating machinery was given consideration, although it is improbable that the quantity of acid or copper sulphate in the tailing will be sufficient to prohibit the use of cast iron, steel, or perhaps a high-silicon iron which has high acid-resisting properties.

Tests of Metals

Krupp bronze and 'Monel' metal were both submitted to the following tests. Pieces of each metal were allowed to stand in acid solutions and in acidified copper sulphate solutions of varying strengths, the bronze for two and one-half and the Monel metal for three months. The bronze precipitated the copper completely from all but the two strongest solutions. The Monel metal precipitated no copper, but passed into solution to a greater extent than the bronze. The results were as follows:

With Sulphuric Acid

Strength of acid, per cent H_2SO_4.	Loss in weight: Bronze, %.	Monel metal, %.
0.12	3.22	3.89
0.25	3.26	5.92
0.50	3.77	8.86
3.54	0.50	7.62
1.00	3.64	7.55
1.50	4.55	10.07

With Acidified Copper Sulphate Solution

Strength of solution, per cent Cu.	Loss in weight: Bronze, %.	Monel metal, %.
0.05	1.22	14.50
0.10	1.22	7.20
0.20	0.76	4.73
0.30	0.82	5.08
0.40	0.10	2.17
0.50	0.22	7.87

The Monel metal was also allowed to stand about six weeks in the following solutions:

	Loss in weight, %.
10% sulphuric acid	2.81
10% sulphuric acid and 10% copper sulphate (2.5% Cu)	4.88
10% copper sulphate (2.5% Cu)	1.99

A high-silicon iron, under the trade name of 'Duriron' was tested in a similar manner by these solutions. So far as could be observed at the end of a few weeks, this metal was not corroded in the least, but the experimental work was closed before this test was finished. The acid-resisting qualities of this alloy is well known, but it has the disadvantage of being very hard and brittle.

There have been almost as many methods proposed for precipitation of copper from solution as there have for leaching it from the ore, and today there is probably more uncertainty and more difference of opinion concerning the methods of precipitation than there is concerning the methods of leaching. Of all the methods proposed, only one has been demonstrated a commercial success, and that is precipitation on metallic iron. Lime or limestone was used in some of the earlier methods of hydro-metallurgy, but this yielded a precipitate that was little better than the ore itself. Sulphurous acid came into prominence a few years ago, but it involved difficulties of manipulation that have not been overcome, even in small-scale operations. Hydrogen sulphide, produced from iron matte, has been tried, but has not been developed on a large scale, and is likely to prove a troublesome reagent under such conditions.

Electrolytic precipitation is always attractive and has probably received more attention and intelligent experiment from skilled metallurgists than any other method. While some small plants use this method from time to time, it cannot, as yet, be called a commercial success. When working on a metallurgical problem, where the margin is narrow, one must always consider the materials at hand as the cheapest obtainable and most likely to permit profitable operations. As possible precipitants for the copper, I considered the following in the order named: natural sulphides of iron, artificial sulphides of iron, sponge iron, pig iron, and electric current.

Natural Sulphides of Iron

If acid leaching is used for the oxidized ore some other process will have to be used for the sulphide ore. It is probable that this would be some form of mechanical concentration. Tests had already been made by the ordinary methods of wet concentration at the University of Arizona before my arrival. These, by very careful manipulation, gave a recovery of 68% of the copper, 77% of the gold, and 63% of the silver, but the concentrate carried only 10.2% copper from an ore that assayed 2.3% copper, 0.02 oz. gold, and 0.22 oz. silver per ton. By a combination of flotation and concentration I was able to raise the recovery to over 76% and the grade of the concentrate to nearly 14% copper, although the flotation concentrate assayed nearly 24% copper. As is often the case when chalcopyrite has its source in igneous rocks, it is intimately associated with magnetite. Even fine crushing to 40 mesh failed to separate the magnetite from the chalcopyrite in this ore, and this destroyed the properties of the latter for flotation methods to a great extent, as well as lowered the grade of concentrate. However, by treating the concentrate on a magnetic separator, I was able to raise the grade to 18.5% copper. The magnetite itself carried nothing of value.

This, then, was the product and probably the best that can be obtained from the sulphide ores by the usual methods of treatment. It must be shipped to the Company's smelter at Douglas for treatment, or it must be smelted into matte and blister copper on the ground. If shipped to the smelter, it would certainly be advisable to raise its grade, if possible, either with or without removing the magnetite. Its efficiency as a precipitant was important but not essential, since any precipitation of the copper from solution and consequent enrichment of the concentrate would be a distinct gain. The only factor to make it a commercial success was the speed of the reaction, and in this it failed. However, having secured sufficiently speedy reactions from other natural sulphides of iron on previous occasions, I am not prepared to say the last word has been spoken in this case.

Artificial Sulphides of Iron

Two sources of this precipitant would be available. First, the matte produced by smelting the concentrate at the mine, and second, the matte that could be produced by smelting the low-grade pyrite at Bisbee. If soluble sulphides precipitate cupric sulphide from copper solutions and natural sulphides of iron precipitate cuprous sulphide, it is reasonable to expect the artificial sulphide of iron to do the same. Earlier experiments had shown me that iron sulphide precipitates metallic copper and not sulphide of copper from solution. This investigation was carried further and I found the reaction to be, not a simple transposition of the metals, but the following:

$$4FeS + CuSO_4 = Cu + FeSO_4 + Fe_3S_4$$

I found also that the precipitation of copper stops at this point, although free sulphuric acid will readily decompose the FeS_4 with the liberation of hydrogen sulphide. Therefore, less than 25% of the iron in pure iron sulphide is available for the precipitation of copper and the resulting product cannot carry more than 17.7% copper.

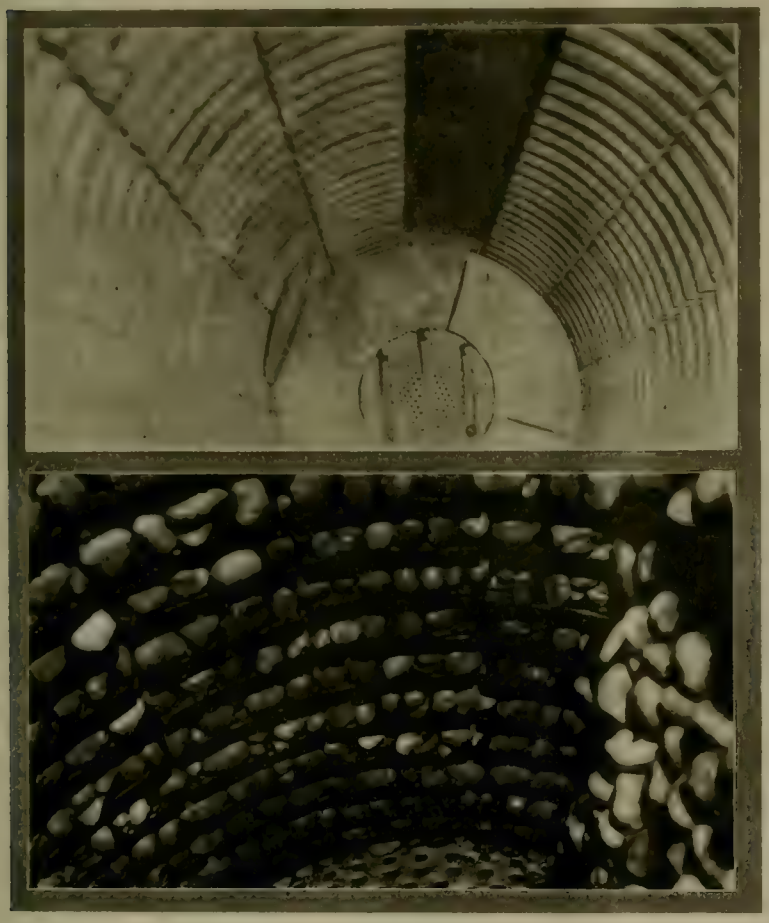
Increase in the copper content of a matte decreases its precipitating power so much that a matte containing over 30% copper precipitates practically no copper from solution. Nevertheless, the iron from the matte passes into solution to an appreciable extent. The only explanation I can offer for this phenomenon is a reduction of the cupric sulphate to cuprous sulphate and an oxidation of the cuprous sulphide of the matte to cupric sulphide, but I am not prepared to say that this is correct.

(To be continued.)

New Tube-Mill Liner

By J. G. MUELLER

A large number of different tube-mill liners are used in grinding gold and silver ores, each with its advantages and superiority over some other. A patent has been recently issued in the United States and Canada covering a tube-mill lining thought to be devised on entirely new and novel but practical lines. It was evolved at Cobalt, Ontario, by Messrs. Globe and Mueller after continued trouble and excessive expense on account of the use of the parallel ribbed type of liner usually supplied by manufacturers of tube-mills. These could not stand the severe abrasion to which the coarse-grinding mills of the district were subjected.



GLOBE AND MUELLER TUBE-MILL LINER.

From the halftones the construction should be readily understood; the narrow chilled iron ribs are placed circumferential to the shell of the tube, thereby forming a series of tapered and dovetailed pebble pockets alternately disposed between the ribs on a soft cast iron base of the usual form. The pocket or channel is widest in the direction of rotation of the mill, and the ribs taper inwardly toward the base, forming a tapered groove so disposed in relation to the direction of the rotation that the pebbles are automatically and quickly picked up and jammed securely into the grooves. This action takes place quickly and thoroughly.

It is absolutely essential that the initial load be a good mixture of all sizes of pebbles from marbles to number fours. The smallest pebbles find a secure hold in the crevices and voids of the larger ones, and the resulting surface, after two weeks, looks neat and is efficient; its roughness and irregularity tends to a better mixing and cascading action, and therefore better results in grinding.

So far there have been a dozen or more mills in Cobalt and Porcupine equipped with the liner, some coarse grinding, others on sliming, and in all cases they were installed after having been tried out against the parallel ribbed liner half and half in the same tube, or they have been recommended by operators who were satisfied with the results, showing a longer life.

It should be remembered that in coarse-grinding machines the liners are deprived of that cushioning and retarding effect in sliming mills, on account of the more rapid water circulation, which causes a more rapid discharge of much coarse particles. In other words, the voids in the pebbles of a sliming mill are filled with a thicker and more sluggish mass than in a coarse-grinding mill, therefore the abrasive action on the liners and pebbles of such machines is not so severe.

The cost of re-lining a 5 by 20-ft. tube-mill, with a full set of 72 pieces, including 2 doors, is as follows: 15,550 lb. at $3.75 per 100 lb., $583; a set of 130 bolts for same at 15c. per pound, $19.50; felt washers at 1c. each, $1.50; one mechanic, 12 hours at $3.50, $5.25; two helpers inside the mill, 16 hours at $2.50, $10; two helpers outside the mill, 16 hours at $2.50, $10; one man putting on nuts and washers, 16 hours at $2.50, $5; one-half of the mill foreman's time, $2.25; making a total of $636. The actual time, including the removal of the old liners, with six men up to time of refilling with pebbles, was 12 hours, and no difficulties were encountered.

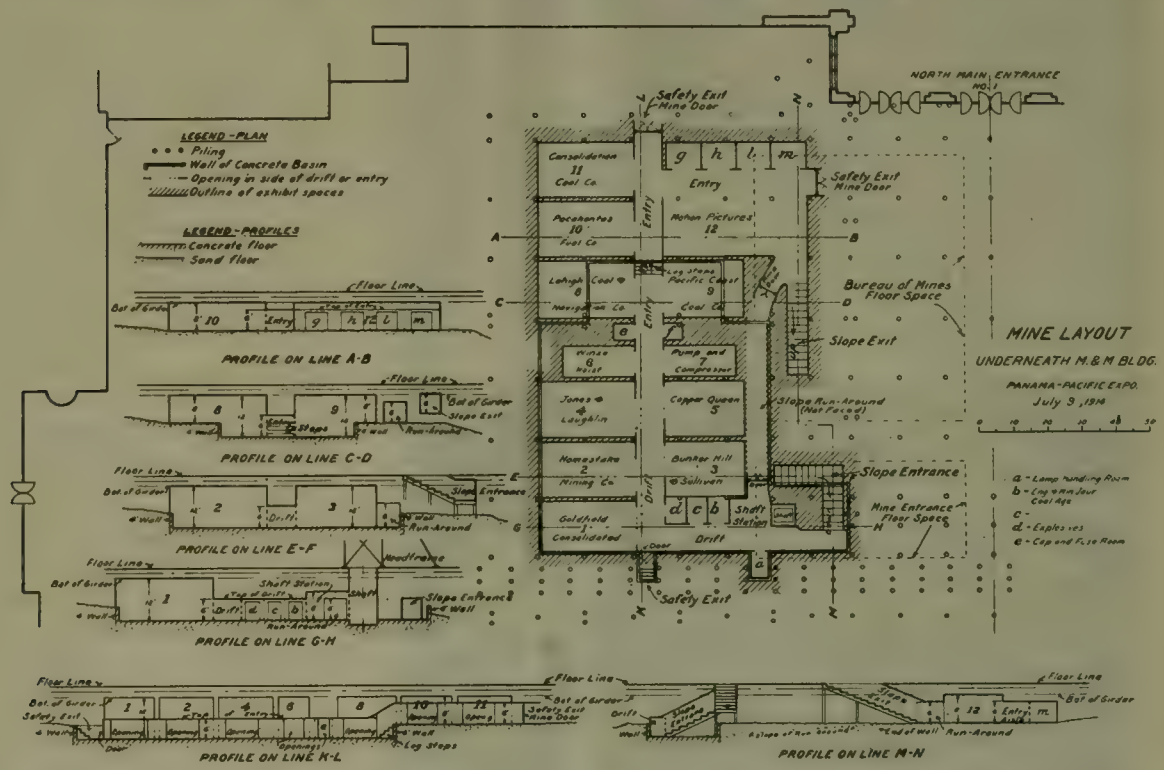
GOLD PRODUCED by Indian mines in May was as follows: Balaghat, £5445; Champion Reef, £44,131; Mysore, £76,371; North Amantapur, £4109; Nundydroog, £25,194; and Ooregum, £28,900.

Exhibition Mine at the Panama-Pacific Exposition

The plans for the mine beneath the floor of the Palace of Mines and Metallurgy at the Panama-Pacific Exposition, San Francisco, have now progressed under the direction of the Bureau of Mines to the point where it is expected that the most comprehensive exhibit of mines and mining subjects, including mining equipment and supplies, which has ever been prepared for the education of the general public, will be presented.

Characteristic working places, or stopes, will be prepared in the mine to simulate the character of the ore, or coal; and the methods of working, typical of some of the largest and most important copper, silver, lead, gold, and anthracite and bituminous coal mines of the country, and motion pictures will be shown in one of the rooms of the mine, illustrative of workings such as open-cut copper and iron mines and stone quarries, which cannot otherwise be shown in such an exhibit.

The plan of the mine here shown gives a good idea of the manner in which the exhibit is to be presented. The entrance to the mine may be made by a shaft or by a slope which has been placed adjacent to the Bureau of Mines space in the Government Exhibit. From the bottom of the shaft, which is on a lower level, the entry way leads past small rooms which will be used for exhibits of lamps, mining journals, etc., through metal-mining stopes, showing two levels in which various mining machines will be shown as working exhibits. Beyond the metal mining rooms the entry leads past a room typical of the Pennsylvania anthracite mines and a room typical of the Pacific Coast coal mines, in which the sloping veins occur. At this point steps in the entry lead to an upper level, along which are arranged rooms of bituminous coal mines. Opposite these, there occurs the motion-picture room, in which will be shown the operations of some of the great open workings of the country, by means of which iron, copper, gold, and stone are obtained. The exit from the motion-picture room leads direct to the slope exit from the mine which opens into the radium booth of the Bureau of Mines exhibit.



Here actual radium emanations will be shown while the visitors' eyes are still accustomed to the darkness.

The mine will be equipped with the usual tracks, trolleys, locomotives, cars, cages, hoists, motors, pumps, air-compressor drills, mining machines, signs, mine doors, etc., all of which will be installed as working exhibits. Each day there will be a demonstration of rescue and first-aid following an imaginary explosion in the mine. Rescue crews from the Bureau of Mines exhibit will enter the mine wearing apparatus and bring out the supposed victims, who will be given first-aid treatment in the surface emergency hospital, which will be one of the features of the Bureau's exhibit.

The exhibit should serve a good purpose in educating the public regarding the magnitude of the mining industry, the cost of its operation, and the amount of capital invested in its conduct.

DISCUSSION

Readers of the MINING AND SCIENTIFIC PRESS *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

What is the Matter With Prospecting?

The Editor:

Sir—I read with great interest 'Operator's' article on prospecting, published in the *Mining and Scientific Press* of July 18. I have also read some dozens of articles on the same subject in various mining magazines during the past few months, and not one but was interesting and instructive, and well worth the space occupied.

I take it that every normal, intelligent man is interested in prospecting, using the word in the broad sense to include the search for, sale of, incomplete development, and general opening up of new mineral wealth. To discuss every phase of this subject in one article is impossible. I believe nearly every one will agree that a majority of the most easily found placers and lode deposits have been brought to light, and that most of those so far found have been developed, at least in part. Every great discovery, like Cripple Creek and Goldfield, leaves just one less such to be discovered. But discoveries of profitable orebodies will be made, and new mining camps will be developed within the present limits of the United States a thousand years from the present time.

In spite of the ranting of politicians, demagogues, and alarmists in general, supply and demand are the great controlling factors in economics. When there is a sufficient demand for an article, there will presently be a supply of that article. Some four hundred years ago, owing to the awakening from the Dark Ages and the consequent increase in business and commerce, there arose a great demand for gold and silver, as well as other metals. The demand was met. Again, owing to the great changes brought about throughout the better part of the earth by inventions, advance in general intelligence and living conditions, increase in the number and scope of industrial enterprises, commerce, etc., there arose a demand for a greater supply of gold, silver, and other metals in the fifties, sixties, and seventies of the last century. The demand was met. In the latter part of the last century, the world made stupendous strides in the arts of peace, and it began to look as if the supply of gold, as well as some other metals, was going to fall far short of the demand, but again the world's production of gold quickly quadrupled, in spite of the predictions of the wise ones to the contrary. Only a very few years ago, when the new and increased use of copper, coal, oil, and iron began to tax to some extent the productiveness of the best known supplies, a coal and oil shortage, and an iron and copper shortage, was confidently predicted in the not remote future, especially as regards copper. Not much of that sort of prophesying is heard at present. But if copper should go to 30c. per pound within two years, and the price of coal, oil, and iron double within a like period, then the wise ones would bray from every hilltop that these commodities would be entirely exhausted within a very few years, and then woe be unto us. As a matter of fact, if copper, or any other metal, should double in price within two years, and remain at that figure for any reasonable length of time, production would be so stimulated that within a few short years it would be selling even cheaper than at present.

It is hardly worth while to elaborate further on this point. The same general laws and facts will hold a million years from now. Those who agree with me will say amen at once, and those who disagree with me could not be convinced by my writing many volumes upon the subject.

If the present civilization should reach its zenith within 300 or 400 years, and then fall into decay and go back to the dark ages, there would be little demand for the metals and little would be produced, and that little would be much harder to produce at that time than ten or a hundred times the same amount at present. If then an awakening should come, and a few hundred or thousand years of cumulative progress ensue, every demand for metals would be met, although it called for ten times the present world's production of every one of them, including oil and coal. Just as soon as the shortage of any metal becomes acute enough, the supply of that metal will gradually increase until there is a sufficient supply for all reasonable purposes. This talk about the world's progress, intelligence, inventive genius, and productiveness having about reached its zenith is the merest rot, and proclaims the advocates of such foolishness as too conceited to be entitled to any consideration whatever. Merely because we have made great strides, or think we have (perhaps our posterity won't think so) in invention, general intelligence, education, sociology, hygiene, economics, increase of wealth, mining, agriculture, transportation, etc., during the last one hundred years, is absolutely no reason why we have about reached the limit. On the contrary, it is the best of reasons why we have only begun to make a start, and great progress is to be expected.

There is really nothing of consequence the matter with prospecting. Just to keep peace in the family, I

might admit that it may be slightly indisposed just at present, but certainly there are no alarming symptoms, and to send for the doctor would be very foolish, indeed.

Admitting for the present that there is at least a slight indisposition, what is the cause and cure? The cause is the same as in most cases of indisposition—indigestion. There are more prospects than there is capital available for their development. There are thousands of incorporated mining companies that never shipped a carload of ore, and yet are good prospects. If all the mining companies in the United States could sell all of their stock at par within 30 days, it would require all the money in existence available for investment purposes. No other enterprise could raise a dollar for any purpose for years. This does not take into account thousands of prospects that have never been incorporated, and most of them are of at least some merit.

There is a constant demand for money to finance railroads, public-service corporations, agriculture, industrials, mining, governments, states, municipalities, etc. Of course, there are fashions or crazes in investments. At certain periods railroad stocks and bonds seem to be all the craze with investors. At another time public-service corporation investments are very popular and no one seems to want to put money into steam railroad securities. Just now railroad securities are somewhat in disfavor. At other times, the investing public wants real estate, and all kinds of real estate booms in consequence. At another time, municipal bonds are very much in favor, as, for instance, right now. Then again, at another time industrials are very popular, as for example from 1898 to 1905, or thereabouts. Once in a generation or so the public gets the mining fever, and must needs buy mining stock by the pound, hundredweight, ton, and carload. Then is the time the prospector and his best friends (or should I say his worst enemies?), the wild-catter and promoter, wade in clover up to their ears.

For several years mining securities have not been in very particular favor, for much the same reason that railroad securities are not much in favor just now. Owing to such men as Charles S. Mellen in the railroad world, and Charles E. Brown, of Boston and Chicago, in the mining world, people have been duped, or think they have. Then, too, the supply of railroads, on the whole, somewhat exceeds the demand just at present. For this and other reasons they are not earning a sufficient rate of interest on the money invested. In like manner, the price of metals, mines, mining stock, mine prospects, etc., just now show that the supply, as a whole, somewhat exceeds the demand.

'Prospector' wants at least $5000 to $25,000 for his 'mountain of ore,' said 'mountain of ore' being exposed at one or two places, and 'Operator' is willing to pay but $1000 to $10,000 at most. 'Operator' says it looks as though 'Prospector' would die of starvation in sight of food. 'Prospector' says he would rather die of starvation at once and be done with the agony than to try to eke out a miserable existence on the few crumbs that 'Operator' offers him. If 'Prospector' incorporates his prospect with 1,000,000 shares, par value 10c. per share, which he considers exceedingly conservative, he can possibly—if he is a good 'rustler'—sell five thousand, or ten thousand at the outside. This gives him $500 or $1000, which does not go very far toward making a mine of a prospect. Why, if he has a good prospect, can't he sell more than $500 or $1000 worth of stock? Because the supply of such wares exceeds the demand. The public is afflicted with a slight case of indigestion from trying to assimilate too much mining stock and too many mine prospects, and many other kinds of stocks and prospects.

I might add as minor and contributory reasons for the supposed lack of interest in prospecting: (1) The constant 'knocking' by all the leading Eastern magazines for the past seven years of any kind of mining securities or mining properties; (2) the millions lost in mining ventures and mining stocks between 1902 and 1907; (3) the total ignorance of real mining by 95% of the public; (4) the laziness or lack of judgment of the prospector, in not better opening up his prospect himself than he generally does before offering it for sale to some capitalist, or trying to sell stock; (5) the inability of the prospector and operator to see things alike, or anywhere near alike; (6) the continual 'knocking' of prospecting by those well meaning people who must have it that the patient is sick unto death; (7) the inability of the prospector to get most millionaire mining men, who were once poor prospectors themselves, even to listen to a story about a likely prospect, much less to put up a cent on any term for its development; (8) the absolute lack of any interest whatever on the part of the big mining companies in small undeveloped prospects; (9) the lack of any recent great discoveries, like Goldfield and Cripple Creek, which appeal mightily to the public; (10) the absorbing of so much money lately by the automobiles, moving pictures, and many other fads, fancies, speculations, and extravagances; (11) the tendency most mining engineers have to reject every prospect in order to be on the safe side, and because it does not look enough like a mine—no prospect looks like a mine until it is developed into a mine, when, of course, it looks like what it is, a mine; (12) the 'knocking' of every prospector's property by every other porspector; (13) the nation-wide crusade against gambling and speculating that has to some extent killed the gambling spirit in the American public—a very good thing, too, it ought to be further discouraged; (14) the lack of any general moral support and encouragement of the prospector and his business just now (a few mining magazines and Western newspapers, it is true, are trying in a half-hearted way to encourage the prospector); (15) certain alleged imperfections in our mining laws, and alleged rulings and practices of those who administer the forest reserves; (16) psychological

hard times; (17) wars and rumors of wars. But the general reason that includes all the rest, is, as pointed out above, the lack of any great public interest in mining. The reason there is no great public interest in mining is, as also pointed out above, that the demand for the miner's commodities—prospects, mining stocks, metals, etc.—is hardly equal to the supply. If for any reason there should suddenly come such a demand for gold, lead, zinc, copper, coal, oil, and iron that the price of each would double within five years and remain so for any considerable length of time, then there would be a mining boom such as the world never yet saw. There would be a regular mining craze, a perfect debauch, and the prospector, for a while, would bathe in champagne, ride in $10,000 limousines, and build palaces galore. And as for the wild-catter—those that have starved to death during the past seven years would turn over in their graves, and those in jail would speedily procure a pardon, or break jail, and become exceedingly active; and those who are now eking out a miserable existence by doing odd jobs, would suddenly become prosperous and flourish like the proverbial green bay tree.

In conclusion, I wish to say again that there is nothing seriously the matter with prospecting. There is a little dullness in the business for the reasons pointed out. There is no tremendous boom in prospecting just now, of course, and there won't be until, for some such reasons as I have mentioned, the general public becomes greatly interested in the prospector and his prospects, and in mining in general. But I will venture to say that there are even now hundreds of men of more than ordinary intelligence out in the hills in their automobiles (some with their families), scouring the hills for new orebodies, and examining old discoveries. We must not forget that the business of prospecting is undergoing a transition from the old lone, long-haired man, with one or two disreputable burros, frying pan, coffee pot, grubstake, and old fashioned pick and shovel, exiling himself in the hills for months at a time, to the up-to-date, modern prospector with his automobile and assaying outfit. As to which is capable of producing the better results, the old-time prospector or the strictly modern prospector, I am not yet prepared to say.

Park City, Utah, July 21. CHAS. MOORE.

[With this excellent summary of the situation direct from the field, we must close the discussion of prospecting for the present. Interesting as the subject is, and helpful as we hope the discussion has been, we must reserve our space for other topics in turn. We are grateful to the many whose letters we have published and to the others for whose comment we have been unable to find room, and we trust that some of our friends may soon locate another Goldfield, if indeed it has not already been staked. There is no competition in gold mining, and the finder of a new high-grade district will help his fellow-prospectors quite as much as himself.—EDITOR.]

Revision of Mining Laws

The Editor:

Sir—Regarding the discussion on revision of mining laws, in issue of July 18, by F. R. Ingalsbe and C. K. Colvin, the present requirements necessary to patent mining property vary with every change in the administration of the Land Office at Washington; the law should be clear, distinct, fixed, and not left to the whims of any man or set of men, giving Pinchotism an opportunity to ruin the mining business.

I believe that it is hard to improve upon the Mexican mining law. Anyone can locate all the mineral land he desires, within 90 days; thereafter it must have been surveyed, examined, and reported upon, and monuments of rock and mortar or cement, about 2 ft. square and same high, erected upon the external boundaries, in such a position that, from each, the one in front and one in back can be seen, plainly. No location is valid when overlapping another claim. After patent is obtained, a tax upon each claim and fraction thereof is required, which is payable every four months. If not paid in the month due, the next month the penalty tax is 50%, the second month 100%, and the third, one loses the property. Notice is then posted upon the bulletin of the mining agent's office, and he notifies the general office in Mexico City. Within six or eight weeks the general office notifies the agent of the district where the claim is located, and the agent posts a notice for 30 days that the claim is again open to re-location, to anyone except previous locator. The engineer in charge of location work must be a registered engineer of Mexico, if there is one resident in the distrcit, or else an engineer agreed upon by the locator and the mining agent of the district. The name of the claim must be painted distinctly on each monument.

No work whatever is required, and title is perfect as long as taxes are paid. After the claims are surveyed and reported upon, the mining agent posts a description of the claim for four months, and causes to be published in the official paper of the state (only one) a description of same, for 60 days. During four months anyone may protest the claim if cause is shown.

If discovery of mineral is demanded, it should be anywhere on the claim, allowing one or more non-mineral discovery claims, owing to their size. If one is willing to pay say $3 per acre for mineral land, generally not worth 25c. for other purposes, and pay taxes on this, why not let him locate all that he wants? It is known that the $100 per claim annual assessment work, nine times out of ten, is a farce. I recently examined an old camp where a few men are holding the whole district, and, with one or two exceptions, practically no work is being done. On most of these claims the only way one could determine where they were or make other valid locations in their vicinity, would be by procuring a copy of the location certificate and put a competent surveyor in the field.

Ely, Nevada, July 23. G. L. SHELDON.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

IN DRAINING Kerr lake at Cobalt, Ontario, the pumps removed 325,000,000 gal. of mud and water at an average of 6000 gal. per minute for 38 actual working days.

FOUR small graphite-coated diamonds have been found in the Premier mine, Transvaal, and is an addition to the already large list of unsolved problems connected with diamonds.

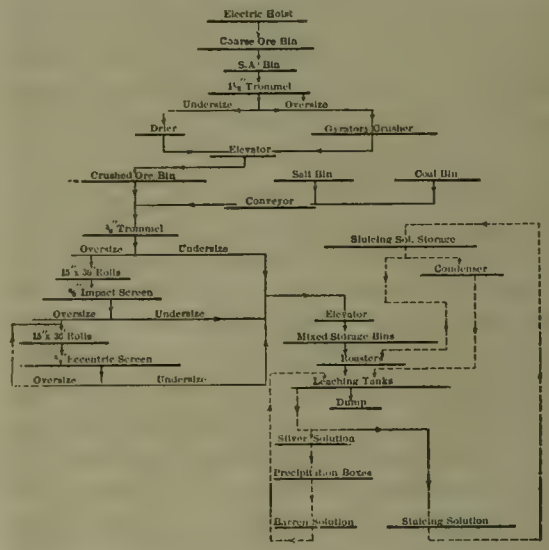
BULLION-MELTING FURNACES using coke should be provided with a seamless cast iron ashpit. In case of breakage of a crucible during melting bullion, it is then a fairly easy matter to recover everything which may have been spilled. An ashpit constructed of brick is very hard to clean, and concrete is not much better. The time, trouble, and satisfaction of knowing that all the bullion has been recovered, well repays for installing an iron ashpit.

ELECTRIC POWER generated at the Waihi Grand Junction mine, New Zealand, in 1913, from four 600-hp. Babcock & Wilcox boilers, three 580-hp. Parsons turbines, and one A. E. G. turbine of 2680 hp., totaled 6,588,708 units at a cost of 0.9376c. per unit, or $81.90 per kilowatt per year. The maximum load was 1742 hp. This included two Ingersoll-Rand air-compressors, 26 motors in the mill, 15 motors in the mine, 14 motors in the power-house, and 6 motors for sundry purposes, with a total of 2487 horse-power.

DYNAMITE AND TROJAN POWDER amounting to 435,525 and 15,394 lb. respectively, exploded in the Panama canal magazine at Mindi on July 5. A large hole was made in the ground where the magazine stood, a huge mound of earth formed, and the Mindi river was filled 10 or 12 ft., making it take a new course. The magazine was so constructed and surrounded by hills that any explosion would not affect the villages of Cristobal, Colon, Mount Hope, and Gatun. It was 9 by 48 by 112 ft. in area and was large enough for 600,000 lb. of dynamite. The detonator house, 10 by 17¼ by 33 ft., and 150 ft. away, was partly damaged, but its contents did not explode. The cause of the explosion is attributed to spontaneous combustion, although the place was inspected every day.

WATER USED by the partners of the Kalgoorlie and Boulder Mines Water Trust, Western Australia, which is a concern connected with the Chamber of Mines, represents the large properties at Kalgoorlie, and deals with the water bought from the Government of that state, was as follows during the half-year ended March 30, 1914: sluicing services (disposal of residue) at 36c. per 1000 gal., 31,910,000 gal.; sluicing at 84c. per 1000 gal., 9,022,000 gal.; and general services at $1.68 per 1000 gal., 166,286,300 gallons. This was a decrease of 15,551,200 gal. compared with the same period of the last year, but an increase of 7,336,000 gal. over the year ended September 30, 1913. About 850,000 tons of ore was treated during the term reviewed, the production of 11 mines. To supplement the great 353-mile water scheme supplying this and other mining and agricultural districts, a 10,000,000-gal. reserve tank has recently been constructed at Kalgoorlie. In the event of a break or necessary repairs, the reservoirs there have about a week's supply.

CHLORIDIZING LEACHING at the Mines Operating Co.'s plant at Park City, Utah, is described in the July *Bulletin* of the A. I. M. E. Ore treated contains 6 to 14 oz. silver, 0.01 to 0.015 oz. gold, and 1 to 2 lb. of copper



FLOW-SHEET OF MINES OPERATING CO.'S MILL AT PARK CITY, UTAH.

per ton, with a little lead and zinc. After roasting the ore is leached by a solution made up of soluble salts, mostly NaCl, from the roasted product, carrying in addition about 4 lb. of free sulphuric acid. Leaching costs from 17 to 44c. per ton. Recovery of metals is done by passing the leaching solution through boxes filled with any kind of scrap iron, and the precipitate of gold, 1.78 oz.; silver, 6868.5 oz.; lead, 13.2%; copper, 36.94%; iron, 2.5%; sulphur, 1.6%; and zinc, *nil*, is shipped for refining. The mill treats 160 tons per day with a good extraction and reasonable cost.

MINING IN THE FAR NORTH*

Valdez and Prince William Sound

By E. E. HURJA

Prince William sound was discovered in 1778 by Captain James Cook. It was visited by other explorers later, Vancouver in 1794, contributing maps of the district. Although Russians had trading posts at different points along the sound, but little prospecting was done. Reports are that copper prospecting was carried on by the Russians in the mountains of western Hinchinbrook island. The first activity of Americans in the copper fields was noted in 1897, when the staking of the Gladhough claim on the east side of Virgin bay started the excitement. This claim was the nucleus of the Ellamar mine. The Bonanza property, on Latouche island, was staked the same year and has been a good producer.

The Bonanza has shipped regularly since 1904. The mining is largely done from an open hill face, and the ore trammed through two tunnels to the quarry floor. Considerable driving has been done, as well as prospecting with a diamond-drill.

The Ellamar Mining Company's claims, operated by L. L. Middelkamp, are situated on Virgin bay, 28 miles from Valdez. The Gladhough claim, located by W. L. Johnson in 1897, is the centre of development. A 600-ft. shaft, with levels at intervals of 100 ft., taps the orebody, a lenticular mass carrying copper, gold, and silver. For the last two years a start has been made toward cleaning out the remnants of the orebody. Work is now conducted between the 300 and 400-ft. levels. The fill system of mining is followed with slate waste used as filling material. A 1200-ft. Nordberg compressor supplies power to the drills, including one diamond-drill. The drill has found new orebodies, but the extent has not been definitely determined as yet. A 10 by 12 Duplex double-drum hoist is used, and will be supplemented by another to be erected this fall. A new Broderick & Bascom tram, with a capacity of 200 tons per hour, has been built and was to be ready for use before August, according to the manager, Middelkamp. The tram will connect the bunk-

[*Previous articles in this series by Mr. Hurja on mining in Alaska and the Yukon have been 'Mining Revival in the Ketchikan District, Alaska,' July 4; 'Wrangle, Alaska,' special correspondence, July 11; 'Developments of the Alaska Gold Mines Co.,' July 18; 'Juneau, Alaska,' special correspondence, July 25; 'Cordova, Alaska,' special correspondence, August 8. Mr. Hurja is now in the interior and in subsequent letters will give our readers full accounts of present conditions in each of the great producing districts of the Far North.—EDITOR.]

BIRD'S-EYE VIEW OF PRINCE WILLIAM SOUND DISTRICT.

ers at the mine with the dock bunkers, a distance of one-half mile. The mine will be able to ship 5000 tons per month with the completion of the new tramway. F. M. Jordan, of Seattle, and W. M. Rust, of Tacoma, are the chief owners of the property.

Engineers of the United States S., R. & M. Co., Messrs. Hughes and Anderson, are in the district now, conducting examinations of different properties. Sampling parties are in the field, making Valdez the headquarters. The Three Man Mining Co. claims at Landlock bay, which has shipped considerable ore, is one of the groups under examination by the new Company. The Fidalgo-Alaska Copper Co. claims, at Fidalgo bay, also are being examined by the engineers. No work has been done there since April. Two-hundred-ton bunkers at the mine are connected with the 1000-ton bunkers at the dock by an aerial tramway 2600 ft. long. Two thousand feet of underground development work has been done.

Adit work aggregates 6000 ft. Discovery of copper at Unakwik bay in Port Wells has aroused interest in that district. The most recent find was made by Martin P. Anderson, who owns the Snowstorm group of claims. The claims have been bonded by F. S. Sinnicks, of Boston, for $50,000, who planned to have a prospecting party at work before August. A 5-ft. vein of ore carrying copper, galena, and silver has been traced for 3000 ft. on the claims. Seventy feet of adit has been driven by George Wagner and Harry Wilson on an 8-ft. vein of copper-bearing ore at Siwash bay.

The Work of the Granby Consolidated M., S. & P. Co., in the Valdez district, is the largest construction work in the Prince William Sound country at present. Over a hundred men are being worked, with a monthly payroll of from $10,000 to $15,000. E. E. Campbell is engineer in charge, with G. E. H. Smith superintending the construction. The 15 claims making up the Midas property have been taken over by the

MAP OF PRINCE WILLIAM SOUND.

The Rua and Valentine properties on Knight's island also are to be sampled by the United States Smelting engineers. Larson Brothers are doing assessment work on their holdings on Knight's island. The Viking group, five miles from the head of Fidalgo bay, is being developed in a small way.

The Fidalgo Mining company owns 24 claims at Fidalgo bay. The development is confined to the Winchester and Elgin claims, on which two adits have been driven, the lower one serving as a working adit. A surface tram 900 ft. long connects the portal with the upper terminal of the Riblet two-bucket aerial tram which carries the ore a distance of 2000 ft. to the main bunkers at the dock. Development work at the mine is to be centred on a 1200-ft. adit, which will start 200 ft. from the beach and tap a proposed winze from the present workings. A depth of 600 ft. will be attained. T. W. Blakney is in charge of the work at the mine.

Prince William Sound Mining Company

Nineteen claims, owned by the Prince William Sound Mining Co. on Copper mountain, are being surveyed for patent. Granby interests, and work at the mine will start next week. A main working adit, 6 by 7 ft. in dimensions, which will tap the ore, will be connected with the present workings. Five-hundred-ton ore-bins at the mine will be connected with a 3000-ton bin at the beach by a Riblet aerial tram five and one-half miles in length. At the mine, a ten-drill Ingersoll-Rand compressor has been installed, and will be operated by electric power. A small machine-shop has also been constructed. The ore-bins at the beach will be at the low water mark and the dock 200 ft. farther out. A belt-conveyor 24 in. wide will carry the ore from the bunkers, at the rate of 200 tons per hour, to an elevation of 30 ft., there to be released into iron chutes. An electric motor will operate the conveyor. The Midas orebody is pyritic and contains copper, gold, and silver, occurring in a replacement shear zone in schist. Development work undertaken by the Alaska Syndicate, which operated the property up to two years ago, aggregates 2000 feet.

Though copper is still the mainstay of the district, the gold discoveries near Valdez are attracting considerable attention

and are producing some money. On July 6, $29,500 in bullion was shipped from Valdez, the result of 14 days' operation of the quartz mines. The output of the quartz mines this summer is estimated will be $300,000.

Port Valdez

Port Valdez, the main gold district, is an inlet trending northeastward from the main waters of Prince William sound. Gold was first found in the gravels at the mouth of Mineral creek in 1894, but the mining done at that time did not amount to much. Four years later, the work of the prospectors bore fruit and additional placer claims were staked on Solomon gulch, on the south side of the inlet and about opposite the glacial moraine on which the town of Valdez was built. The place was first known as Copper City and was the outfitting place for the thousands of prospectors who swarmed over Valdez glacier on their way into the interior to the Klondike and other discoveries. Quartz mining in the district is confined to small veins of rich ore. A number have been discovered and some have been worked profitably. The most successful mining venture of the district, the Cliff, gave stimulus to prospecting after 1909 and the district has forged ahead rapidly since that time.

Work has been suspended now at the Cliff mine and the affairs of the Cliff Mining Co. are rapidly being settled. A 4% dividend was declared July 6, and another, the final one, will be forthcoming soon. The Cliff Mining Co., owners of the lease on the Cliff claim, has produced $900,000 in gold and paid $231,000 in dividends, aside from royalties. The claim is situated eight miles from Valdez at the east entrance to Shoup's bay. Sea-water invaded the workings recently and so rapidly that one pump on the lower level was lost. Operations at the property in the future depend on the desires of the owner, who is in the States. The Sealey-Davis property, adjacent to the Cliff, is under lease and bond to J. Devinney. He is continuing the adits, which have attained an aggregate of 1600 ft. The Three in One claim also is being worked between Gold creek and Shoup's bay. An adit 200 ft. long is about to be started on the Tomboy property on Pickett bay. F. L. Wagner, who has a $40,000 bond on the claims, has leased the property to the Colin-Murray company which is engaged in active development. A 40-ft. adit has been run on the lode with a width of 3 ft. If the work from the new adit is satisfactory, plans for a reduction plant and tram will be made. Work on the larger of two shoots on the four claims comprising the holdings of the Gold Bluff Mining Co., adjacent to the Cliff property, will be started this fall. The claims are being surveyed for patent now. The adit work on the property aggregates 240 feet.

The Blue Bell Claim

The Blue Bell claim, situated on Valdez bay at the entrance to Shoup's bay, 1500 ft. from tidewater, is being developed from a cross-cut 120 ft. long, which taps the ore at a depth of 60 ft. The vein is from five to six feet wide and carries free gold. The claim is owned by F. M. Boyle and associates.

Operations on the Cameron-Johnson property, situated 17 miles from Valdez and five miles from Shoup's bay, are being continued. On July 10, work was started on the construction of a 3800-ft. Bleichert tram to replace the present temporary tram between the mine and the mill. The Company owns 23 quartz and three placer claims. The quartz operations are being centred on the Treasury Note, Walloper, Gold Certificate, and Mazuma claims. Adits, raises, and drifts on the Treasury Note aggregate 478 ft. in length, with a maximum depth attained on the orebody of 217 ft. Stoping operations are being conducted between the middle and upper levels, a raise is being driven to connect the lower with the middle level and both the middle and lower levels are being extended along the vein. Three shipments of ore from the vein made to the smelter yielded from $101 to $226 per ton. A 100-ton lot of selected ore milled on the property yielded 180 oz. gold. On the Gold Certificate claim, 68 ft. of adit has been driven, on the Walloper 35 ft. On the Mazuma, a 110-ft. crosscut has been driven, with a 60-ft. raise to the surface. The claims are at an altitude of 2000 ft., with the mill equipment at an altitude of 2000 ft. The five-stamp Risdon mill on the property will be supplemented this year with a 7-ft. Lane mill and two Monarch concentrating tables, the equipment now being on the ground, ready for erection. The mill is operated by water-power derived from a Pelton water-wheel with a 246-ft. head. Sidney Drake, general manager, expected the new equipment to be in use and the mill operating to its full capacity by August 15. Forty men are being employed at the mine.

GOLD KING MINE, VALDEZ.

A contract for driving 100 ft. of adit on the claim of the Rambler Gold Mining Co., situated on Shoup's glacier above the Cameron-Johnson property, was let in July by F. L. Wagner. The new work will make the total on the claims 600 ft. A drainage adit to unwater the workings of George Herman and William Eaton at Bettles bay, Port Wells, is contemplated. The group comprises five claims, on which 115 ft. of shaft has been sunk with 130 ft. of driving on a vein varying in width from 20 to 24 in. Water put a stop to the work two weeks ago.

Ramsay-Rutherford Mill

Construction of the Ramsay-Rutherford mill is continuing steadily. The Ramsay-Rutherford company owns a group of ten claims situated near Valdez glacier 12 miles north of

Valdez at an elevation of 3500 ft. A 150-ft. double-compartment, vertical 9 by 6 shaft has been sunk. On the 50-ft. level, 135 ft. of drifts have been driven on the vein. On the 150-ft. level, the vein has been tapped, but no driving has been done as yet. On the 50-ft. level, a cross-vein 12 in. wide was found 80 ft. from the shaft. The main lode varies in width from 6 in to 11 ft., with an average width of from 20 to 24 in. Forty-six tons shipped to the Tacoma smelter in 1912 yielded average returns of $87 per ton. The foundation for a five-stamp Joshua Hendy mill is in and the mill building is under way. The mill will be in operation in September. Twenty men are employed. If work on the 150-ft. level justifies, a 600-ft. cross-cut to serve as the main working level, with the portal at the same altitude as the mill, will be started this fall.

The Golden Eagle Mining company, operating at Port Wells, is planning to erect a five-stamp mill this fall. Two hundred feet of adit has been driven on the vein. The mine will be connected with the mill by a 1000-ft. aerial tramway. Edwin Griset is the manager. M. J. Callaghan, who has a $50,000 bond on the property of William Hogan and Peter Black in Harriman's fiord, plans to continue the adit on the claim this fall. Present underground work on the vein totals 200 ft. The lode is from 4 to 16 in. wide. A lode from 1 to 6 ft. wide on the Sweepstakes claim at Harriman's fiord will be under development by the end of July, according to Mr. O'Neil, one of the owners. Two small shafts and 150 ft. of adit comprises the present development. The work on the Alice Mining company claims at the head of Shoup's bay is at a standstill, pending a settlement of financial difficulties. Two drifts totaling 270 ft. and a 300-ft. adit make up the development on the lode, which varies in width from 6 in. to 2 ft. long. Two hundred feet of work remains to be done on the 1000-ft. adit on the Ellis-Imperial group between Shoup's bay and Gold creek. Work will be started soon on a drift along the vein where it outcrops on the surface.

A test shipment of 3800 lb. crushed July 21 at the mill of the Mountain King Mining Co. yielded $100. The Company owns five claims eight miles from the mouth of Mineral creek at an altitude of 3000 ft. Two thousand feet of driving has been done on the property, with a maximum depth attained on the 20-in. vein of 285 ft. W. L. Smith, manager, let a contract the middle of July to haul 200 tons of high-grade ore from the mine to the mill. The mill is a two-stamp Hammond, with 1000-lb. stamps, situated at an altitude of 800 ft. A survey has been made for a 4300-ft. tramway to connect the mine with the mill.

A Straub mill is being erected on the Big Four property, owned by San Mateo, California, people. Work on the claims, which are at the head of Mineral creek, aggregates 300 ft. Development of the orebody is being continued. The Collins-Fish property, four miles from the head of Passage canal, has been bonded to B. F. Millard. Prospecting has been confined to the surface. A contract to run 90 ft. of adit on an 18-in. vein on the No. 9 property on Portage bay, one and one-half miles from Golden, has been let. One 60-ft. shaft and another 50 ft. deep have been sunk on the Ohme property, above No. 9. The vein varies in width from 10 to 30 in. Prospecting on the Hogan-Olson claims, two miles from that of the Granite Mining company, is being conducted by lessees working under a lease and bond of $70,000.

The Granite Gold Mining Co. of which J. E. Chilberg, Jafet Lindeberg, B. F. Millard, and Ray Millard are the owners, has a group of three claims near Hobo bay on Port Wells. The claims are 1000 ft. from tidewater, with an altitude of 600 ft. Development on the Center claim consists of a 156-ft. cross-cut tapping the vein at a depth of 106 ft. Driving on the vein aggregates 240 ft. A 152-ft. raise has been driven to the surface 106 ft. from the portal of the adit. A 50-ft. winze, with dimensions of 7 by 10, has been sunk, and driving started on the vein. This lower drift totals 250 ft. Ore from the lode, which varies in width from 2 to 13 ft., maximum width being attained in swellings, has averaged $38 per ton. Work was started in April 1913, and since March 20, ore to the value of $32,000 has been mined. The clean-up made July 3, yielded $10,500 for a 22-days' run of a 7-ft. Lane mill. Power at the mine and mill is derived from gasoline engines. A 25-hp. Foos engine operates the compressor and furnishes power for a No. 5 Cameron sinking pump. A 15-hp. Fairbanks-Morse gasoline hoist is used, and a Triplex station pump, operated by a 12-hp. engine, has just been installed. Sinking is being conducted from the second level. Thirty-five men are employed. From the portal of the adit, the ore is trammed over a 320-ft. trestle to bins, and carried from there by an aerial tramway 340 ft. long to the mill. Mill equipment consists of a Blake crusher, a 7-ft. Lane mill, and a Deister table, all operated by a 20-hp. West Coast engine. Additional equipment has been ordered, to consist of a set of Allis-Chalmers rolls, style B, which, operated in connection with the Lane mill, will double the capacity of the present reduction plant. A Wilfley concentrating table will be added. Tailing is impounded. One ton of concentrate worth $50 in gold is derived from 60 tons of ore. Mr. Millard says the milling equipment will be increased with a 10-stamp outfit if results on the next level justify. Freighting costs are not high, for goods are towed to the beach on barges from Valdez and then hauled on a corduroyed road to the mine. Fuel is distillate from the Katalla fields, delivered in drums at the mine for 14c. per gal. The vein has a northwest-southeast strike and dips northeast at an angle of 45°. One-half of the vein is in altered granite; grading from that into a slate formation.

Gold King Mining Company

An output of $15,000 per month is being maintained at the Gold King Mining Co. property, 15 miles from Valdez above Shoup's bay. The equipment comprises a Dodge crusher, a 3½-ft. Huntington mill, and a Risdon-Johnson concentrating table. Underground work on the orebody totals 1850 ft., and the maximum depth attained is 76 ft. The vein varies in width from 16 to 50 in. Another vein, averaging 8 inches in width, is being developed by adit. The mill operates but six months in the year and the summer payroll amounts to $2500 per month. The clean-up made July 4, gave $5800 for 10 days' run. In the summer of 1913, a 35 days' run yielded $18,500. A two-stamp Nissen mill will be installed this fall. Gasoline engines supply power to the mill equipment, consumption being at the rate of 30 gal. per 24 hr., with a cost per gallon of 55c. Difficulty in freighting the outfit to the mine was overcome by a novel scheme worked out by Charles R. Crawford. With a 6-hp. Fairbanks-Morse gasoline upright single-drum hoist, he first pulled the supplies off the barge to the shore. Then, by fastening the donkey to a 12 by 12 'dead man' imbedded in the snow, the supplies by relays were hauled up the face of Shoup's glacier, across that and Columbia glacier, to an altitude of 4500 ft. From there, the material was lowered to the mine workings. The freighting cost was 3c. per lb. from the beach to the mine.

Work on the cross-cut of the Valdez Mining Co., operating claims on Valdez glacier eight miles from Valdez, is being continued. The first adit is 125 ft. long. From it a winze 50 ft. deep has been sunk on the orebody, and 50 ft. of drift run from the bottom of the winze. Seventy feet of the cross-cut remains, which will tap the 6-ft. lode 375 ft. below the surface. Johnson and Erickson, lessees on the Williams-Jentzler property on Mineral creek, are continuing development. George Calligan is working a stringer in the same district and plans to make a shipment soon.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

LONDON

SLUMP IN MYSORE SHARES. PAST RESULTS OF THIS GREAT MINE. GEOLOGICAL FACTS, AND FUTURE.—SHAMVA AND ELDORADO MINES.

The London market has had a bad fit of the nerves this week, owing to a slump in the quotation of Mysore shares. For several days the price dropped ominously, and many 'croakers' predicted the coming of the end. The Mysore is the oldest and most prosperous of all the gold mines in the Kolar district in Central India, that have been managed so ably by John Taylor & Sons. The orebodies are found in the pre-Cambrian rocks, and they have fulfilled Malcolm Maclaren's contention that ore in such rocks is likely to persist to great depths. The Mysore has been paying dividends steadily since 1886, and has distributed $35,000,000, earned from a production of $70,000,000, extracted from 3,900,000 tons of ore. The yield in 1913 was $4,300,000 from 302,662 tons, and $1,890,000 was distributed as dividend, being at the rate of 125%. The ore reserve is sufficient to keep the mill employed for four years, and it is no wonder therefore that the shares stand at a high premium. For some time the quotation of the 10 shilling share has been over £5. Last week the first movement for a long time took place, and every day saw a fall of 5 shillings, until £3 15s. was reached. The directors issued a circular assuring shareholders that nothing had occurred since the last general meeting to warrant any gloomy forebodings. It is true that developments have been practically suspended during the last four months, but that was because the drought caused a shortage in hydro-electric power. The geological formation encourages the theory of alternating poor and rich zones, so that shareholders do not as a rule get scared when development gives reduced results. A glance at the vertical longitudinal sections at the Mysore and its neighboring mines, the Champion Reef, Nundydroog, and Ooregum, shows that these 'alternating zones' are misnomers, and that a more satisfactory explanation of the formation is to describe the richer zones as a series of flat-pitching ore-shoots. The shoots in the Mysore pitch northward into the ground of the Champion Reef, but unfortunately for the Mysore there are no known orebodies to the south to pitch into its ground in depth, so that when a 'zone of impoverishment' is encountered in the bottom workings at the south end, the chances are that no further 'zone of enrichment' will be cut. That John Taylor & Sons are fully aware of this formation is shown by the fact that exploration outside the southern boundary is being conducted from the 2100 and 2300-ft. levels of the Mysore. No orebody was ever found in this area by exploration from the surface, but it is just possible that there may be one there that does not outcrop. As a matter of fact, other orebodies that do not outcrop have been found in this great lode, farther to the north, and consequently another may be found. Unfortunately, however, no results have been obtained as yet.

Rhodesian mining operations are in the hands of a few big corporations, the directors of which do as they like with the shareholders and the public, both financially and technologically. The Shamva mine provides an instance. This is controlled by the Gold Fields Rhodesian Development Co., which handles the Rhodesian interests of the Consolidated Gold Fields of South Africa. The Shamva orebody is a big one, and as it outcrops on the top of a hill, it can be worked cheaply. The Gold Fields people heralded it as a 'banket,' thinking that the magic of that name as known on the Rand would boom the shares on the market. The same thing was done by the same promoters in connection with the Eldorado mine, which is in the same district of Rhodesia. The deposit is not a pebble-bed at all, but a breccia or agglomerate. Another questionable point of policy at the Shamva has been the sudden stoppage of development at depth just at a time when the persistence of the orebody in depth became an interesting topic for discussion. On the prospect level, the orebody is 740 ft. long and 88 ft. wide, averaging 3.8 dwt. per ton; on No. 1 level the corresponding figures are 920 ft., 110 ft., and 4.14 dwt.; on No. 2 level, 820 ft., 97 ft., and 6.77 dwt. Work on the fourth level was stopped when 150 ft. of the length was proved, measuring 62 ft. wide and averaging 5.36 dwt. per ton. The cause of the stoppage is alleged to be lack of compressed air, but it is also stated that winzes are being sunk from the No. 3 level to a depth where a No. 5 level can be started. The total reserve is reported at 2,405,796 tons averaging 5.01 dwt. gold per ton. A mill containing 56 Nissen stamps and 10 tube-mills has been erected, capable of treating 50,000 tons per month. The first portion was started in January of this year, but the plant was not running at full capacity until May. The remarkable feature is that there is a big discrepancy between the assay-value of the feed and tailing, and the actual yield. This has been going on all the time, and the shortage of yield is perplexingly great, far too great for the absorption of gold by the plates and held in the circulating cyanide solutions to account for it. People are asking whether screen sampling is regularly done, or whether the assay-value of the feed is really the estimated assay-value in the stopes. Whether with the object of investigating this shortage or otherwise, the amalgamating plates have been removed, and it is stated that the extraction by cyanide alone is as satisfactory as by the two processes. But these metallurgical questions are not sufficiently illumined to warrant any discussion here.

The Eldorado mine was mentioned in the above paragraph. The details of the ore deposit here have been kept secret, but geologists who have had the privilege of going underground state that in some places very rich ore was found. Its presence was never divulged, so that no rush of prospectors ever occurred. The free prospector is disliked by the powers-that-be in Rhodesia. It is only the tributer who is ready to accept the crumbs that fall from the rich man's table that is encouraged. The Eldorado appears to be reaching its end. Bad mining methods caused a collapse of part of the upper workings some time ago, and such ore as can now be extracted from those levels is mixed with much worthless rock. One of the lodes, called the Parallel Reef, has proved valueless below the No. 8 level. On the main lode the orebody is only 65 ft. long on the No. 13 level, having shown a continued shrinkage from the No. 9 downward. The ore sent to the mill has been reduced, as well as the grade. Ore reserves mention 14 dwt. as the content, but the ore fed is of an 8-dwt. grade. The reserve stood on June 30, 1914, at 55,000 tons averaging $15 per ton. The main shaft is down to No. 15 level. On No. 14 the cross-cut should open the lode at any time. The main winze east from No. 13 level is down over 38 ft. and assays $17 over 55 in., the face showing free gold.

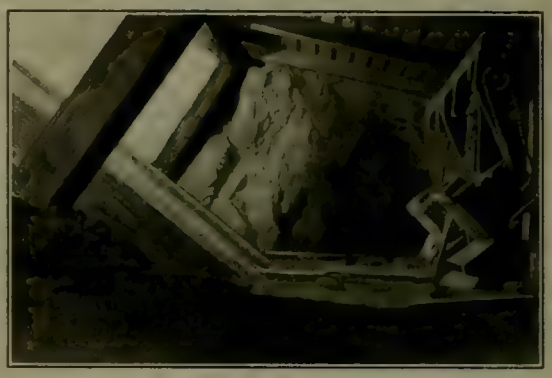
HOUGHTON, MICHIGAN

Wide Use of One-Man Drills in the Copper Country.—Quincy Air-blasts.—Efficiency Campaign.—Strike Notes.

Illustrative of the recent tendency to replace old-fashioned heavy machine-drills by light one-man and water-Leyner drills, the copper country manager of one mine machinery house states that, since the latter part of 1911 he has sold 2000 drills, which is nearly equal to the total number of drills in use in the Lake Superior copper mines—this in spite of the practice of mining companies of manufacturing their own repair parts. The Leyner is the most popular all-around driving and stoping drill, being a 150-lb. machine, the pioneer of the mounted hammer types to give satisfaction, and the Calumet & Hecla even uses it for driving inclined raises (although most other companies use stoper drills for raising); the Quincy used the 'Baby Leyner,' a ninety-odd pound machine, for driving and stoping. Since being taken over by the Ingersoll-Rand Co., the Leyner drill is made with a 'butterfly' valve, which is an improvement over the spool variety of air-thrown valve. The little jackhamer, also with a 'butterfly' valve, a self-rotating 'plugger' drill, has proved popular in shaft-sinking (as in the Michigan iron mines), and is used for block-holing large masses underground. But the most important result of the advent of the jackhamer is the discoveries made in the foot-wall of old stopes on account of being able to dig after showings of copper conveniently, where tripods and heavy drills would be quite awkward. When in the days of heavy drills a little showing of copper was noticed in the foot-wall, the mining captain sometimes gave orders to "carry a tripod and drill up there and see what it is"; but more often he did not, as the foot-wall was liable to be rough climbing. The jackhamer, weighing 40 or 50 lb., is just the drill for prospecting such places, and some of these insignificant little showings in the foot-wall of amygdaloid lodes are leading the way to valuable deposits, in many places large 'chambers' of rich copper as wide as the original lode. The old Wolverine mine is considerably prolonging its life in just this manner, while one of the officials at the Quincy has hopefully stated that that famous mine "bids fair to produce as much copper, working from the bottom up to grass roots, as it produced from the grass roots down to bottom." The Quincy has 110 jackhamers, which shows the extent to which foot-wall exploration is being carried. Incidentally, the Quincy is being considerably bothered by air-blasts, which are increasing in frequency, often shaking the ground in Hancock and Houghton quite noticeably. (On one occasion, a gentleman in Houghton, feeling a particularly heavy air-blast, dropped in at his brokers and sold some Quincy stock, guessing rightly that it would depress the stock a little.)

The Calumet & Hecla's efficiency campaign, particularly as regards underground details, is producing wide results in the copper country. In addition to considerably reducing the cost of mining at the lower-grade mines of the Calumet & Hecla interests, such as Isle Royale and Superior, so that these properties can pay dividends, the other companies in the district are getting into the efficiency habit, and some of them employ men to direct their underground affairs who have been trained by the Calumet & Hecla's efficiency department. Thus the Victoria mine, which has struggled for so many years with the disadvantages of very lean ore (or 'rock'), and of being four miles off the railroad in rough country (and which, in fact, has only managed to exist by virtue of practically free compressed air from its rock-bound, water-entraining air-compressor), recently hired as mining captain a young man who had learned underground methods with the Calumet & Hecla. This new foreman discovered that part of the time the Victoria had been in the lode and part of the time groping out of the lode, so that now with more discerning superintendence the Victoria is doing better than for a long time and opening good ore. The seat and centre of the Calumet & Hecla's efficiency movement is at its Superior mine, just south of Houghton.

The superintendent for the Superior Copper Co. is also chief efficiency engineer for the Calumet & Hecla companies, and he tries out in his mine most of the efficiency innovations before they are adopted on a large scale; furthermore, if in introducing a new method, say at Calumet, the miners declare "it can't be done," the superintendent of the Superior will go up and do it for them himself, being an expert at handling a drill and at practical mining. It is, of course, known that too autocratic 'efficiency' helped to bring on the disastrous miners' strike, but as one mining man expressed



LOADING STATION IN A MICHIGAN COPPER MINE.

it, "the strike taught both sides a lesson, and things are going better now." In the light of later developments, it is realized that what really broke the backbone of the strike was the spectacular kicking out of Charles Moyer by the enraged mining men and citizens, since such a procedure represented action that the striking miners could understand and relieved the tension, being a typical Lake Superior method of dealing with trouble. As to whether general manager James MacNaughton of the Calumet & Hecla was a member of the 'serenade party,' as Moyer claimed, or merely his brothers, even those on the inside of things say "no one knows." It is admitted, however, that Moyer was lucky to get no worse than he did.

BUTTE, MONTANA

Effects of the War in Europe on Copper Mines and Works; Many Unemployed; Business in Butte Very Dull.

Labor troubles at Butte, which are always with us to a greater or less extent, have sunk into insignificance in the light of the new menace, the European war. The war crisis has had an immediate and serious effect on the mining industry at Butte. The copper companies claim that there is no market for their product, and in consequence are ordering wholesale closing of the mines with their dependent industries. The Great Falls smelter has been ordered closed entirely; the Anaconda smelter has laid off a large force of men, and has stopped all work on construction and improvements. At least half the Butte mines are closed, and it is predicted that within a week most of the rest will close. Nearly all properties in which prospecting and development work was in progress have been closed, because of the tightness of the money situation, and the uncertainty of future conditions. The East Butte Copper Co. has closed both its mine and reduction works, which affects not only this property, but some smaller properties which ship to the Pittsmont

smelter. One of the banks at Butte has already closed its doors, and others have issued notice demanding time on all savings accounts. The whole community is in an unsettled and scared condition, undoubtedly worse than at any time in Butte's history. The stores are idle, no purchases being made, except those absolutely necessary. Of course there is no trading in stocks, or any speculative investment of any kind. The town is full of idle men, who spend their time reading war bulletins, and discussing gloomily the foreboding situation. A large number of technical men connected with the mining industry here, who had planned to attend the meeting of the American Institute of Mining Engineers in Salt Lake City on August 10 have found it necessary to cancel their arrangements, either because they did not feel justified in spending the money required for the trip, or because business cares at home demanded their presence here. It is expected, and it is to be hoped, that the idle miners and others who have been thrown out of employment can scatter to the agricultural areas and secure work in the harvesting of the crops of Montana, which, fortunately, are large and extensive. As this situation has come upon us like a thunderbolt, we are far from adjusted to it, and are able to draw no conclusions, nor make any predictions.

DEADWOOD, SOUTH DAKOTA

Leaching Plant for Jungle Copper Ores.—Titanic Gold Mining Co.'s Work.—Homestake Company's Recreation Hall Opened.

Owners of the Jungle mine, in the Custer Peak district, announce they will proceed immediately with the erection of a copper leaching plant of 30 tons daily capacity, in which the details of the process will be worked out preparatory to the construction of a much larger unit. A portion of the machinery and equipment has been secured second hand in the Black Hills, and the balance will be delivered promptly by the manufacturers. The property shows a large quantity of oxidized ore which laboratory tests indicate can be successfully leached. John H. O'Brien, of Roubaix, South Dakota, is superintendent.

At the annual meeting of the Titantic Gold Mining Co., held at Deadwood, it was announced that $22,000 had been spent during the past year in development and equipment of the Iron Hill mine, at Carbonate camp, and in the purchase of the Albe fraction, which consists of less than two acres. The work included erection of a shaft-house, installation of hoist, air-compressor, Jackhamer drills, etc., sinking 267 ft. (making the shaft 300 ft. deep), and driving 290 ft. of drifts and cross-cuts. Ore was cut in several places, but not in any great quantity. At the present time drifts are being driven east and west on the 100-ft. level, following the main crevice. On the 150-ft. level a cross-cut is being driven south in which some high-grade ore has been found. On the 300-ft. level, a diamond-drill will immediately be installed, and a number of holes put in different directions. This level is connected with the old Iron Hill workings, giving good ventilation. Fred Schnauber, of Yankton, South Dakota, was elected president, and W. S. Elder, of Deadwood, secretary and general manager.

On July 27 the swimming pool and shower baths in the basement of Recreation hall, at Lead, were opened to the public and thoroughly enjoyed by hundreds of people. Stocks of bathing suits in the stores at Lead were quickly sold out, for the opening came at an opportune time, during a spell of extremely hot weather, and the result was that seemingly everyone wanted to indulge in a plunge. The baths will be opened daily, excepting Sunday, a part of the time for men, other times for women, and twice a week for mixed crowds. The Homestake company constructed the building at a cost of over $250,000 for the free use of its employees.

TORONTO, ONTARIO

Work at Porcupine Crown Mine.—North Dome Shut Down.—Nipissing Doing Custom Work.—La Rose Prospects.—Tough-Oakes Mine.

During the past few months the Porcupine Crown company has been doing a large amount of development work in an effort to find a continuation of the veins which were cut off by the faults to the south of the orebody, and below the 100-ft. level. So far, these efforts have been unsuccessful, and the indications at the south end of the property are considered promising. In order to assist the management in planning the development, an economic geologist has been employed, and he is at the present time making a study of the deposit. The mill is only working six days per week, and the daily tonnage treated is below capacity. The Company does not desire to do more than earn enough to pay dividends. The comparatively small tonnage of ore in reserve at the present time probably represents a little less than two years supply, but the mill is a disturbing factor, and the Company is extremely anxious to develop new orebodies.

The Temiskaming Mining Co. of Cobalt has made an application for an order for the winding-up of the North Dome property. Two years ago, the Company purchased control of the North Dome, and spent a considerable amount of money in development. It only succeeded, however, in opening up three small shoots of low-grade ore, which would not justify the erection of a mill, and the property was subsequently closed. The Temiskaming is stated to be a creditor to the extent of $85,000.

The Nipissing company's high-grade plant is treating considerable custom ore in addition to the Company's own output, all of which is shipped from the camp in the form of bullion. The ore is purchased outright by the Nipissing, and the bullion goes out under its own name, so that the apparent production from Kerr Lake and La Rose, in particular, is less than would appear from the published returns.

The La Rose company has also taken an option on outside properties, and is now developing the Kensy claim in Boston township, near Swastika. The surface showing is small, but is reported to give satisfactory assays. The financial statement sent out with the June dividend shows that the surplus, which stood at $1,528,776 on December 31 last, has been reduced to $1,359,920. The decline of this once famous property is one of the most interesting features of the present situation in Cobalt. The La Rose was the first discovery in the camp, and for a long time was the largest producer. It is now, however, practically worked out, and officials of the Company entertain only a slight hope for the continuance of its productiveness. It is understood that the consulting engineer has recommended the closing down of some of the properties in the immediate future. To date, the La Rose Consolidated has produced approximately 2,500,000 oz. silver, valued at $11,500,000. Of this amount, the profit would be roughly $6,500,000. While it is possible that other discoveries may be made, the mine has been developed in an aggressive and conscientious manner, so that little hope can be held out of the Company maintaining its position much longer.

H. H. Johnson, consulting engineer of the Tough-Oakes mine in Kirkland Lake, estimates that the developed ore has an average value of $32.60 over a stoping width of between 4 and 5 feet. He also states that by January, the mine should have three years' supply of ore developed for a mill having a capacity of 30,000 tons per year, and that the estimated net profit per annum will be $750,000. Excavations for the new mill have been started and orders have been placed for machinery. Since the commencement of operations, up to May 19, the mine had produced a total of $220,000. At present underground work is stopped for lack of power.

WASHINGTON, D. C.

PHOSPHATE LAND LAWS.—BILL TO QUIET TITLE TO LANDS LOCATED BEFORE 1912.—REMEDIAL LEGISLATION REGARDING OIL AND GAS LANDS.

Progress is once more reported on the bill to validate location of phosphate deposits. This has been up in Congress since 1908, and while it seems simple, it has met many snags. It has now passed the Senate and has come out of the House Committee on Public Lands with a favorable report, and therefore is in a good position to pass when the House gets into a mood to rush small bills through. This may occur in this summer session. The bill as reported purports to validate locations of deposits of phosphate rock on the Pacific Coast heretofore made in good faith under the placer-mining laws. The particular occasion for the passage of the bill is the uncertainty that existed prior to 1912 of the right to make entry for lands containing phosphate. Prior to that date it was the practice of the Department to patent locations made under either the lode or the placer mining laws. In 1912 the Department of the Interior decided that a deposit of phosphate rock, confined by well defined boundaries, constituted a 'vein or lode of mineral-bearing rock in place,' and that such a deposit was subject to disposition only under the provisions of the lode-mining laws. To permit the locations made in good faith under the placer-mining laws prior to the 1912 decision to pass to patent, and to quiet title to those receiving patents under the placer-mining laws prior to 1912, the pending bill offers relief. The bill has the approval of the Department of the Interior. In a letter to Scott Ferris, congressman from Oklahoma and chairman of the Public Lands Committee of the House, A. A. Jones, first assistant secretary of the Department, says: "Where the asserted placer-mining locations on the phosphate deposits antedated withdrawals and where no conflicting adverse lode locations are involved, this Department perceives no objection to the confirmation of such locations and the authorization of the issuance of patent thereon. In the absence, however, of remedial legislation these locations cannot be passed to entry and patent. The only relief the Department, under the condition of the law as it now exists, is able to extend to such placer locators is to permit them after a modification of the outstanding phosphate withdrawal has been secured, to re-form their locations or make new locations under the lode-mining laws, and thereupon to proceed to entry and patent. Prior to 1912 it was the practice of the Department to permit locations under either the lode or the placer-mining laws to pass to patent, but consideration of the Harry lode mining claim, supra, and the position taken by the federal courts in the decisions above mentioned, precluded the further pursuit of such a practice. Since that time no patents have been issued to placer locators. The remedial legislation in the bill is therefore essential, and, in the opinion of this Department, should be enacted."

An agreement has finally been reached by the House Public Lands Committee and the Interior and the Navy Departments on the bill to provide for the temporary development of oil and gas lands, particularly on the Pacific Coast, in dispute between the Government and private claimants. The proposed law, as stated, would allow the present occupants of the lands whose title is contested by the Government to develop and protect the oil resources under agreements with the Secretary of the Interior which would impound or divide the proceeds of the development pending the settlement of the disputes over the title. The amendment agreed upon provides that the money accruing to the United States under the agreement dealing with land in naval petroleum reserves shall be set aside in a separate fund for the use of the Navy under the control of Congress.

NEW YORK

EFFECT OF THE WAR ON COPPER, TIN, CYANIDE, AND MANGANESE.—CHILE COPPER CO. *v.* ANTOFAGASTA & BOLIVIA RAILWAY.

What will happer to the copper mines has been the chief topic of interest all the week. The obvious thing, of course, is that, for the present, copper shipments to Europe must come to a halt, as ships are not available to carry it, even if any European consumer could conceivably wish to buy. This cuts off the market for over half the American output, and the principal producers have promptly moved to meet the situation by cutting down their output, as chronicled in 'The Mining Summary.' In the Lake Superior district the Copper Range will reduce its output, but the Calumet & Hecla is reported to plan to continue full time for a month yet. The cases are not quite parallel, as Copper Range sells most of its copper abroad, while the C. & H., as it is generally called, sells the larger part of its copper in this country. The collapse of the copper market brings special individual hardships, as well as the general ones. The Superior & Boston at Globe has just succeeded in pushing itself into the dividend-paying class, and for the first time in its hitsory the financial year will show an operating profit. Profits to September 30 were expected to be $30,000, while a shut-down would entail a monthly loss of $6000, and copper at 12c. per pound corresponds to about $4000 per month operating loss. Another company which is hard hit is Granby, which has had uphill progress for the last few years. The new smelter at Anyox began turning out copper in April, and produced 1,000,000 lb. during June. The Phoenix plant has been shut down, but the smelter at Anyox will be kept going, as it has only just got running in good shape and it would be a pity to have to stop so soon. Companies everpwhere will use the slack interval to make repairs and put their plants in good shape.

The war has completely disorganized the supply of some metals and minerals. Tin has gone up to 60c. per pound already. Most of the tin comes from the Straits Settlements and comes through the Mediterranean to England to be reshipped to this country. The chances of forwarding regular shipments through the Mediterranean for some time to come are remote in the extreme, and tin has correspondingly gone up. Presumably tin plate for making cans for preserving food will be in strong demand. It would be quite possible to send tin to America by way of the Pacific, of course, but the lines are indirect, the freights high, and the time required longer. Cyanide is another commodity which is worrying mining men. A large part of the supply comes from Germany, and regular shipments are stopped. Some firms with plants at Niagara Falls are engaged in the manufacture of cyanamide, which is largely used as a fertilizer, and have for some time been urging the use of their product as a substitute for cyanide. If it proves satisfactory, this may serve to save the situation. The war has also cut off the ferro-manganese supply of American steel-makers. The subject of this mineral was discussed at some length in this paper a year ago. The United States Steel Corporation is said to have a good supply of manganese ore on hand, and will at once begin to turn it into ferro-manganese, and it is to be hoped that the business, once established, will continue. There are large deposits of excellent manganese ore in California, and their development could be undertaken.

The Chile Copper Co. is engaged in a lawsuit with the Antofagasta & Bolivia railway over the water rights to the river Loa, which is the source of supply for both companies. The river crosses the railroad at some distance from the coast, and the railway built a dam and developed the water supply which serves all the western end of its line. Those familiar with the country say there ought to be plenty of water for both companies if properly conserved.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

Fairbanks

From Chitina to Fairbanks is 325 miles, and on July 13 R. Sheldon and three others arrived in his Ford automobile, having covered the distance in 34 hours 50 minutes.

Nome

The Ben Bernard dredge at the mouth of Anakovik river has been started. The dredge moved from Peluk creek to Anakovik by the company has been operating successfully for several years.——The Union Construction Co. of San Francisco is rushing work on the Bangor dredge for Cole, Mitchell & Brower. Forty men are employed.

ARIZONA

Cochise County

Wages have been reduced 10% at the Copper Queen and Calumet & Arizona smelters at Douglas on August 6. This affects 2000 men. There were 500 men laid off. These companies' miners also had a similar reduction.

Gila County

At the Miami mine, one shift has been stopped, and only three of the six units of the mill are working.

Greenlee County

The Shannon Copper Co. reports as follows for the second quarter of 1914:

Ore treated, tons	67,464
Copper production, pounds	3,118,156
Gold, ounces	420
Silver, ounces	20,702
Average cost of producing metal, cents per pound	12.695
Net profits	$40,952

Pinal County

The second quarterly report of the Ray Consolidated Copper Co. shows the following:

Mine development, feet	31,515
Cost of mining, cents per ton	61.741
Ore milled, tons (equal to 8396 tons per day)	764,040
Average copper, per cent	1.786
Recovery by concentration, per cent	68.69
Cost of milling and coarse crushing, cents per ton	50.651
Smelter output, including ore treated direct, pounds	19,062,555
Net profit	$959,494
Dividends paid	545,364
Net surplus	414,130
Copper on hand, in transit, sold and unsold, pounds	25,819,674

The output, recovery, and costs were an improvement on the previous term.

Yavapai County

About 300 men have been dispensed with at the United Verde mine and smelter at Jerome, in order to reduce the copper output.

CALIFORNIA

Eldorado County

The Big Cañon mine has been unwatered, and work is to be started proving the ore between 600 and 700 ft.——Three feet of fair ore has been opened in the Crusader mine near Eldorado.——Electric plant for the Shaw mine is nearing completion.

Placer County

Negotiations are proceeding in connection with the Placer County Properties Co. ground near Iowa Hill, the amount being given as $35,000.——Another 40 acres of dredging ground at Gold Run is to be bought by Lawrence Gardella, of Oroville. Lumber for the new dredge has been ordered.

Shasta County

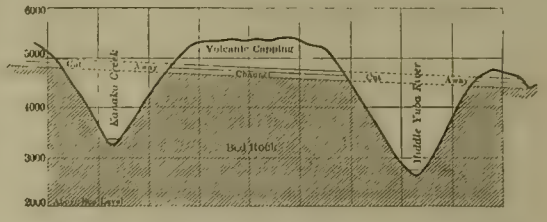
On account of the war in Europe the Mountain Copper Co. shut down its Iron Mountain mine on August 6, laying off 350 men. The Hornet mine is still worked. The smelter at Martinez is shut down.——Work has been suspended at the Balaklala mine.——The Golinsky copper claims, four miles from Redding, were under bond to a German syndicate for $100,000, but the deal is now temporarily off.

The Mammoth Copper Co. has decided to keep two furnaces in blast, and all employees will get at least 5½ days' work per week. There will be no reduction of wages, and married men on vacation need not pay rent for Company houses, which their families are occupying.——The Mountain Copper Co. will also remit rent due and give good credit at its store.

Sierra County

The Croesus mine is opening well, 35 men are employed, the mill is running at full capacity, and the monthly output is about $30,000.——The Sierra Nevada gravel mine at Forest is to be reopened. The property consists of 270 acres containing a good channel.

The ancient auriferous gravel channels of this county are discussed by Mark N. Alling, of Downieville, in the July *Bulletin* of the A. I. M. E. Sierra county is about 10 miles long, east and west, and about 20 miles wide. The summit of the Sierra Nevada mountains passes through the central portion of the county in a northerly and southerly direction. All the mines lie on the western slope of the mountains. In the extreme western part of the county the rocks are principally black, highly metamorphosed clay slates, designated by government geologists as the 'Delhi slates.' They are



EFFECT OF MODERN EROSION ON ANCIENT DRAINAGE SYSTEM, SIERRA COUNTY, CALIFORNIA.

underlain by granites which are exposed in the bottoms of the deep cañons. Porphyry and diorite dikes are common in the slates. A few good mines have been found in this formation. Lying just east of the Delhi slates is a zone about 10 miles wide, consisting of alternating belts of Calaveras formation and serpentine or amphibolite. This zone parallels the course of the Sierras, flanks the range, and is the line of weakness. It is highly fractured and mineralized and forms what is known as the 'Father Lode' of California, in contradistinction to the Mother Lode, which occupies a similar position relative to the range in Amador, Calaveras,

Tuolumne, and Mariposa counties. In this zone are found most of the quartz mines and practically all of the gravel mines. Next to the east lies a zone of quartz porphyries, granites, slates, and occasional small dikes of serpentine. Here are found the Sierra City quartz mines, some of which have been large producers. The zone is from three to five miles in width. Between the Sierra City quartz-porphyry zone and the summit few mines of importance have been found. Beyond the summit no mines are found until the state of Nevada is reached. The lode mines and ancient channels of the districts are described in an interesting manner. Some of the former are yielding good returns, notably the Tightner, Red Star, Rainbow, and Sixteen to One properties. In the past, ancient channels of the county have yielded from $150 to $500 per linear foot. In large channels, gravel worth $1 per cubic yard, if free, will about pay for extraction. Cemented gravels cost from 50c. to $1.50 more per ton to handle than free gravels. In the Downieville-Forest City-Alleghany district, gravel averaging from $1.50 to $2.50 per cubic yard is considered good 'pay.'

In the introduction to his paper, Mr. Alling made the following remarks: "A few years ago, gravel mining in the ancient river beds of Sierra county was the principal industry of the county. Operating drift mines were numerous and many large hydraulic mines were in action. Eventually the state laws put an end to hydraulic mining, it being claimed that the silt carried down the streams to the valleys filled the rivers and caused winter floods, which were damaging to the surrounding farms. The ancient river deposits which could easily be found were, in the course of 40 years, worked out or practically so. The prohibition of hydraulic mining was a severe blow to the industry in general. The deposits were not developed and the gravel-mining industry practically stood still for many years. In Sierra county, nearly all the hydraulic mines were at the points where the ancient channels were exposed to view by reason of the modern stream erosion, or, in the miner's language, where the channels enter or 'break out of' the ridges. The claims covering them also covered large areas in which were long segments of lava-capped channels, suitable for drift mines, and the points being hydraulicked were usually the controlling points of attack. Men who have followed hydraulic mining for any length of time seldom are content to work a drift mine. Knowing the great value of their deposits and feeling that they had been robbed by the state, these men have stubbornly held to their claims. The gold that is carried in these gravel-channel deposits is more or less scattered throughout the depth and width of the deposit; the percentage that can be recovered by the process of driving ranges from 50 to 75 of the total. In hydraulicking, practically all of the deposit is put through the sluices, and as the cost per cubic yard is only about 10% of the cost of driving, the deposits, if classed as hydraulic mines, are much more valuable than if classed as drift mines; hence the old-timers have held their claims (now worthless as hydraulic mines) at prices which the drift-mining industry could not stand; and such mines are still intact. Gravel deposits formerly valued at a great price have reverted to the Government. Some of the claim owners, realizing the truth, have sold their mines for reasonable figures, and many of these properties are now being reopened. But there is another and important source of future drift mines. Only the deposits which could easily be discovered have been found. There are many unworked segments of ancient channels in this rich district; some have been discovered in a general way, but never exactly located or traced through the country; still others have been partly developed, requiring the investment of more money than the owners possess. The district is isolated, timbered, and brushy (especially in the vicinity of the moist-gravel deposits), and hence the more difficult forms of prospecting have been left to the coming generations. The long period of comparative inaction in the gravel-mining industry has given rise to the common opinion that the gravel deposits are all worked out: but such is not the case. The field is young and large, and yet to the stranger passing through the county for the first time the impression is given that the district is an old and exhausted one. This is principally due to the fact that in the boom days, when the shallow placers were yielding fortunes for the thousands who worked them, large towns sprang up, only to be deserted in whole or in part upon the exhaustion of the shallow placer deposits and the desertion of the hydraulic mines. Following the exhaustion of the discovered placers, and the suspension of hydraulic mining, came the search for the sources of the gold. Mining companies began to reopen the old drift mines, exploring for the quartz veins, and with such remarkable results that the annual gold output of the county was increased last year by about $1,250,000. Other companies are now exploring for the undiscovered channel segments."

COLORADO

Clear Creek County

The Chamberlain Ore Co., at Georgetown, was only paying 40c. per ounce for silver, the balance to be settled later; but afterward refused to buy any more ore.——The Burleigh mill is shut down indefinitely.——An adit is being driven in the Capital Central mine to cut a vein at a depth of 200 ft.——Treatment of the low-grade ores of upper Clear Creek county by flotation and cyanidation is suggested by Edward J. Wilcox.

Teller County (Cripple Creek)

The Vindicator mine produced 2250 tons of ore on company account, and 800 tons on lessees' account in July. The respective gold content of shipments was about 2 oz. and 1 oz. per ton, ore from 1600 ft. making the former high value.——Rainfall of the district in July was 9.12 in., a record, and compared with an average of 17.07 in. per year.——A new hoist is being installed at the Eclipse mine of the El Oro company.

IDAHO

Bonner County

At the Marguerite mine near Hope, a contract has been let for 200 ft. of development work in extending the lower adit. Ore should be cut at between 500 and 600 ft. A good deal of gold-silver ore has already been opened. The Bonner Mining Co., of Spokane, controls the property.

Shoshone County

The Montana-Idaho Copper Co. has recently been formed, with Otis Hall, of Spokane, as general manager. It owns eight claims near Adair, and the Monitor mine. It is proposed to drive an adit 7500 ft., giving a vertical depth of 1800 ft. below the collar of the Monitor shaft. Laterals from the adit will open the orebodies of surrounding claims, and furnish an outlet for ores to the Chicago, Milwaukee & St. Paul railway. This is one of the most important works projected in the Coeur d'Alene district. E. P. Spalding, of Spokane, is consulting engineer.

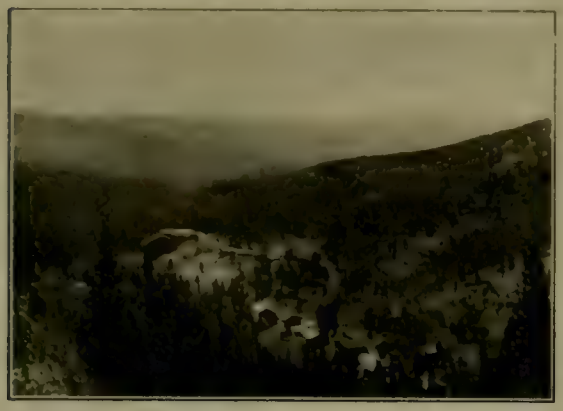
The Caledonia Mining Co. held its annual meeting at Kellogg on August 4. A unit of the Bunker Hill & Sullivan mill is working one shift on Caledonia ore, treating 100 tons. The balance sheet shows about $45,000 in the treasury. Profit on the July output of 700 tons of concentrate was 1.5c. per share on the capital of 2,600,000 shares.

There are 25 defendants, including individuals, a corporation, and a state, in the action of the Marsh Mining Co. to condemn part of the surface ground of the Never Sweat lode mining claim near Burke. The area in dispute is 3.382 acres.

Lemhi County

(Special Correspondence.)—The Salmon River Power &

Light Co has been formed mainly by Colfax and Spokane, Washington, people. The Citizens' National Bank of Salmon also subscribed for shares. This Company takes over the property of the Lemhi Power Co. A new hydro-electric plant is being constructed 15 miles above Salmon.——Two new



GOLD DUST PROPERTY, NEAR LEESBURG, IDAHO.

dredges are to be built soon, making five in the county.——Good lead and copper ore is being mined from Brough's and others claims on Phelan creek.——At Gilmore the Allie and Latest Out are the principal lead-silver ore shippers.

Salmon, August 4.

MICHIGAN

Houghton County

After unloading coal at the Isle Royale mill last week, the steamer *Gogebic* went to Point Mills to load stamp-mill sand for the Ontario Paving Block Company of Ohio. Over 15,000 tons of this sand has already left the copper country this season, and the demand is likely to increase. It is possible to load a boat with 5000 tons in 10 hours.

The Wolverine Copper Co. reports as follows for the year ended June 30, 1914:

	1914.	Changes from 1913.
Copper produced, pounds	3,435,459	— 4,914,853
Total revenue	$484,061	— $842,439
Expenses	388,708	— 336,278
Net profits	$95,353	— $506,161
Construction and strike charges	14,277	+ 14,277
Balance	$81,076	— $520,438
Dividend	.....	— 600,000
Surplus	$81,076	+ $79,562
Previous surplus	748,034	+ 1,514
Total surplus	$829,110	+ $81,076

The general balance sheet as of June 30 shows cash in hand of $20,558, assets of $905,503, and balance of assets $829,109.

While a good deal of the copper output of this district is sent to Europe, the bulk of domestic business is held by the Lake Superior mines. There will be no curtailment of metal production on account of the war. A large number of Europeans are employed there, but not many are leaving to take part in the European war.

All exploration and development work at Calumet & Hecla subsidiaries, as well as preparations to increase production, have stopped.

In July there were 256 vessels bound up, and 209 bound down, through the Portage Lake ship canal. The amount of freight up was 251,701 tons, of which 200,119 tons was coal, also 10,750 passengers; the freight down was 86,018 tons, of which 7489 tons was copper, and a large quantity of grain.

MISSOURI

Jasper County

Owing to the war in Europe, and the general condition of the spelter market, higher prices are predicted at Joplin.

MONTANA

Silverbow County

The Bullwhacker mine and leaching plant has been shut down indefinitely by a suit brought in the district court by Clark Bros. & Klein, brokers, of Spokane, for the recovery of $121,000 loaned on promissory notes, together with an attorney fee of $24,000. The money was spent on the new plant, and $20,000 more would have made the plant a profitable concern.

Work has been suspended at the Butte-Ballaklava mine.——On account of the State's Saving Bank closing its doors, development at the Tuolumne, Pilot, and Butte Main Range mines will probably be stopped, as this institution held funds for this purpose.

NEVADA

Esmeralda County

A Chilean mill is to be erected at Gold Crater, east of Goldfield, by the Gold Prince Mining & Leasing Co. A good tonnage of ore has been opened to 265 ft.——McGucken, an organizer of the I. W. W., was prevented from making an inflammatory speech at Goldfield last week by the sheriff, and left for Tonopah. He said that Goldfield did not appeal to him as a particularly favorable field for his endeavors and those of his following.

Nye County

John G. Kirchen, president of the Nevada Mine Operators' Association, telegraphed Senator K. Pittman on August 7 urging Congress to pass an act authorizing the Treasury to purchase 25,000,000 oz. of silver on the last market quotation. It is urged that unless this is done the mines will be unable to continue operations and thousands of miners will be thrown out of employment. Probably the mining companies will store their silver, which totals about 1,100,000 oz. per month, and wait for favorable prices.

A cloudburst at Manhattan on August 7 did a great deal of damage to placer mines and the town.——Shipments of $40 ore are being made from the White Caps mine to the Western Ore Purchasing Co. Development underground is adding good ore to the reserves.

Storey County

A 200-ton plant to treat old Comstock tailing by a new process, 4½ miles north of Dayton, has been erected by the Metals Recovery Co., in charge of Andrew J. Trumbo.

White Pine County

The Nevada Consolidated Copper Co. reports as follows for the second quarter of 1914:

Overburden stripped, cubic yards	1,162,049
Cost of removing overburden	$371,304
Steam-shovel mining, per cent of total ore mined	95
Ore milled, tons	831,589
Average copper content, per cent	1.53
Ore milled for Giroux Consolidated, tons	55,879
Copper output, pounds	14,322,807
Net earnings	$614,818
Dividends	749,796
Deficit, including depreciation, ore extinguishment, etc.	364,216
Surplus of assets over liabilities	$7,071,850
Copper on hand and in transit, sold and unsold, lb.	23,276,016

Copper production of the Nevada Consolidated has been reduced about 50% on account of the war in Europe.——A study of the Ruth mine of the Company is being made by Robert Marsh and others, to determine whether it is suitable for steam-shovel work or the present caving system. Churn-drills are at work on the deposit. The overburden is about 2.7 cu. yd. per ton of ore. The mine contains about 8,000,000 tons of 2.5% ore.

NEW MEXICO

Grant County

The Chino Copper Co.'s mill has four units at work for five days per week, and producing about 50% of normal output. The Company reports as follows for the second quarter of 1914:

Overburden moved, cubic yards (9 shovels working)	1,119,805
Cost of stripping, cents per yard	30.7
Ore treated, tons	587,900
Average copper content, per cent	2.165
Recovery, per cent	66.897
Concentrate produced, tons (16.276% copper)	52,323
Copper production, pounds	17,032,871
Total profit	$1,102,104
Dividends paid	652,080
Surplus	450,024

SOUTH DAKOTA

Lawrence County

A committee from the U. S. Industrial Commission, consisting of R. Commons, A. B. Garretson, John B. Lennan, and John O'Connell, have been at Lead investigating the relations existing between employers and employees at Lead, mainly concerning the Homestake Mining Co. A large number of witnesses were summoned, including Thomas J. Grier, superintendent of the Homestake. He supplied the authorities with records of the Company, and all information asked for was gladly produced. Never has so much data been given as to its operations as a gold producer, and one interested in the welfare of its employees. There are about 2200 men employed, receiving from $2.50 to $7 per day in wages, and a total of $225,000 per month. Bishop Busch, of the Roman Catholic church, who is said to have instigated this investigation, is to testify before the Commission.

A half car each of cyanide and sheet zinc, quantities of fluxes, acids, crucibles, and other assay and mill supplies were destroyed in a fire in the warehouse of the Kirk G. Phillips estate at Deadwood on the night of July 20. The total loss was placed at $20,000, of which only $1700 consisted of buildings. As this was the only stock of cyanide and zinc in the Black Hills, there was a threatened shortage of the former, but it is not expected that any of the mills will be forced to close, as a new shipment will be rushed to Deadwood and in the meanwhile the Homestake and other operators who keep some surplus on hand, will share with the less fortunate. It happened that a carload of zinc was on the way to Deadwood when the fire occurred, so there was no shortage of that commodity. A peculiar feature of the fire was that a quantity of asbestos mixture pipe covering was completely destroyed; not a trace of it remains.

TEXAS

El Paso County

The American Smelting & Refining Co., operating the El Paso smelter, will pay 10c. per pound for copper and 25c. per ounce for silver in ores from mines with which it has contracts. D. J. Roberts, ore buyer for the Company, when at Globe, Arizona, urged companies to curtail operations somewhat.

UTAH

Beaver County

A rush has set in for the gold district in the Bald hills, 15 miles north of Beaver. The area is the only unwatered portion of the eastern part of the county, while the people voted it 'dry' at last election. A correspondent to the *Nevada State Journal*, of Reno, talks of "intense excitement," "a second Goldfield is thought possible," "new town of Fortuna in the throes of birth," "golden gate to a golden avenue," "city of gleaming tents throws back the sunlight across Beaver valley," "men grim in the lust for gold," "all hearts afire," "old-timers from Nevada stand aghast," and so forth. It is sincerely hoped all this will turn out as dreamed.

Ore assaying 194.8 oz. silver and 58.8% lead, and 37 in. wide, has been cut in the Leonora mine in the Star district. Work done here 30 years ago missed this ore by four feet.

Juab County

The Chief Consolidated Mining Co.'s report for the first half of the year shows that development totaled 3353 ft. One shoot extends from the 750 to 1400-ft. levels. Ore is being opened also at 1600 ft. Another shoot is from 1250 to 1700 ft. depth, the latter level showing $35 ore for the last 100 ft. There was shipped 23,739 tons of ore assaying 0.198 oz. gold, 16.56 oz. silver, and 9.01% lead, a gross value of $16.46 per ton. The total metal content was 4689 oz. gold, 393,151 oz. silver, and 1,696,798 lb. lead. The net yield after paying transport, sampling, and smelting was $183,288, or $7.72 per ton. With cash on hand, etc., there was available $408,538. Of this, $125,777 was operating expense, and $42,838 in dividend. Cash on hand at July 1, 1914, was $228,135.

Salt Lake County

Smelters around Salt Lake City continue to buy ore, but are holding up payment until the metal market is settled. C. W. Whitley, general manager for the American Smelting & Refining Co., said that the smelters of the Company at Murray and Garfield would not be closed on account of the falling off of the demand for copper. He said that the future operation of the Garfield plant depends on whether the Utah Copper Co. ceases mining copper ore on account of the European war, and whether the plant at Murray continues to accept ores for reduction. The forces at the two plants will be maintained as they are at this time.

G. W. Heintz, manager for the United States Smelting, Mining & Refining Co., said the Company would not close its smelter at Midvale nor any of its mines which are producing copper, lead, or silver. He said the matter of closing the smelters which accept custom ores depends on the mining companies. Mr. Heintz attributed the deferring of payments on copper ore to the suspension of quotations on metals. He said that they might be suspended indefinitely.

The Salt Lake City Stock Exchange is still open, with big business and knocking down prices.

The Utah Copper Co. reports as follows for the second quarter of 1914:

Capping removed at mine, cubic yards	1,824,997
Ore treated, tons	2,006,157
Average copper content, per cent	1.4573
Recovery, per cent	68.44
Copper production, pounds	40,017,562
Net profit from milling operations	$2,424,536
Dividends from Nevada Consolidated, etc.	394,569
Total profit	2,819,104
Dividends paid	1,201,710
Net surplus	1,617,394
Copper on hand and in transit, sold and unsold, lb.	46,704,098

The above figures are in every instance an advance over the previous term.

The Utah Copper Co.'s Arthur mill has been shut down in-

definitely, and the staff transferred to the Magna mill, where it is hoped to keep the men employed half time. Practically construction work at the Company's properties has been stopped. The A. S. & R. plant at Garfield has now only three reverberatory furnaces working, and the men will work half time.

The Utah-Apex Mining Co.'s quarterly report shows gross receipts of $161,450; expenses, $105,308; development, $3664; interest, etc. $5488; and net profit, $46,988. The new mill is doing good work, and is treating up to 425 tons of ore per day. The residue disposal problem has been solved by buying 100 acres of land at low cost.

Summit County

A transmission line two miles long is being strung by the Utah Light & Power Co. from Park City to the Silver King Consolidated. This will require about 30 days. A change from steam to electric power is to be made.

CANADA

Alberta

There is still considerable activity in the Calgary oil district in spite of the war, as many of the companies were financed before it started. The Dingman well is producing 250 bbl. per day, selling at $11 per barrel, and retailing at 25c. per gallon for gasoline. The Monarch well is down 2100 ft., and oil is expected in 200 ft. The drilling record was 1600 ft. in three weeks. Geologists of the Canadian government are examining the district. Henry R. Johnson, of California, has 16 men examining the fields in the Northwest.

British Columbia

During the past week 22 mines of the Boundary and Kootenay districts sent 8887 tons of ore to the Trail smelter, making a total of 211,105 tons for the first seven months of 1914. The Whitewater and Panama mines in the Slocan and Ainsworth districts made initial shipments to Trail; also the Molly Gibson, near Nelson, resumed ore deliveries, the first since February.

Ontario

The uncertainty of the silver market has affected mines at Cobalt, and some are expected to shut down.——After a shutdown of about two years, underground work has been resumed in the Vipond mine near Porcupine. Dorr machinery is being installed in the mill.——In the North Thompson mine, adjacent to the Vipond, there is 16 ft. of ore at 200 ft., according to diamond-drilling. Other development is encouraging.

Quebec

At the last session of the provincial legislature the price of the mining land was reduced from $10 per acre, according to its distance from a railway line, to $5, irrespective of its location. The prices of $20 and $10 per acre as the price of mining concession were adopted in 1907. Although these rates were higher than in the provinces, this was counteracted by the fact that the system of mining licenses allowed liberal time, at a yearly rental, to search and develop, and the high prices for the concession did not need to be paid before the mineral deposit had been sufficiently proved.

Yukon

The Pueblo copper mine, near White Horse, is shipping 250 tons of ore per day to Skagway *en route* to Tacoma smelters. ——The proposed government wagon-road from Skagway to the summit of the White Pass has been surveyed, the work being done under L. T. Merry, with E. Achison and H. Olson, in about six weeks. The road is intended to connect at the international boundary line at the summit with the Canadian roads to Atlin and Yukon territory as far as Dawson. The average grade is under 5%, and at no point will it exceed 8%.——Thirty-seven licenses have been issued in the territory for motor vehicles, 26 being in Dawson.

PERSONAL

Thos. F. Ryan is at Paris.

Karl and Anton Eilers are in Germany.

R. S. Rainsford has accepted a position at Detroit, Michigan.

Barton Sewall, president of the Braden Copper Co., is in London.

F. L. Cole was in Korea in June, but has since returned to Shanghai.

Will L. Clark was in San Francisco on his way to Salt Lake City.

Elbert H. Gary, of the Steel Corporation, is among the Americans at Paris.

Ludwig Vogelstein, of L. Vogelstein & Co., when last heard from was in Rotterdam.

E. K. Soper is in northern Minnesota for the Minnesota State Geological Survey.

L. E. Belford and L. M. Lewis recently crossed the Nevada desert from Fallon to Reno.

H. Foster Bain is at Salt Lake City attending the annual meeting of the American Institute of Mining Engineers.

Lloyd B. Smith has returned to Pittsburgh, Pennsylvania, after seven months' geological work in the Oklahoma oilfields.

H. L. Smyth is to be head of the combined school of mines of Harvard University and Massachusetts Institute of Technology.

D. M. Riordan has been appointed to act as special adviser to the Secretary of the Treasury and has sailed on the *Tennessee* for Europe.

C. T. Griswold has returned to Pittsburgh, Pennsylvania, from Newfoundland, where he spent July examining copper mines and prospects around Notre Dame bay.

Arthur L. Walker, who has been visiting metallurgical plants in Michigan and Montana, sailed on July 9 from Vancouver for a holiday visit to Japan and China.

Weldon Morris, formerly superintendent of the Hornsilver Mining Co.'s property in the Hornsilver district, south of Goldfield, has been appointed superintendent for the Goldfield Oro Mining Co., which duties he assumed on August 1.

Stanly A. Easton, general manager for the Bunker Hill & Sullivan M. & C. Co., was reëlected president of the Caledonia Mining Co. at the annual stockholders meeting on August 4. C. Fred Kratzer, of Spokane, was reëlected vice-president; Charles McKinnis, of Wallace, Idaho, was reëlected secretary, treasurer, and general manager; and John A. Finch, of Spokane, and J. E. Gyde, of Wallace, were reëlected to complete the directorate.

Obituary

W. S. O'Brien, general foreman for the Homestake Mining Co., died at his home at Lead, South Dakota, on August 1. He had for sixteen years been in the employ of the Company in various capacities. Born in Maine 69 years ago, he served in the Civil War, later removed to Minneapolis, from where he went to Montana, and afterward followed mining in that State, Nevada, Idaho, Utah, and California. He was a member of the constitution convention which organized the state of South Dakota, was later a state senator, and afterward state mine inspector, which position he resigned to enter the employ of the Homestake company. His death was rather sudden, caused by a severe hemorrhage induced by miner's consumption, from which he had been a sufferer for several years. His family consisted of three daughters, two of whom are married. All of them reside at Lead.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, August 13.

Antimony	No quotes
Electrolytic copper	" "
Pig lead	3.90
Quicksilver (flask)	$85.00
Tin	No quotes
Spelter	" "
Zinc dust, 100-kg zinc-lined cases	" "

The principal local dealer in these metals reports no prices at present. Supplies of zinc dust are low, but a consignment is expected on a steamer from Europe at any time if not intercepted by German warships. The zinc smelter at Canon City, Colorado, produces about 20 tons of dust per month, and the total consumption in the United States is about 85 tons per month. It is reported that the export of zinc from England and Europe has been prohibited, being necessary for war purposes.

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, August 13.—There being no market for copper, there are no quotations available. Exports for the first week in August were 5056 tons, a decrease of 4343 tons. The A. S. & R. Co. has declared dividends of 1¾ and 1% on preferred and common stock respectively. Idle cars in the United States on August 1 were 198,998, against 228,384 two weeks ago. Lead and spelter are strong and advancing, good demand for domestic trade, and enquiries from England.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.		Average week ending	
Aug.	6 No quotes	July	1 56.58
"	7 " "	"	8 56.42
"	8 " "	"	15 55.60
"	9 Sunday	"	22 54.14
"	10 " "	"	29 53.42
"	11 " "	Aug.	5 No quotes
"	12 " "	"	12 " "

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	51.90
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The silver market is practically at a standstill, the following being some transactions: Bullion worth $2,000,000 left Vera Cruz for London on August 7. The English government was buying the metal for coinage purposes, but on August 11 it was cabled that there had been a reaction in price to 26½d. (53c.) per ounce, as the currency requirements had been temporarily satisfied. The San Francisco Mint is buying 200,000 oz at 51.5c. The U. S. government has also bought 1,175,000 oz. at 52c., delivered at Denver, Philadelphia, and San Francisco. The U. S. Assay Office at Salt Lake City is paying 51c. for silver taken in through the purchase of gold. As Cobalt, Ontario, mines can only get 25c. per ounce, the balance on future settlements, several of them are reported to be shutting down. The general position promises to be better.

COPPER

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.98	....
June	14.71	13.60	Dec.	14.25	....

As will be seen by reference to 'The Mining Summary' of this issue, there has been a general reduction of output of copper, the great mines being at practically half capacity, which is necessary. The last quarterly reports of the 'porphyry' companies show large stocks of metal on hand and in transit. Imports of copper into Germany during the first half of 1914 were 116,904, of which 102,188 tons was from the United States. This business is entirely stopped. There have been sales in London at 12⅞ to 13¼c., and also in New York at 12⅝ to 12¾ cents.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Aug.	6 3.85	July	1 3.90
"	7 3.85	"	8 3.90
"	8 3.85	"	15 3.90
"	9 Sunday	"	22 3.90
"	10 3.85	"	29 3.85
"	11 3.85	Aug.	5 3.85
"	12 3.85	"	12 3.85

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	....
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

QUICKSILVER

Week ending			
July	16 37.50	July	30 37.50
"	22 37.50	Aug.	6 No quotes
		"	13 85.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

The price of this metal is still moving up and stocks are low. The Nevada Cinnabar Co., operating near Ione, Nevada, has 165 flasks of mercury at Battle Mountain on the Southern Pacific railway, and which is on its way to San Francisco. Supplies from Europe are stopped indefinitely.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Aug.	6 5.25	July	1 4.75
"	7 5.25	"	8 4.75
"	8 5.25	"	15 4.75
"	9 Sunday	"	22 4.75
"	10 5.25	"	29 4.75
"	11 5.25	Aug.	5 4.75
"	12 5.25	"	12 5.25

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.61	....
Mch.	5.94	5.12	Sept.	5.65	....
Apr.	5.52	4.98	Oct.	5.32	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

Joplin, Missouri, zinc people expect a rise in this metal, as Europe supplies 66% of the world's total, this being cut off for the present.

TIN

There is no local quotation for tin, while the latest price in New York was 65c. per pound, with further increases certain. The chief sources of this metal are Australia, Bolivia, and the Federated Malay States, shipments usually going direct to England or Holland, these routes now being interrupted by the war.

CYANIDE

Enquiries show that stocks in the United States are normal at the mines, but very low on the Pacific coast. A steamer has been expected at San Francisco with a cargo of this salt. Supplies mostly came from Germany, while the firm of Roessler & Hasslacher manufacture some in New Jersey. It is suggested that the cyanamide made at Niagara Falls be tried if supplies run out. A large tonnage of German cyanide is made from the residue of beet-sugar mills, and should be made in the United States. The process was described in the Mining and Scientific Press of August 2, 1913. The Rand, Australia, India, and other mining countries depend on Germany and Glasgow for their supplies.

RECENT PUBLICATIONS

Transportation Problems. Five lectures delivered at the Johns Hopkins University in May 1914 by Logan G. McPherson. P. 110. Baltimore, 1914.

Investigations on Drain Tile. Report of Committee C-6, on standard tests and specifications for drain tile, American Society for Testing Materials. Bulletin 36. P. 112. Iowa State College of Agriculture and Mechanic Arts. Ames, 1914.

Flumes and Fluming. By Eugene S. Bruce. Bulletin 87 of the U. S. Department of Agriculture. P. 36, with 9 plates. Washington, 1914. This is a valuable contribution from an expert lumberman, and should be useful for miners and lumbermen alike.

Panama-Pacific International Exposition. Booklet for foreign distribution. P. 62, with halftones of scenes in the Canal Zone and San Francisco, and colored plates of the Exposition buildings. Published from the office of the commissioner, W. D. Egilbert.

Ein neuer Erhitzungsapparat zur Bestimmung der Anderungen des optischen Achsenwinkels bei höheren Temperaturen. By E. H. Kraus and L. J. Youngs. P. 4. Illustrated. Mineralogical Laboratory, University of Michigan, Ann Arbor. Printed in Stuttgart, Germany, 1914.

University of Illinois publications, Urbana, 1914:

Acoustics of Auditoriums. By F. R. Watson. Bulletin 73. P. 32. Illustrated.

Coal-Mining Practice in District I (Longwall). By S. O. Andros. Bulletin 5. P. 42. Illustrated.

Magnetic and Other Properties of Electrolytic Iron Melted in Vacuo. By Trygve D. Yensen. Bulletin 72. P. 71. Illustrated.

United States Bureau of Mines publications, Washington, 1913. Technical papers:

Permissible Electric Lamps for Miners. By H. H. Clark. No. 75. P. 21. Illustrated.

Quarry Accidents in the United States in 1912. Compiled by Albert H. Fay. No. 73. P. 45.

Specific-Gravity Separation. As applied to the analysis of mining explosives. By C. G. Storm and A. L. Hyde. No. 78. P. 13.

Methods of Oil Recovery in California. By Ralph Arnold and V. R. Garfias. No. 70. Petroleum technology 16. P. 57. Ill., index. This paper discusses the general methods employed for recovering oil when, owing to insufficient gas pressure or other causes, it does not rise to the surface by natural flow.

Brass-Furnace Practice in the United States. By H. W. Gillett. No. 73. Mineral technology 14. P. 298. Ill., index. This bulletin is issued as a contribution to the increase of safety and efficiency in the preparation and utilization of the mineral resources of the United States. There are probably 3600 plants melting brass or bronze at work at the present time, which vary from one small furnace to great concerns melting up to 50,000,000 lb. of copper alloy per year. Alloys employed and their uses are legion, and castings vary from a fraction of an ounce to 10-ton propellers for ocean liners. Losses in melting average about 2.5%. In this work is discussed the types of furnaces used, furnace data, general factors affecting furnace operation, possible improvements to furnaces, fuels, and disease and danger to brassworkers.

COMPANY REPORTS

STRAITS TRADING COMPANY

This Company operates tin smelters at Singapore and Penang, practically controlling the business. During the six months ended March 31, 1914, the profit was $250,700. A dividend of 50c. and bonus of 25c. per share was paid. $66,000 was carried forward. Smelting capacity is to be enlarged.

WAIHI GRAND JUNCTION GOLD COMPANY, LTD.

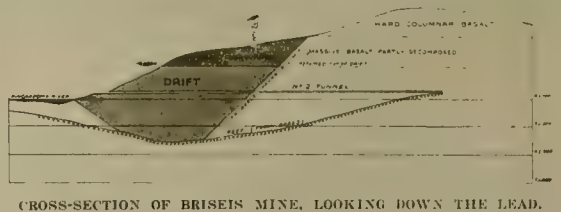
This Company's property is east of the Waihi mine, New Zealand, and lodes of the latter run into the Junction, which are the source of ore supply for the mill. The report under review covers the year ended December 31, 1913, and the remarks of the general manager, William Frank Grace; mine manager, William McConachie; mill superintendent, James R. Noble; and electrical engineer, W. H. Cole, are included in the following abstract:

Previous labor troubles retarded mine development, which totaled 5909 ft., against 8751 ft. in 1911, there being plenty points of attack had men been available. The cost of this work was $1.55 per ton. Work on No. 6 level on the Empire lode and Empire foot-wall leader was highly satisfactory, but the Royal lode east of the cross-cut was disappointing, although on the level above it was of good width and value. Little work was done on other lodes. The main shaft was sunk to 1212 ft., and No. 7 level is being opened at 1200 ft. Sinking was done in spite of 35,000 gal. of water per hour, and during the year a total of 106,936,610 gal. was pumped. (The Waihi mine pumps lifted 537,300,000 gal. in the same year.) Ore reserves in eight lodes total 175,100 tons, of which 65,000 and 46,400 tons are in the Empire and Royal lodes, respectively. Broken ore in shrinkage stopes amounted to 33,180 tons.

The 40-stamp mill, which is being increased by 20 more head, treated 98,383 tons of ore averaging $8.74 gold, and $1.24 silver per ton. The recovery of these metals was 89.9% and 74.1%. Actual recovery of bullion was £180,020, being just £127 in excess of assay extraction. Sand treated was 17,151 tons, and slime 81,232 tons. Costs of treatment were $1.71 per ton. Several alterations were made to the flow-sheet. The maximum electric load was 1300 kilowatts.

Revenue of the Company for the year totaled £179,358, after deducting New Zealand government gold duty and realization expenses of £7509. The profit was £41,591, and balance from 1912 was £19,616, making £61,207 available. Of this, £19,219 was paid as a dividend of 24c. per share.

Erratum.—On the 'Company Report' page of the *Press* of August 8 was the report of the Briseis Tin & General Mining Co., Ltd., illustrated by a line drawing which was similar in



CROSS-SECTION OF BRISEIS MINE, LOOKING DOWN THE LEAD.

some respects to the correct one as here used, but belonging to notes on the ancient gravel channels of Sierra county, California, appearing in 'The Mining Summary' of this issue. The Briseis tin mine is clearly shown in the accompanying cut.

New Machines and Devices

A New Electric Winch

The utility and economy of electric hoists has been so well established and their applications so numerous that a variety of special types has resulted. The electric winch shown in the accompanying illustration is one of the modifications of an electric hoist which has been designed for all kinds of hauling, usually in a horizontal direction and at comparatively slow speeds, one of the most frequent uses being for pulling cars. The pinch-bar method of moving cars is slow, and on curves or slight grades it sometimes fails entirely.

ELECTRIC WINCH.

The service of a switch engine is expensive, and the engine is not always available. For certain haulage problems the electric winch has been found to be particularly adapted.

The winch shown is self-contained and weather-proof in design and may be placed in a convenient position, and either by direct pull or with the aid of a snatch-block be made to move cars when and where desired. Other users are numerous and many will suggest themselves in the operation of mines and smelters. In the construction of this winch the aim has been to make it strong and simple. The entire mechanism is enclosed in the cast iron base to protect it from the elements. All parts must also be easily accessible for inspection. The motor is of the direct-current series wound or polyphase induction type and is geared to the winch head through a triple reduction gearing. The gears are steel castings and the pinions are steel forgings, all teeth being cut from the solid. The bearings are of bronze and are lubricated with grease by compression grease cups. The winch illustrated is one of the types manufactured by the Sprague Electric Works of the General Electric Co. with main offices in New York City.

Metallic Tape 'Threader'

The Lufkin Rule Co., Saginaw, Michigan, has just patented a measuring tape attachment known as a 'threader' which will hereafter be furnished with its metallic woven tapes. The 'threader' is a loop and stud arrangement by means of which the tape, though securely fastened to the winding drum of the case when in use, can yet be detached from it and a new tape attached, no manipulation of the case, case screw, or drum being required to do this. Woven tapes are sometimes torn or through use become worn in such a way that they must be replaced while the case is yet in fair condition. The case not receiving the same hard use as the tape-line, usually outwears it, and representing approximately half the value of the outfit, it is of importance that it be a simple matter for anyone to insert a new tape in the old case as often as necessary and thus get the fullest measure of use out of the case as well as the tape.

Commercial Paragraphs

SCHUTTE & KOERTING CO., Philadelphia, Pennsylvania, is distributing 'Catalog 8, Section H,' which is devoted to the hydraulic operating valve manufactured by this Company. This valve is designed for pressures up to 2000 lb. and is particularly adapted to hydraulic plants.

The NORDBERG MANUFACTURING CO., Milwaukee, Wisconsin, announces that it is now building high compression gas engines, especially in the larger sizes, having recently entered into a contract with the Usines Carels Freres, of Belgium, whereby the Nordberg company has been granted the exclusive privilege for the manufacture of this type of engine in the United States.

The JAMES ORE CONCENTRATOR CO., Newark, New Jersey, is supplying the new Butte-Timber concentrator with 8 tables which are riffled for heavy capacity to treat the re-ground and classified tailing product from the first set of tables. It is also proposed to treat the coarse portion of the flotation concentrates on a second set of 8 James sand tables to remove a lead product and a lead-iron middling product. The Company announces that it has a small laboratory at 35 Runyon street, Newark, New Jersey, for the accommodation of consulting engineers who desire to work out a flow-sheet for the treatment of complex or other concentrating ores, for the use of which only a nominal charge is made.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pennsylvania, has recently supplied the August Mining Co., of Landusky, Montana, with three 75-kva., 11,000-volt transformers, one lightning arrester, switchboard equipment, 12 motors of various sizes, and other equipment; the Anaconda Copper Mining Co. with four 30-hp. motors, three 3½-ton, 18-in. gage locomotives, making the fifth repeat order for this class of locomotive, and 10 motors for the new leaching plant being built at the Washoe smelter; the International Smelting & Refining Co. at Miami, Arizona, is being furnished with seven 50-hp. motors with magnetic brakes for operating 12-ft. Great Falls type converters, and 14 motors for other uses about the new copper smelter. The Westinghouse company is also supplying the Tooele smelter with 7 motors of various sizes to be used in the sintering plant at the old smelter, and a motor-generator set for use in connection with the Cottrell fume deposition process. Other orders which have recently been received include Ray Consolidated, sixteen 10-hp. special slow-speed motors for oil flotation plant; Utah Copper Co., seven 10-hp. motors for flotation plant; Daly West Mining Co., one 300-hp. hoist motor; Alaska Gastineau Mining Co., one 6-ton storage battery locomotive and one 50-kw. generator set; Empire Mines & Investment Co., one 500-hp. motor and liquid controller, three 200-kva. transformers, six 35-hp. stamp-mill motors and other equipment; Calumet & Arizona Mining Co., two 300-kva. transformers and switchboard equipment.

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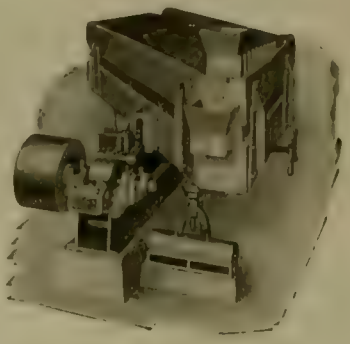

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By E. H. Leslie 280

In this, the fourth of the series on zinc smelting, one of the foremost of the modern producer-gas zinc smelters is discussed. The practice at the American Zinc, Lead, and Smelting Co.'s plant presents many novel features from a structural and mechanical standpoint. The operation of the furnaces, handling of raw materials and finished products, coal storage facilities, chamber acid process, utilization of excess furnace heat, and splendid organization stamp the Hillsboro plant as one of the foremost of the American zinc smelters. While the metallurgical process is almost identical with the standard practice, the smelter equipment and practice are discussed in detail. The new Rose Lake smelter of the Granby company will be the next of the series described.

DEVELOPMENT OF GOLD MILLING IN THE PHILIPPINES.
By C. M. Eye 287

The occupation of the Islands by the Americans in 1898 marked the beginning of a new era of gold mining in the Philippine Islands, and while the Islands have not become conspicuously important as gold producers, they have made progress in the development of these resources during the past fifteen years, and it is of this development that Mr. Eye writes. The early history of the Philippines shows but little evidence of these islands being prospected systematically for gold, and recent developments would augur that the Islands have latent possibilities from the standpoint of gold mining.

LEACHING EXPERIMENTS ON THE AJO ORES—III.
By Stuart Croasdale 291

The experimental work which has been done on the Ajo ores presents many details of interest and value to the copper metallurgist. In this, the last of the three installments of Mr. Croasdale's articles, precipitants for copper are given special attention and the experience of various investigators of this subject is discussed. The experiments with sponge iron and pig iron developed many interesting problems, which are discussed in detail. Interference of other metals has proved the chief stumbling-block in most of the attempts to use the electrolytic method for the recovery of copper. Arsenic and antimony are troublesome, and iron and manganese present other difficulties. An attempt has been made to overcome the obstacles imposed by these elements to electrolytic deposition of copper, and results at Ajo as presented are helpful. The paper was one of the most important read at the Salt Lake City meeting of the Institute of Mining Engineers last week.

PHOTOTOPOGRAPHY.
By J. A. MacDonald 295

Topographic surveys are as important to the engineer as to the geologist, and among the many methods of making topographical surveys the photo method described by Mr. MacDonald presents many interesting features. While transit and stadia, or plain table surveys will remain standard for many years to come, phototopography is a simple and easy method which has found favor and use in many instances.

SULPHUR DEPOSITS OF SOUTHWESTERN TEXAS.
By Clyde M. Becker 296

Few miners are aware of the fact that what is probably the largest deposit of sulphur in the United States lies in southwestern Texas. While these deposits have attracted attention during the past fifteen years, no really serious effort has been made to operate them on a commercial basis. Mr. Becker's opinion that they must be worked on the 'steam-shovel basis' and that it will require a man of steam-shovel proportions to handle these deposits, has been formed after a careful study of the situation.

AMERICAN INSTITUTE OF MINING ENGINEERS' MEETING..... 301

The Salt Lake City meeting was one of the most important in the history of the Institute, and in addition to reviewing and discussing modern trends in mining and metallurgical technology, the meeting was characterized by a feeling of brotherhood among the members present. The making of new friends and the renewing of old friendships is coming to be more generally accepted as one of the real benefits of the organization, and the social side of the Salt Lake City meeting, which was given no little attention, was ample evidence of the successful effort which is being made to foster this spirit among the members of the Institute.

DEPARTMENTS

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By C. B. Horwood 297

Those who have followed the Rand Banket series and subsequent discussion will be interested in reading Mr. Horwood's reply to the discussion of his series of articles. In this the first installment, Mr. Horwood replies to the discussion of Messrs. Lindgren, Thomas, Bain and Hatch. The reply to Mr. Hatch's discussion will be continued in the next issue, and others who have taken part in this discussion will be answered in turn.

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EDITORIAL

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PETROLEUM producers are among those affected by the war, since petroleum and its products are largely exported, and in foreign ships. It is said that gasoline recently sold in London above Scotch whiskey.

MINING men interested in the Mother Lode and old neighbors and friends joined in giving a complimentary banquet to Mr. W. J. Loring at Calaveras Hotel, Angels Camp, California, Thursday evening. A fuller account will be given later.

ZINC-DUST is in large demand, as shown by our market pages. American zinc smelters have shown a general disinclination to go into this trade, mainly because of the trouble incident to maintaining a small side line, but now that the foreign supply is shut off at least two of the larger companies have undertaken to prepare dust for the cyaniders.

FLOTATION is attracting attention everywhere, but by reason largely of litigation, mine managers have been chary about giving out technical details for publication. Many, however, are glad to exchange information if it can be done anonymously. Our 'Concentrates' department has answered many inquiries already, and we will be glad to answer other questions regarding the technology of flotation so far as data are available and may properly be made public.

LEASING of coal lands in Alaska as a part of the conservation program upon which the Administration has entered, will soon be given a hearing before the House of Representatives. The present bill was drafted as the result of many conferences between the Secretary of the Interior, officials of the Geological Survey, and of the United States Bureau of Mines. The consensus of opinion regarding the measure is expressed by Mr. Lane, who has presented to Congress the urgency of Alaska's demand that these coal deposits be made available to the people for domestic purposes and the local industries. The bill if passed will permit of the leasing of large enough coal areas to warrant the installation of large equipment and permit of large scale operations by the payment of a reasonable royalty, while small areas may be mined without royalty to meet the domestic requirements. The bill contains provisos which make monopoly impossible and is generally conceded to be both fair and equitable. We would join the Secretary in his conclusion that the measure will provide a fair and acceptable method for the development of Alaska coal, will safeguard the interest of the public, and will result in direct and immediate benefit to the territory.

CALIFORNIA petroleum production for the first six months of 1914 is estimated at 52,411,390 barrels. Consumption is rated at 50,024,599 and the total stock of crude on hand July 1, at 52,145,007 barrels.

LITIGATION is notoriously expensive, but just how vexatious it may be in mining is illustrated by the experience of the Montana Mining Company, Limited. At the meeting when this Company's affairs were wound up, it was brought out that it took 28 years to get a final decision in the courts of the United States. In one case it cost $150,000 and six months time to get judgment for $905. It is not particularly surprising that Mr. R. T. Bayliss and his associates have turned to other countries for mining investments.

MINING men should take serious notice of a bill at Washington which passed the House last March and has recently been reported favorably to the Senate by the Committee on Education and Labor. It is House bill 10735 and it creates a new Bureau of Labor Safety, in the Department of Labor, with authority to investigate and report upon conditions of labor in all industries as regards safety. With the general purpose of the bill there is no disagreement, but it trenches severely upon the work of the United States Bureau of Mines, and in most undesirable fashion. There are few things that that Bureau has done better or with more general support than its work relating to safety in mines. The reason is that the work has been conducted by men familiar with mining as an industry and having at heart its good. The United States Steel Corporation has reduced its accident rate to little more than 25 per cent of the old rate without upsetting production, or seriously, if at all, increasing costs. There is a vast difference, however, between such work and a general stampede such as might readily result from the action of a labor bureau owing no particular allegiance to mining. This is undesirable and unnecessary. In the bill it is made the duty of the Public Health Service to furnish to the new bureau such reports on vocational diseases as may be needed, and in a similar way it would be easy to require that such investigations of safety in

mining as the new bureau requires should continue to be made by the Bureau of Mines. It is better to avoid trouble than to face it, and the Bureau of Mines should be allowed to continue the excellent work that it has already begun.

COAL PRODUCTION statistics as compiled by the United States Geological Survey during the past five years show a marked tendency toward large units of production in both the eastern and western coalfields. In the anthracite mines of Pennsylvania this tendency has been growing for many years and in the bituminous mines during the past five years there has been an increase in production of approximately one hundred million tons every year with practically no increase in the number of commercial mines. Mines of the first class, which produce over 200,000 tons annually, have increased 29 per cent in number and the average production of mines of this class has been raised from 300,000 to 350,000 tons annually during this period. The movement in coal as in metal mining is evidently toward wholesale operations with the reduction in cost per ton mined with the increase in tonnage.

ZINC is at present tending upward, and the rise in price is resulting in optimism on the part of the producers. The semi-annual production statistics of the United States Geological Survey printed on another page show the total domestic production of spelter from all sources to have been 175,058 tons during the last half year, as compared with 166,463 tons for the previous six months. American production has hardly met the home consumption, and it is anticipated that the increased demands of foreign markets formerly met by the German and Belgian smelters will bring a strengthening influence to bear upon the American spelter situation. Last week ore buyers throughout the West received orders to pick up all the ore they could find. The two important producers of spelter other than the United States are Germany, with an output of 298,794 tons in 1912, of which 49,895 tons was exported, and Belgium, with an output of 220,678 tons in 1912, of which only 73,964 tons was consumed at home, the remainder, 146,714 tons being sold in the markets of the world. Thus, according to the last Survey figures available, there would be a deficit of almost 200,000 tons of spelter in other markets of the world due to the suspension of Belgian and German furnaces if consumption remains normal. While a good percentage of the German and Belgian exports was consumed by Great Britain, there still remains a decided shortage to be met and American producers will hope to share in the spelter demand of neutral powers, provided that the spelter from our furnaces can be delivered to these markets. The spelter stock on hand in the United States on June 1, 1914, was 64,039 tons as compared with 21,856 tons at the same time of the previous year. The past year has not been a year of normal activity in the zinc industry, and we trust that the ill wind which is sweeping Europe will reduce spelter stocks and bring relief to smelters. This influence is already beginning to be felt. In the London, Joplin, and Platteville letters this week, our correspondents give glimpses of zinc mining in widely varied quarters.

MANGANESE is one of the minerals brought into demand by the war. Shipments from Russia have been discontinued, and even if trade routes be opened promptly it is hardly likely that men would be available to mine and ship the ore. Manganese has been selling in New York recently at 17 cents per unit. Since the war began, quotations of 30 cents have failed to scare customers. There are numerous deposits throughout the United States and preparations are being made to work many of them. The Carnegie Steel Company and the Illinois Steel Company are the only regular makers of ferro-manganese in the United States, though the Cambria Steel Company and the Tennessee Coal, Iron & Railroad Company formerly made it. The Tennessee company is reported to have made a small amount early this year, and the American Manganese Company owns two stacks at Dunbar, Pennsylvania, with ore lands in the Lake Superior region. This Company is reported to have on hand 50,000 tons of ore analyzing 10 to 20 per cent manganese and presumably will work this up. The Spanish American Iron Company formerly mined manganese ores in Cuba, but the works were burned during the revolution and have never been rebuilt. It would require about four months to get them into shape to resume shipments, but as consumers are said to be offering $75 to $100 per ton for prompt shipment of ferro-manganese, rebuilding may prove worth while.

DEVELOPING FOREIGN TRADE

The interruption of shipping in foreign bottoms by the war in Europe has roused American exporters to a keen interest in methods of stimulating the foreign trade of the United States. Numerous proposals have been made, some of them promising, others ridiculous. The most important of all the moves so far made is the action of the National City Bank of New York in making arrangements to act as a clearing house for South American credits and debits. For various reasons, one of them a law which until recently prevented our national banks from having any foreign branches, the American doing business in South America has perforce been obliged to carry on his banking operations through German and British banks. These international relations have become so firmly established that American banks hesitated to enter the field even after they were permitted to do so. The effect of the absence of any such relations is well shown in the case of the Guggenheim interests in Chile, which when their regular banking operations were interrupted by the war were forced to make arrangements directly with the Chilean government whereby the latter is to issue currency to the Guggenheim companies in Chile, against which the companies will make deposits to the credit of the Chilean government in New York.

Absurd as it may seem, it is actually the case that an American company doing business in South America has no means of financing its transactions there except through European banks. Seeking for foreign trade without providing banking facilities, is like going rabbit hunting without taking along a gun. After the tumult and the shouting of such proposals as that of employing our warships to carry contraband goods dies away, it is possible that the general agitation and discussion may have led to the carrying into effect of some of the more obvious changes necessary to develop our foreign trade. The tariff has been effectively revised downward, and presumably the guardians of the tariff wall are now not so potent as of yore in maintaining price levels in this country at the expense of the development of our export trade, and the few big shipbuilders who have maintained their business at the expense of our merchant marine are likely to be overrun in the sudden outburst of enthusiasm for the provision of American ships for carrying American goods.

THE TRADE COMMISSION AND MINING

The Senate has passed the bill providing for a Federal Trade Commission to exercise about the same authority over corporations engaged in interstate trade as is held by the Interstate Commerce Commission over the railroads. The act will doubtless become a law, and another great step toward government regulation of industry will have been taken. In general the country looks upon this with suspended judgment. Many are strongly favorable, others as strongly dissent, but the majority are probably disposed to see the new method of dealing with 'trusts' given fair trial. It is evident that much will depend upon the spirit and intelligence with which the law is enforced, since in many particulars its terms are broad. No one familiar with modern industrial conditions fails to recognize that they are in a most chaotic condition, but opinions differ as to whether this is due to too much or too little interference on the part of the Government. Certainly he is a wise manager who knows what he may and may not do and still stay within the law, and certainly there should be some simpler and more efficient method of learning than the old one of trial and error—especially when the latter invites prosecution, fines, and possible imprisonment.

Some forms of combination are necessary to the conduct of business and beneficial to both the country and the industry. This fact is tacitly admitted even when not stated in terms of law. We all rebel at discrimination, but there is more than fear of votes back of the exemption made in favor of combinations of laborers and farmers. The California fruit growers combination has been an efficient means of preventing waste and developing markets and, however much we may protest against individual acts of individual unions, we must all recognize that in the present stage of development they are necessary if workingmen are to have a fair chance. We believe that the country would be the gainer if it would recognize the fact that union in other lines is equally important and justifiable. In a straightforward and sound thinking address delivered before the Independent Producers' Association at Bakersfield a few weeks ago, Mr. Mark L. Requa pointed out that the Standard Oil Company has succeeded because it was an efficient business combination of producing, transporting, and marketing agencies, and that the independent could not hope to succeed unless he placed himself upon a similar basis. The advice was so taken to heart that a valuation of the independent properties is now being made with a view to possible organization of a single great company. We point out elsewhere that growth in the size of the unit is characteristic of business enterprises throughout the country, and to think of insisting upon a return to small warring units throughout the business world appears to us as absurd as to reëstablish in Europe the political conditions of medieval times. Whether intended or not, we believe the new Federal Trade Commission will be driven to recognize trade combinations and that it will find its chief usefulness in regulating them.

It is as illegal as it ever was for competing railroads to agree as to rates, but in fact freight and passenger rates are uniform, rate wars have disappeared, and the whole country is richer and better therefor. The laws of business have shown themselves superior to the laws of Congress, and we do not think it probable that the new commission will prove a drag upon industry. On the contrary, we expect to see it help and steady general trade just as the Interstate Commerce Commission has helped the railroad situation.

For many years the Interstate Commerce Commission had neither authority nor influence. It became the roosting place for 'lame ducks.' When, however, the law was amended, men of first-class ability were glad to serve upon it, and those already there became active. The result has been good for the country and the railroads. We expect to see even better results, as the commission learns that it may safely raise as well as lower rates. Good service and fair rates is what the American people want, but they sometimes need education as to what are fair rates. The success of the new commission will depend upon the men appointed, and we sincerely hope that among them may be at least one who is familiar with mining, one of the great basic industries too often overlooked at Washington. When it is remembered that even the 'granger' roads draw nearly one-third of their freight from the mines, and that to the railroads as a whole the mines furnish nearly 60 per cent of their freight, the importance of mining is better understood. The real value back of the securities of the United States Steel Corporation is the ore land owned, and many of the large railroad systems have more invested in mineral lands than in tracks. If interstate trade is to be intelligently regulated, the commission must have real knowledge of mines and mining, and that can best be insured by including among its members a mining man.

FIG. 1. GENERAL VIEW OF THE HILLSBORO PLANT OF

Zinc Smelting at Hillsboro, Illinois

By E. H. LESLIE

In passing from the natural gas zinc smelters of Oklahoma to the producer gas smelters of Illinois the transition is marked by a notable change in smelter equipment. While the underlying principles of zinc smelting are practically identical, the structural details, furnace practice, utilization of by-products, and stability of smelter design give to the Illinois smelters, and especially the more modern which will be discussed in this series, an atmosphere of industrial permanence and operating perfection which is not to be found in the natural-gas belt. The handling of supplies is more automatic; roasting furnaces of the single hearth reverberatory give place to multiple hearth muffle furnaces with sulphuric acid plants for the utilization of furnace gases; the cellar type distillation furnaces of Oklahoma are replaced by elevated floor furnaces in the more modern Illinois plants; waste heat boilers and regenerative equipment make for greater thermal efficiencies in the operation of the Illinois distillation furnaces; the storage and handling of fuel becomes a subject of importance and concrete and steel construction take precedence over wood and corrugated iron; power plants, machine shops, and accessory equipment are studied with greater detail and the industry becomes one which is dependent upon ore supplies and markets, and not upon a fuel which is abundant today and meagre tomorrow.

The American Zinc & Smelting Co.'s plant at Hillsboro, Illinois, is one of the most modern of American producer-gas zinc smelters. While the metallurgical process is almost identical with what has come to be recognized as standard practice in zinc smelting with producer gas and chamber acid process equipment, the layout of the plant and mechanical equipment for the handling of smelter supplies and the operation of the furnaces and various departments of the smelter, present many novel features which are interesting from a technical standpoint.

The smelter site is at Taylor Springs, about two and one-half miles south of Hillsboro, Illinois, and on the right of way of both the Chicago & Eastern Illinois, and the New York Central railroads. The property of the Company embraces about 200 acres of comparatively level ground, together with natural reservoirs for the storage of water and coal, and ample dumping ground to meet all the requirements of the smelter for years to come. A plan of the smelter buildings, standard-gage railroad sidings, and the reservoirs is as shown in Fig. 2.

BUILDINGS

The buildings are of structural steel and concrete with steel sidings and roofs which afford both permanent and fireproof construction. The character of the construction is seen from Fig. 1.

The fuel is supplied from the Illinois coalfield, which, with the modern coal storage facilities at the smelter property, guarantees a permanent and continuous fuel supply. The concentrates treated are derived largely from the mines of the American Zinc, Lead & Smelting Co., which are situated in the Joplin district of Missouri. Concentrates are also received from the Mascot property of the American Zinc Company of Tennessee with

THE AMERICAN ZINC, LEAD, AND SMELTING COMPANY.

other concentrates from Wisconsin, Colorado, and New Mexico.

The ore is received at the property in standard freight cars which are delivered inside of the ore storage house. As the cars enter the house they are run over a concrete waste-heat tunnel from the kilns seen under the freight cars in Fig. 3, and by this means the temperature of the ore-house is kept above freezing in the winter time. The concentrates, which are often frozen in the cars, are thawed in this manner and unloading facilitated.

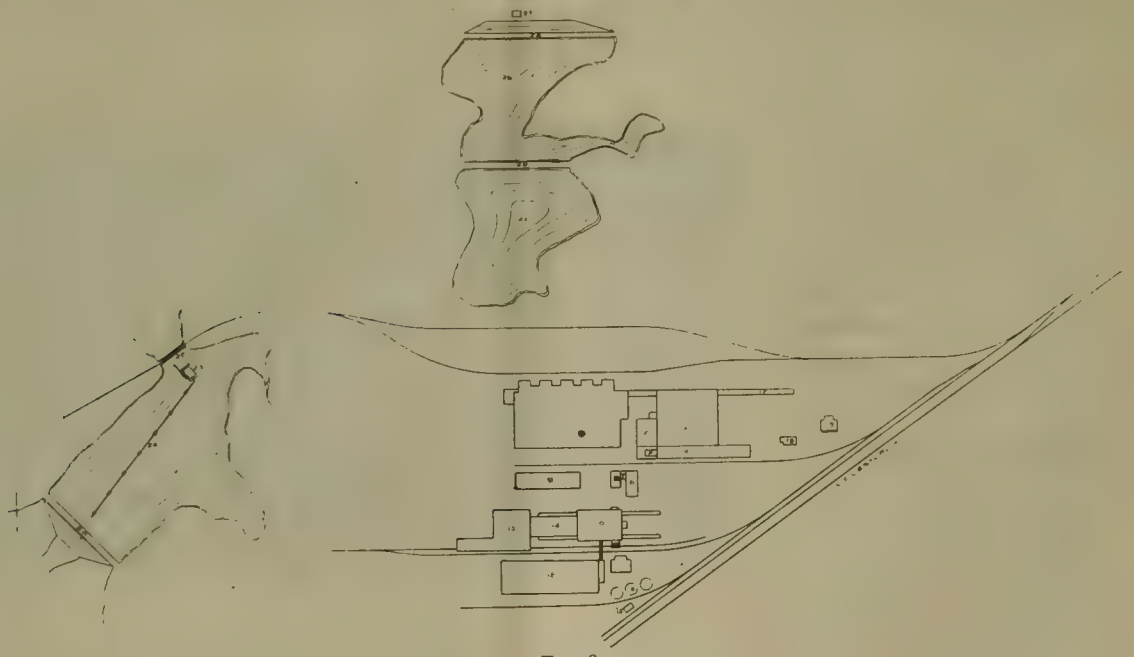

FIG. 2.

1. Furnace house.
2. Engine room.
3. Pottery.
4. Clay storage.
5. Calcining oven.
6. Carbonate crusher.
7. Spelter storage.
8. Carpenter shop.
9. Machine shop, store room.
10. Roasting house.
11. Nitric acid plant.
12. Sulphuric acid plant.
13. Ore storage.
14. Crushers and dryers.
15. Pumping station.
16. Reservoirs.
17. Spelter loading platform.
18. Laboratory.
19. Office.
20, 28, 29. Dams.
21. Coal storage.
22. Water reservoir.
23. Floating pumping station.
24. Discharge pipe-line.
25. Bridge.
26. Water reservoir.
27. Pumping station.

The unloading of the cars is accomplished by an automatic scoop-shovel. The scoop removes the concentrate from the cars, after which it is elevated and discharged into a weighing hopper bin which is superimposed on a traveling gantry crane, which is seen in Fig. 3. This crane, with the elevator attachment, scoop-shovel, and weighing scales, which are mounted in it, is moved over tracks to convenient positions for unloading the freight cars. The traveling unloader and elevator are driven by a 25-hp. motor. The scales, with the hopper-bin attachment, are of 100-tons capacity, and the hopper-bin discharges into one-ton industrial cars by which the ore is distributed to the bins. There are ten storage bins with a total capacity of from 8000 to 10,000 tons. These bins are flat bottomed and made of concrete.

FIG. 3. WASTE-HEAT TUNNEL UNDER CARS AND UNLOADING CRANE.

STRAIGHT-LINE DRYERS

The concentrates are removed from the bins in buggies and wheeled by hand a short distance to the feed end of a duplicate straight-line dryer. Here the buggies are dumped into the boot of an elevator and elevated into a hopper-bin which automatically feeds the dryer. This dryer, which is 100 ft. long, with hearths 4 ft. wide, is heated by a dutch oven fire-box at the feed end of the furnace. The concentrate is drawn through the hearths by the rabbling mechanism, which consists of a continuous link belt arrangement, to which the rabbles are attached. When the rabbles emerge from the discharge end they are returned over the top of the dryer, and cooled on the return passage. The discharge from the dryer is screened, the oversize crushed in a pair of rolls, and the entire product elevated to overhead concentrate storage bins.

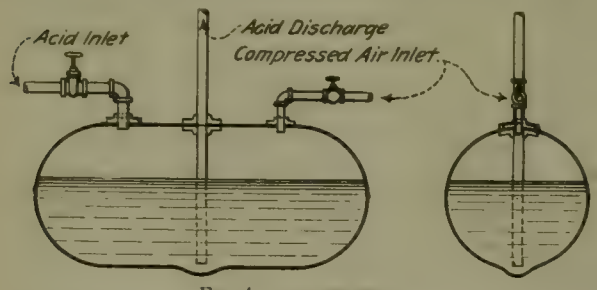

FIG. 4. AN ACID EGG.

The dried ore is drawn from the bins into industrial cars and trammed to the roaster house. Here the concentrate is dropped through a grating into the boot of a bucket-elevator, which elevates it to a spiral conveyor by which it is transferred to the feed hoppers of the roasting furnaces. The roasting equipment consists of two multi-hearth modified Hegeler furnaces, which consist of seven superimposed hearths 70 ft. long and 6 ft. wide. Each furnace is made up of two units of seven hearths each with two feed and two discharge openings. The ends of the hearths or muffles are inclosed by swinging sheet iron doors which are opened and closed by the passage of the rabbles. Each kiln is rabbled once every two hours, the rabbling requiring 15 minutes. The gas is burnt under the lower three hearths only, and the temperature of the hearths are recorded by a Bristol pyrometer, temperature readings being taken every hour. In this manner an accurate record of temperatures is kept and a uniformity in performance is possible. These furnaces are doing excellent work, reducing the 30% sulphur in the concentrate as fed into the furnace to 0.9% sulphur when discharged. The concentrate requires 72 hours in its passage through the furnace. Each batch as discharged is immediately sampled and the sulphur content determined. In this manner an accurate record is kept of the performance of the furnaces and any change in the condition is at once noted and corrected. The rabbling mechanism of the two kilns is of the regulation Hegeler type and driven by a 150-hp. motor. The gases from the kilns are conducted to the acid building through individual flumes and dust chambers. The fuel for the kilns is supplied by two Hegeler type gas-producers. The coal for the producers is unloaded from the cars by a locomotive crane and elevated to the hopper-bins which feed the producers.

The roasted concentrate from the furnaces is discharged into cars which are weighed and drawn through a tunnel and up an incline to the mixing room, where they are discharged into 12 steel and concrete storage bins. The roasting furnace building is being fitted with a vacuum cleaning arrangement by which all the dust about the furnaces can be collected and re-charged into the furnaces. On both sides of the furnaces there are chiseling tables supported on rails on which the furnace men stand when removing slag and clinkers from the hearths. The flue through which the furnace gases pass to the acid plant is lined with brick and the dust cham-

ber is lined with baffles which assist in cooling the gases as well as separating the flue dust.

The acid building is a concrete and steel structure with steel roof and sidings. The building is about 325 ft. long by 100 ft. wide, with the working floor 6 ft. above the ground level to permit of good ventilation. The acid process employed is the standard chamber process and the equipment consists of two Glover towers, a cooling and mixing tower, two systems of chambers of six each, and four Guy-Lussac towers, together with fans at the top of the Guy-Lussac towers and reserve fans at the end of the system. The gases enter the Glover towers from the kilns and from them pass to the mixing tower and then to the system of chambers. It is then returned to the Guy-Lussac towers, through which it passes in series and is finally expelled into the atmosphere. The weak acid from the chambers is returned to the top of the Glover towers where nitric acid is added to produce the nitrous oxides necessary in sulphuric acid manufacture and then passes through the three Guy-Lussac towers in series. The acid circulation is effected by means of acid eggs. The acid-egg pump consists of a steel shell about 7 ft. in length, 3 ft. in diameter, and elipsoidal in shape, as shown in the diagram, Fig. 4. The acid is admitted near one end of the egg and compressed air is admitted near the opposite end and on the upper side of the shell. The discharge pipe is connected at the centre and at the top of the shell and passes through to the bottom. When air is admitted the acid is forced out through the discharge pipe. This means of pumping acid has proved most effective in that it does away with the wear and tear on pistons and valves. There are no moving parts in the construction of this apparatus.

FIG. 5. HILLSBORO DISTILLATION FURNACE.

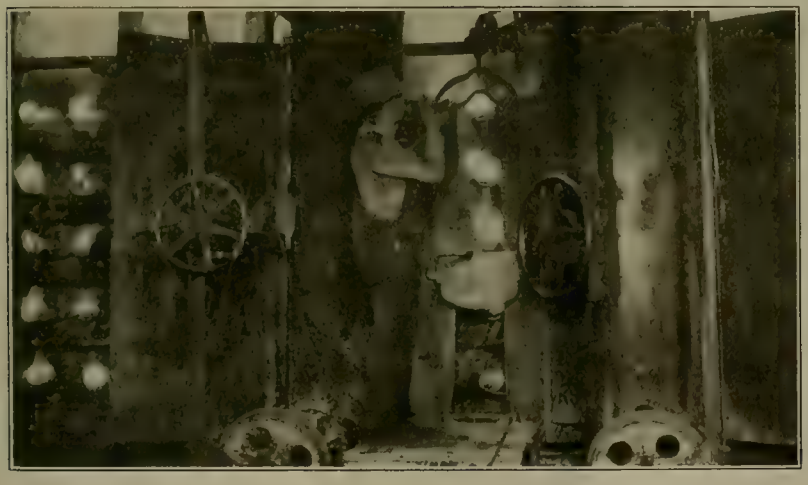

FIG. 6. DRAWING RETORTS.

About 1,250,000 lb. of lead has been used in the construction of the acid plant. Nitric acid used in the process is manufactured in a separate building on the grounds, the equipment consisting of an absorption tower and kettles. The sulphuric acid produced is 60°B. and is being manufactured at the rate of 200,000 lb. per day. The acid from the tanks in the building is pumped to tanks at the top of the acid building, from which it flows to three large 1000-ton steel storage tanks. From the storage tanks it is pumped by centrifugal pumps to the Company's tank cars, in which it is delivered to steel mills, fertilizer plants, glass factories, and other plants.

The roasted concentrate is drawn from the steel and concrete storage bins, which are about 1500-tons capacity, into a weighing hopper, where it is automatically weighed. The fuel is then added in the same hopper and contents are discharged into one of two drum concrete mixers. The discharge from the mixers is elevated by a bucket-conveyor, which dumps it into a car which holds one 'batch,' four 'batches' being required for a furnace. This car is pulled by a cable over elevated tracks to the front of the furnace. The cars are of the side-dump pattern and discharge through

FIG. 7. COAL STORAGE RESERVOIR AT HILLSBORO.

hoppers into the charging cars on the working floor of the distillation furnace building.

DISTILLATION FURNACES

The smelting department consists of five blocks of distillation furnaces, all under one roof. The building is of reinforced concrete with sides and roof of steel. The furnaces, Fig. 5, are 110 ft. long, with the working floor 16 ft. above the ground-level. There are 5 tiers of retorts and 20 retorts to a section, 20 sections on a side, thus making 400 retorts on a side or 800 to the block. The entire smelter comprises 4000 retorts.

The distillation furnaces are fired with producer gas which is generated in five gas-producer plants, which are of the Hegeler type as used in connection with the roasting kilns. The coal as received is unloaded from the cars by a locomotive crane and dumped into the boots of elevators and raised to the feed-bins which are superimposed over each producer. A drag mechanism is fitted to the bins whereby it is possible evenly to distribute the coal to the bins of the different producers. These producers gasify from 30 to 40 tons of coal daily. The gas enters at the end of the distillation furnaces and passes through toward the stack, air being added at each half-section to complete the combustion and maintain the high temperature of distillation. The air for the furnaces and gas-producers is supplied by duplicate fans which force it through concrete tunnels to the furnaces and producers. The fan-house is at the west end of the smelter building. Two of the furnace blocks are each equipped with two 264-hp. water-tube boilers. These boilers operate on waste gases from the furnaces and supply steam for power purposes. Another block is being equipped with two 400-hp. water-tube boilers, which when in operation will afford sufficient steam for all power purposes. The boilers are also fitted with Dutch oven attachments which can be fired in the event of a shortage of waste gases from the furnaces or to meet an increased load on the boilers. In this manner ample boiler plant is provided and excess furnace heat is used almost exclusively.

The retorts are charged by hand and are drawn three times a day. The drawing is done with the regulation draw car, as shown in Fig. 6, the metal being drawn from the condensers into a pot which is suspended in the frame of the draw car and brought into position under the condensers by means of a hand winch. The blue powder is re-charged in the last section of the furnace and the spelter is cast into slabs for shipment. The retorts and condensers are made in the pottery on the ground. The retorts are cleaned by means of steam which is formed by injecting water under pressure into them by means of a hose. Any slag or clinker which adheres to the interior of the retorts is removed by scrapers. When blowing out the retorts the operator is protected by means of a sheet iron shield which is suspended from a trolley rail in front of the furnaces. The life of the retorts is from 40 to 50 days at this plant.

The carbonate ore, which is mixed with roasted sulphide in smelting operations, is crushed in a special department for this purpose. It is first passed through a Blake crusher and screened through a two-mesh screen. The oversize is returned to a set of rolls for re-crushing and the entire product is then elevated and taken to the ore bins by means of a long belt-conveyor. These ore bins are of concrete and are situated over the tunnel from the roasting house. In this way the ore is dried sufficiently before being taken to the mixing room.

FURNACE BUILDING

In the design of the furnace building no effort has been spared to provide for the safety and comfort of the employees. The elevated floor structure permits of excellent ventilation and in addition to this, at con-

venient intervals in front of the furnace blocks there have been placed blower funnels connected with an air main and fan. By this means during the hot days of summer the furnace men by standing under these funnels are able to get relief from the intense heat which would otherwise be experienced. A refrigerating system has also been installed whereby ice water is available through sanitary drinking fountains throughout the plant. Change rooms with lockers for the men's use and sanitary toilet rooms are also provided. An electric freight elevator has also been installed for the handling of furnace supplies.

The furnace residues as discharged at the front of the furnace, drop through chutes to suspended hoppers below the furnace floor of the smelter building. These hoppers extend the full length of the furnace blocks and are 'W' shaped. Industrial cars of one-ton capacity are moved by a steam donkey locomotive into position under these hoppers and the residues are drawn into the cars and removed to the dumping ground. The depressions in the present smelter site are now being filled with residues and later a large tract of ground to the southwest of the smelter will be used as a dumping ground.

The coal storage system at this plant is one of the novel features and insures the Company against labor troubles in the coalfields and guarantees a continuous fuel supply for all smelter purposes. The coal is mined in the immediate vicinity of Hillsboro and brought to the smelter in the ordinary freight and gondola cars. That for immediate use is dumped directly into the hoppers which are adjacent to the producer plants or unloaded by a locomotive crane, previously described, into the storage-bins above the gas-producers. In order to assure a permanent fuel supply the Company has adopted a system of under-water storage and for this purpose has dammed up a natural ravine at the south end of the smelter site as shown in the plan. This ground covers an area of 4½ acres and by means of the dam a storage depth of about 30 ft. is available. The coal cars are run out on an 80-ft. steel girder bridge and dumped in that portion of the reservoir adjacent to the pumping station, as shown in Fig. 7. This coal is sucked up by means of a centrifugal pump and distributed through pipe-lines to whatever part of the reservoir is desired. These pipe-lines are supported on floating trusses, as seen in the illustration. In removing coal from the reservoir it is pumped out, lifted into cars and transported to the smelter. Twenty thousand tons of coal is at present stored in this manner Besides being a convenient method for coal storage, the under-water system has been proved to be the most economic method,

FIG. 8. MAKING RETORTS AND CONDENSERS.

in that the loss due to oxidation in weathering is reduced to practically nothing.

Pottery

The pottery plant, in which are manufactured retorts and condensers for the Company's use, is complete in every detail. The clay is delivered at the pottery over standard-gage track and stored out of doors, where it is allowed to weather from six months to one year. Missouri and Illinois clay is used for all pottery purposes. The clay stored inside of the pottery is only sufficient to meet immediate demands. The preliminary crushing of the clay and adobe is done in a Blake crusher and the material elevated to a screen, the oversize being returned to a pair of rolls and the entire product elevated to concrete storage bins. These bins have a capacity of 3000 tons, and the material from them is drawn directly into the pottery plant and fed into the first pug mill. Kilns have also been built for calcining clay and a separate set of rolls have been installed for the crushing of this material, which is also elevated to a separate compartment of the pottery storage bins. The calcined clay and green clay are given a preliminary pugging and then stored in cellars where it is allowed to 'rot' for from three to six months. The clay is then removed from the cellars and given a second pugging, after which it is taken direct to the retort press, Fig. 8. An additional pugging machine is about to be added to the pottery equipment. A hydraulic press of heavy design is used for the manufacture of retorts. The accumulator pressure at which this press operates is from 2000 to 2500 lb. per square inch. The capacity of the machine is about 400 retorts per day. From the press the retorts are taken to the dry rooms, of which there are 15 with a storage capacity of 1100 retorts each. These dry rooms are heated by exhaust steam coils in the floor and are kept at a temperature of 100 to 125° Fahrenheit.

The condensers are made from a mixture of clay and old retorts, the material being pugged and condensers molded in an auger machine. This machine, seen in the lower illustration of Fig. 8, has a capacity of about 4000 condensers per day. The condensers are taken from the machine, crimped, and dried in a special drying-room which has a capacity of 20,000 condensers. The retorts and condensers are taken from the drying-rooms, which are sealed by steel doors, loaded on flat cars, and hauled by an incline chain hoist to the furnace-floor, where they are tempered in down-drafts kilns. There are four of these kilns for annealing the retorts and burning the condensers. This same incline hoist is used for lowering the spelter from the furnace-floor to the loading platform. When the cars reach the platform they pass over metal weighing scales and a record is thus kept of the production.

The steam for all power purposes, as previously stated, is supplied by waste-heat boilers placed in the furnace flues. The engine-room equipment consists of two compound engines which are direct-connected to two, 400-kw., alternating current generators. These have both motor and turbo exciters. Power for the pottery is furnished by a 250-hp. Corliss engine. There are also included two small compound air-compressors which are used to supply air for air tools, lifting the kiln doors, and pumping acid. Duplex pumps are used for fire and service purposes. The water-supply is obtained from two natural reservoirs to the west of the smelter buildings, as shown in the plan.

The refrigerating plant is equipped with an engine and compressor, together with the necessary tanks and coils. Distilled water for drinking purposes is condensed from live steam in the power-plant. This water is aerated, filtered, and pumped to all departments of the plant, where it is available through sanitary drinking cups. The water from the two lake reservoirs is pumped into the service line by a direct-connected, motor-driven, centrifugal pump.

The laboratory building is of pressed brick and is equipped with all the necessary analytical apparatus for smelter use. There is also a small research department of the laboratory. The foundations for the balances in the balance-room are distinct from the building, and equipment throughout is the most modern. The machine plant equipment includes two radial drill-presses, one 30-in. lathe, a shaper, a pipe-cutting machine, a power punch, and shear, together with air tools and other minor equipment. There are also an electrical repair shop, blacksmith, and structural shops.

Power Transmission

All of the power is transmitted from the power-plant through concrete conduits to all departments of the smelter. About two miles of industrial track for the handling of smelter supplies and products is within the smelter grounds. Two saddle-tank locomotives and two 15-ton locomotive cranes are included in the equipment. An automatic call system has also been installed whereby the foremen may be summoned to the telephones which are at convenient points about the works, and in this manner it is possible for the head office to get in communication with any of the foremen in a very few moments.

The American Zinc, Lead & Smelting Co. has aimed to embody all that is most modern and efficient in the construction of this plant, and toward this end has succeeded most admirably in the construction of a smelter which is representative of the most modern practice. No effort or money has been spared to make the operation of the smelter as nearly automatic as possible, and it is also a pleasure to record that the comfort and safety of the men has been given considerable attention. While the metallurgy of zinc is often considered as having been marking time for the past 20 years, a visit to the Hillsboro smelter would contradict this opinion. Although retort furnaces and high fuel costs may be looked upon as necessary evils, the advance in the mechanical operation of our modern producer-gas smelters, of which the Hillsboro plant is typical, has reflected in increased efficiency and lower costs, the goal of all industrials.

Development of Gold Milling in the Philippines

By C. M. EYE

Prior to the occupation of the Islands by Americans, in 1898, there appears to have been little systematic attempt to develop their gold resources. For time immemorial, beds of streams and outcrops of gold-bearing lodes had been worked by natives with some success, the gold finding its way into commercial channels through the trading posts and ports. There is evidence that considerable work in this line had been done by Chinese, both in ancient and modern times, but to all these workers, the use of quicksilver was apparently unknown; the recovery of gold being made by very fine grinding in stone mortars and panning in copper vessels and 'horns' made of bamboo.

It seems remarkable that the Spaniards, usually such assiduous seekers after mineral wealth, should have paid so little attention to the search for gold, during the long period of their possession of these islands. Perhaps it was the almost entire absence of silver, perhaps the lack of evidence of fabulous richness such as lured them on to conquest in Mexico and Peru; perhaps they thought the promised gain not worth the risks involved in subjugating wild tribes, for it is a fact that their possession of much of the interior was more nominal than real; whatever the reason, they paid little attention to this line of industry, and followed the more attractive pursuits of agriculture, commerce, and politics—especially politics.

The San Mauricio

Some fifteen years prior to the date of the American occupation, an English company constructed a mill on the San Mauricio property at Mambulao, Ambos Camarines, consisting of ten stamps, a crusher, amalgamating plates, and Frue vanners; but it does not appear that this plant operated for very long. About the same time, a small Huntington mill plant was erected on a neighboring property, the Tumbagua, to work the free-milling ore from a small but high-grade vein. At the time the Americans came, both of these plants had been idle for years, and had fallen into decay. In 1900, not a single mine or mill was working in the Islands.

In the army of invaders, especially in the volunteer forces, were many men from various mining centres of the West. These were naturally on the lookout for evidences of minerals, and when hostilities ceased many of them took their discharge at Manila and scattered to the hills to prospect. The first gold mill built under American rule was made in Manila and taken to Benguet by a man named Hartwell, from western Montana. It consisted of three stamps of 500 lb. each, working in a sheet-iron mortar, with a few feet of copper plate below. Crude as it was, Hartwell operated it successfully on a surface deposit near Baguio, until smallpox claimed him as a victim. The next mill erected in the Benguet district was placed on the Connote mine, in the Antimok district, by three prospectors. It also was of Manila manufacture, but was heavier and more substantial than the Hartwell mill, having three stamps of 850 lb. each, working in a cast-iron mortar, with a 2-ft. apron plate and about eight feet of table plates. This plant was operated intermittently but successfully for a number of years, working on the thoroughly oxidized outcrop of a calcite-manganese deposit, in which the gold was clean and free. Only the softer portion of the ore was mined, owing to absence of crushing facilities. This ran from $16 to $25 per ton, and paid well for working, a fair recovery being made on the plates. Later an attempt was made to work the sand in the tailing by leaching, but without much success, owing to the difficulty of leaching manganese oxide-bearing material and poor classification.

The Copper King

In 1905 another three-stamp mill, of much the same style but better constructed, was erected on the Copper King property near Baguio. In addition to the stamps and plates, a Gilpin county bumping-table, constructed on the ground, was used with some success to recover concentrate which was high in gold and copper. In the meantime, in the Aroroy district, Island of Masbate, several promising ore deposits had been discovered, and small mills built to treat the ore from them. On the Eastern (now known as the Syndicate), a light three-stamp prospecting mill was built, but ran a very short time. The ten-stamp mill of the Tengo mine had a very short period of operation before being closed down, and the ten-stamp mill of the Gold Bug had a similar experience. This mill had two Woodbury belt-concentrators in addition to stamps and plates, but the sulphide content of the ore was too low to allow of making a commercial product. The failure of the early mills in that district was primarily due to their inability to make a sufficiently good saving by amalgamation alone, and, secondarily, to their lack of capacity, the ores in no case being rich, though of sufficient grade to constitute profitable ore when worked on a proper scale by correct methods.

First Cyanide Plant

The first application of cyaniding to gold ore in the Islands was made at the Minnesota mine of the Benguet Consolidated Mining Co. at Antimok, Benguet, in 1906. The milling plant, which I erected and operated, consisted of the following equipment: A 7 by 10-in. Blake type rodded crusher; one battery of three Hendy, quadruple-discharge, individual mortar stamps, of 1050 lb. each; a 4-ft. apron plate, followed by a 12-ft. table plate, both of silver-plated copper. After amalgamation, the

tailing was elevated in belt and bucket elevator, discharging into an inverted pyramidal upward-current classifier, the underflow of which was carried to any one of four leaching tanks, each 25 ft. diameter by 5 ft. high. There were also the usual number of gold and sump tanks, to accommodate strong and weak solution, and zinc-boxes for precipitation on zinc shavings. The whole constituted a leaching plant of the simplest character. The plant was driven from a 4-ft., double nozzle, tangential water-wheel, under a hundred-foot head. As first operated, with battery screens corresponding to 24 mesh, the saving by amalgamation was about 30%, and of the gold in the sand about 60% was saved in a treatment cycle of from 18 to 21 days. At first, an attempt was made to use lime made from vein calcite obtained from the Comote mine, fed dry with the ore, but the formation of calcium sulphate on contact with the free acid of the ore caused much blinding of screens and building up on all exposed iron surfaces, that its use was discontinued. Caustic soda was substituted and used exclusively for several years. Later, when better and cheaper lime was obtainable, its use was resumed though not as addition of dry lime. It was carefully slaked in considerable quantity, run off into pits, and covered with sand, then added as needed in creamy form to the tops of the leaching charges, as well as to the slime charges, for settlement and for securing alkalinity. On the whole, the use of caustic soda was more satisfactory in the leaching work, the only trouble arising with it being the formation of much insoluble hydrate when an insufficient quantity was used to secure distinct alkalinity. These hydrates were fairly readily dissolved on the addition of an excess of caustic soda solution, however.

Early Difficulties

When the plant began operations, it developed that serious loss occurred in the slime run to waste, which often assayed higher than the ore did as it came to the mill. An attempt was made to impound the slime, but the heavy rainfall of the country and the nature of the site in a narrow, steep cañon rendered this unsuccessful. Therefore, as soon as possible, a slime treatment was provided by building a pair of tanks of native pine, 16 ft. diameter by 14 ft. high, furnished with mechanical stirring apparatus. This mechanism, built in Manila from designs that I furnished, consisted of a vertical shaft with four stirring arms extending down into the tank from a truss above. This truss carried two vertical bearings and one ball bearing, the two former keeping the shaft in a vertical line and the latter taking the weight. The whole ball bearing was in turn suspended from a chain block, by which it could be raised and lowered through six feet. The gear worked on the shaft by a feather in a long keyway as in the Dorr thickener mechanism, and was driven from a pinion from a line shaft over the gear. A worm drive would have been much better, but was not locally available. The distinctive feature of the whole thing was the utilization of standard material as far as possible, the ball bearing being made by using one-half of a standard flanged shaft coupling keyed in a reversed position at the upper end of the shaft, with a casting containing the ball-race placed in position below it before it was keyed in place. The other half of the coupling was keyed into place in normal position at the lower end of the shaft, a square sheet of half-inch steel 16 in. square bolted up under it, the arms of a three-inch standard pipe being bolted up under this in the lines passing through to corners by U bolts. The cast iron stirrers, each made in two pieces like a split collar, were bolted on the arms and kept from turning by pins engaging in holes bored in the pipes. These rigs proved efficient and were used as long as the plant lasted.

Slime Treatment

The slime treatment consisted in alternate filling of the tanks, the stream being allowed to flow into one until a settled charge was accumulated, a charge being treated meanwhile in the other. The settled charge, amounting to about 35 tons and containing about 40% solids, was freed of the supernatant water by decantation, solution pumped on from the weak-solution circuit of the sand plant, brought up to strength of 3 lb. per ton in cyanide and 0.1% protective alkali in terms of caustic soda, and agitation continued for 18 hours with a dilution of from 2½ to 3 of solution to 1 of solids. Then the stirrer was lifted and the charge allowed to settle, and decantation begun, following the settling as fast as possible. Three successive charges of weak solution were pumped on, stirred with the charge, and decanted off, and a final charge of water put on, decanted to the weak-solution sand circuit, and the charge then stirred with additional water and discharged.

The chief difficulty with this plant was its lack of capacity. In order to handle the material faster, a 12-ft. Ridgway filter was installed, the plan being to give the slime agitation and one decantation in the treatment tanks, then pump to a thickening-tank, and to give it a final treatment on the filter. Unfortunately, the filter plant never had a chance to operate, as the plant was destroyed just at the time the filter was ready. Experiments made soon after the plant started operations showed that the iron sulphide panned from the pulp leaving the plates ran about $150 per ton, while sulphide panned from treated sand charges ran about $35 per ton. Therefore, a Wilfley table was placed below the classifier to handle the sand before going to the tanks. This table made a product running well above $100 and also enabled the elimination of more slime from the sand. The concentrate was accumulated with a view of putting in a small treatment plant, but after the loss of the plant, was shipped to San Francisco. The loss of the plant occurred in October 1909 from a flood during a heavy typhoon. Everything was lost but the stamps, plates, and water-wheel, the elevator, and one leaching tank. The stamps and plates were used on oxidized material during 1910-11, but another flood

near the end of the latter year carried away the wheel and plates as well as portions of the steel pipe-line, leaving the crusher, bin, and stamps remaining; a forlorn-looking wreck. It has thus stood ever since, but there are hopes now of a new all-sliming plant being put on the property on a more protected site. It should be remarked that a second battery of three stamps was erected about a year after the plant started, and a third battery had been purchased and brought to the site when the catastrophe came.

The Bua Mill

A year or so after the beginning of operations at the Consolidated, a somewhat similar plant was built on the Bua property, just below on the same stream. It consisted of a 7 by 10 crusher, six stamps, apron and table, amalgamating plates, a classifier, and six leaching tanks (each 20 by 5 ft.), the usual solution and sump tanks, zinc-boxes, etc. The ore, drawn from a different vein system than that of the Consolidated, consisted of calcite with considerable carbonate and oxide of manganese, the gold occurring free on the cleavage planes of the crystals of calcite and rhodochrocite. With crushing to 24 mesh in the battery, a saving of about 35% was made by amalgamation, and of the gold in the sand about 70% was recovered by leaching. The period for a complete cycle was from 12 to 14 days. The slime, fortunately, was low in grade, running $2 or less with the ore averaging $7 or $8 per ton. This enabled the slime to be run to waste without a great loss. Another advantage lay in the fact that the ore was naturally alkaline, thus obviating the necessity for the use of lime. Double treatment was used later, the practice being to fill by Butters distributor, give a preliminary treatment with strong solution for a couple of days, then drain and shovel over the charge in the same tank, beginning with a segmental cut along one side, which was thrown up on the charge. Then the charge was turned over, by successive slices, leveled off, and given a second treatment, first with strong then with weak solution, and finally washed. This plant had a successful run of several years, under the careful management of Con. O'Shea, but was finally put out of commission by the floods that wrecked the Benguet Consolidated plant. It was driven by a 4-ft. Pelton wheel, under a head of something over a hundred feet.

In 1910 a small stamp-mill, with plates, was erected on the Major group of claims, in the Baguio district, and in the following year a leaching plant was added, but it was never successful, owing to a combination of adverse circumstances. The ore deposits, rather bunchy in character, were scattered over a large area, making it expensive to handle to the mill, and the ore did not yield easily to the treatment. Steam was used for power, and wood became expensive and scarce when the supply adjacent to the works was exhausted. The life of this enterprise was therefore short, as it was impossible to overcome all difficulties.

During the same period the Headwaters Mining Co. built a mill, on its property near Baguio, which consisted of a crusher and ten stamps of 1050 lb. each, in two batteries of five each, all in one frame, mounted on a concrete foundation block. These were followed by double cone classification for separation of sand, which was reground in an 8-ft. Hardinge pebble-mill to 100 mesh, reclassified, and the oversize returned to the mill. The whole product finally passed as slime to a conical bottom steel thickening tank, of 24-ft. diameter by 24-ft. depth, which removed the battery circuit solution. This was returned to a storage tank set above the batteries. The thickened pulp passed to a series of two Pachucas, and thence to a series of two conical bottom decantation tanks, and finally to a Ridgeway filter. This plant was put into commission in 1911 and was the first plant in the Islands to dispense with amalgamation and to crush in cyanide solution, using continuous treatment throughout. The results were good, but owing to financial difficulties which arose, the first period of operation was only for a few months. Later it was started again, and I understand had a successful period of operation, until shortage of ore compelled a final shut-down.

In 1909, purchasers of the Old San Mauricio mine, at Mambulao, erected a mill of 20 stamps, and concentrating plant, and operated a short time, but were compelled to shut down permanently for lack of pay-ore. This plant (power for which was furnished by a modern steam plant using *manglar* wood for fuel) was substantially built and well erected, and deserved a better fate.

Considerable work was done, covering a period of several years, on the Tumbagua mine in the same district, the old Huntington mill plant having been repaired and used. While the ore was of extremely high grade, the vein was so small and the ore so scarce that it never scored a success.

The Colorado Property

Early in 1910 I assumed charge of the Colorado mine, in the Aroroy district, Island of Masbate, having examined it for intending investors in June of the preceding year. I recommended a continuance of development work and outlined a line of work to be followed. Preparations were made for the erection of an all-sliming cyaniding plant of a hundred tons capacity per day, the showing of ore fully warranting such a plant. This plant was finished late in 1911 and put in operation, development work having been constantly carried on in the meantime. It consisted of a jig-back aerial tramway a thousand feet long from the mine loading bins (the tram having a drop of one foot in two), delivering at the mill head to a 9 by 15 Blake crusher, set on top of a mill bin of 200 tons capacity. This supplied 20 stamps of 1250 lb. each, set on concrete mortar blocks of the Goldfield type, ten stamps to each block. The battery screens were 8-mesh, and solution was used in crushing, in a ratio of six to one of ore.

The combined stream of pulp from all the batteries was carried to a Dorr duplex classifier, set so as to feed by gravity two tube-mills, 5½ by 16 ft., these being placed with the long dimension across the line of the mill, the head or feed ends toward the centre. The discharge was carried back to the foot of a bucket-elevator, lifting 24 ft., which delivered to the same duplex classifier. The overflow from this, containing no particles coarser than 100 mesh, flowed to a Dorr thickener, 27 by 14 ft. The overflow from this, consisting of five parts of solution for one part of ore crushed, flowed to a sump tank supplying a triplex pump, which returned it to a storage tank of 50,000 gal. capacity set on the level of the base of the ore-bin. The thickened pulp, at one to one consistency, was drawn continuously to a series of two Pachucas, 40 by 15 ft., in the first of which it was diluted to about one and one-half to one, with strong solution brought up to requisite strength. After passing through the two Pachuca tanks, the pulp then flowed by gravity to another Dorr thickener of the same dimensions as the first, where a dilution of four or five to one took place, with barren solution from the extractor sumps. The overflowing solution, after clarification, passed through zinc-boxes, and thence to the strong-solution sump. The underflow of one-to-one mixture of pulp and solution went first by gravity to a mixing tank with mechanical agitator, and thence by gravity to two Oliver vacuum-filters, from which, after washing, it was discharged into a sluiceway leading to the river. The whole plant was thoroughly well constructed, all foundations and retaining walls being of concrete, and with floors of concrete on the tube-mill level, filter-floor level, clean-up room, and boiler-room. The mill was arranged in a series of eight descending benches or floors, terminating in the boiler floor on the level of the main roadway below. The material from the excavation, spread out on this level, made a splendid *patio* for storing the *manglar* wood, used in firing the three horizontal tubular boilers of 80 hp. each.

Changes in Operating Plan

The line of treatment given represents that followed at the start of operations. It was soon found that, owing to the extreme solubility of the gold, by far the greater portion was dissolved by the time it reached the first thickener. This necessitated making provision for precipitation at this stage of the treatment, which was done by moving three of the five extractor boxes to a level where the solution from the first thickener flowed through them by gravity and thence on by gravity by the Pachucas, furnishing the necessary diluting solution for the second thickener. The heads assayed about $12 per ton, and the solution from the first thickener from $1.60 to $2. After treatment in the Pachucas the second dilution and decantation left the solution of a value of about 40c. per ton, the overflowing portion of about five to one going to extractors, and the underflowing portion of one to one going with the pulp to the Oliver filters, where the washing reduced the value by somewhat less than half. All of the solution and wash from the Olivers went to the sump, and was returned to the solution circuit to the batteries. The principal defect in the working of the system arose from inability to secure sufficient wash on the filters without loading up the circuit with excess solution, the evaporation in that hot but humid climate being very slight. Since that time, the filtering plant has been rebuilt and two more thickeners added, as well as other minor improvements that have resulted in increased capacity and better saving.

Production

During 1912, with ore of about $12 grade and a saving of 90%, the production amounted to something over $330,000, of which practically one-half represented profits after all expense of development, mining, and milling were covered. While the report for 1913 is not yet at hand, the production was considerably greater, due to increased capacity and better saving. This was the first lode mine in the Islands to pay dividends, which it has done regularly since June 1912 at 10% semi-annually, besides accumulating a substantial sinking and improvement fund. It may be regarded as the first successful lode-mining venture in the Philippines. Plans have been prepared for the addition of ten more stamps and an additional tube-mill, to be placed this year.

The success of the Colorado has encouraged the owners of several other properties in the same district to equip with somewhat similar plants, thought not so large. The Keystone erected and put a plant into operation last year, which consists of a crusher followed by two Lane slow-speed Chilean mills, and a series of Dorr thickeners without filters, the evident intention being to operate on the continuous decantation counter-current system. This plant has been in operation but a few months, and no data are available. Recent advices announce the beginning of operations in a similar plant on the Syndicate mine, above the Colorado. This is the old Eastern, mentioned previously, which, after the first fiasco, changed hands and was steadily though slowly developed, throughout a number of years. In it, as in all of the deposits of this district, the ore calls for fine grinding and cyaniding, amalgamation not being necessary, as there is no coarse gold present. The same is generally true throughout the Islands; certainly in the Aroroy and Benguet districts. The success of plants at the latter place will encourage resumption of milling in Benguet and elsewhere along the same or similar lines. It is said that the more wealthy Filipinos are now becoming interested in mining, since it has been demonstrated at the Colorado and elsewhere that it can be done profitably. Mining and milling are likely to always be minor industries there, but in view of what has already been accomplished, they are likely to contribute materially to the wealth and prosperity of the Islands.

Leaching Experiments on the Ajo Ores—III

By STUART CROASDALE

Sponge iron was first used as a precipitant for copper in England in 1837, although Gossage, in 1859, was the first to use it in connection with the wet extraction of copper from ores. It was made by heating a mixture of finely crushed iron ore and coal in a reverberatory furnace, with a reducing flame. Since then a great deal of sponge iron has been produced by iron manufacturers and a number of furnaces have been invented for its production, all of which are described in books on the metallurgy of iron and steel. It is now produced commercially at Hoganas, Sweden, by heating a mixture of fine magnetic iron concentrate and coal in pots or retorts by means of producer gas.

According to Sir I. Lowthian Bell,† oxide of iron is easily reduced by solid carbon, but carbon monoxide gas is greatly preferred as a reducing agent. The reduction of Fe_2O_3 begins at 420°F. The reduction of FeO begins at 1300°F. and is complete at 1475°F. Sponge iron readily combines with oxygen when exposed to the air at a red heat. It is also capable, at certain temperatures, of splitting up the carbon dioxide formed by its own reduction. The necessary reaction for the reduction of iron oxide by carbon monoxide seems to be

$$Fe_2O_3 + 9CO = 2Fe + 3CO_2 + 6CO$$

or, that there is as much oxygen in the CO escaping as in the CO_2 formed. This reaction is not so simple as it appears, however, for carbon monoxide gas is split into carbon dioxide and carbon in the presence of iron oxide or metallic iron, thus:

$$2CO = CO_2 + C$$

Hydrogen greatly assists in the reduction of iron oxide. George B. Frankforter, of the University of Minnesota, found that finely pulverized iron ore begins to reduce at about 300°F. in an atmosphere of hydrocarbon gas and is completely reduced below 1000°F. S. H. Stupakoff, in a paper read before the Engineering Society of Western Pennsylvania, states that carbon monoxide begins to reduce precipitated iron oxide at 285°F., roasted carbonate at 390°F., and is active on all ores at 750°F. It is most active at 1000°F. Solid carbon begins to reduce iron oxide at 800°F. The reverse action, of CO_2 being reduced to CO by metallic iron, begins at 800 to 1100°F., depending upon mass action, and is most active at 1475°F. A mixture of $3CO_2$ and 2CO is oxidizing at 1000°F., and a mixture of $1CO_2$ and 2CO is oxidizing anywhere above 1500°F.

My plan for the production of this precipitant was to manufacture sulphuric acid at the leaching plant, from the low-grade Bisbee pyrite, and then reduce the iron oxide in the calcine to sponge iron for precipitating the copper. The Bisbee pyrite contains about 38% iron and 1.5 to 2% copper. The copper would pay for the mining. The freight rate on this material from Bisbee to Ajo would be very low and divided equally between the acid and precipitating departments. The acid plant would be constructed so as to have the same life as the oxidized ore in the mine. In this way the cost of acid made at the leaching plant should compare favorably with that made at the smelting plant at Douglas, when the cost and maintenance of acid trains and storage equipment are considered in conjunction with the high freight rates on this commodity. The calcine from this pyrite would be in ideal condition for the production of sponge iron. It would contain a finely divided, porous, artificial oxide of iron which could easily be reduced at low temperatures. The product obtained from the reduction of the calcine would contain 60 to 65% metallic iron in a finely divided, porous condition that would present the greatest possible surface for the rapid precipitation of copper, and the copper contained in the original pyrite would all be recovered.

†'Principles of the Manufacture of Iron and Steel.'

Laboratory Experiments

Laboratory experiments were made by mixing iron ore with 30 to 35% coal, both crushed to 16 mesh, and heating in a closed clay crucible in an assay muffle for 1 hour at a temperature of 1600 to 1800°F. From 75 to 77% of the iron in the ore was reduced to metallic iron. These experiments were repeated by mixing calcine with 25 to 30% coal and heating in the same manner; 98% of the available iron was metallized. Calcine was then placed in an iron tube and heated to a low red heat in an atmosphere of hydrocarbon gas for 1 hour. Over 90% of the available iron was metallized. This experiment was repeated and the tube was heated to incipient redness for 90 min.; 93% of the available iron was metallized. The gas used for heating the tube in this experiment was the impoverished gas coming from the reduction of the calcine. The available iron in these experiments was the iron existing as oxide and not that existing as sulphide.

These experiments were again repeated on calcine from Bisbee pyrite crushed to ½-in. mesh instead of 16 mesh. At the end of 1 hr. 76.6% of the available iron was metallized and at the end of 2 hr. 88.3% was metallized. Sponge iron has been produced in quantity by iron manufacturers in small reverberatory furnaces, and, as I have stated, is now produced commercially in Sweden from magnetite concentrate in intermittent furnaces of the brick or pottery kiln type, so there is no doubt about the metallurgical condition necessary for its production, and the feasibility of its production for the precipitation of copper. The idea of using calcine as a source of iron is new, so far as I know, and was first proposed by me during the course of these experiments.

in the summer of 1912. The advantages of using this material are at once apparent from every viewpoint.

My efforts, therefore, were not to determine if sponge iron can be produced commercially, but to devise a furnace that will receive the calcine hot from the roasting furnaces, reduce it continuously, and deliver the metallized product or sponge iron to the precipitating department of the leaching plant. The problem is simply one of mechanical construction with no impossible or prohibitive features. The production of sponge iron is surprisingly easy, when the conditions are right.

After trying several small furnaces of different designs, I erected a Wedge double-function roasting furnace of special design to meet my conditions. This furnace was 9 ft. 9 in. diameter, had six roasting

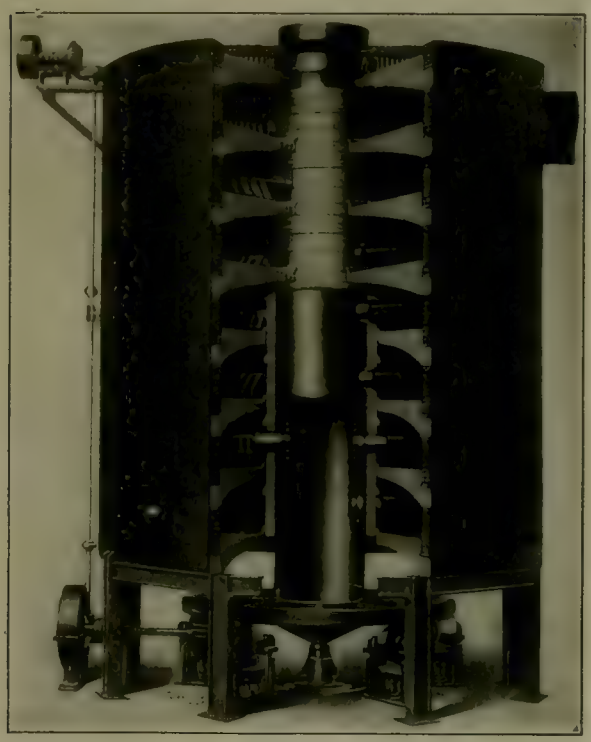

FIG. 2. WEDGE DOUBLE-FUNCTION ROASTING FURNACE.

hearths, one drying hearth, and one cooling hearth. The three upper hearths were of the ordinary type for roasting sulphide ore. The three lower were muffle hearths heated with oil from outside fire boxes. The two sets of hearths were sealed from each other by automatic cast iron valves. The entire furnace was sheathed with sheet iron except the top and bottom. Luting rings were placed around the centre shaft, and every effort was made to make the furnace as air-tight as possible. Each hearth was connected with the flue so the gases could be controlled as desired. A screw feeder was attached to the side of the furnace to deliver pulverized coal on the upper muffle hearth.

I expected to be able to roast Bisbee pyrite on the three upper hearths and deliver the red-hot calcine on the top muffle through the automatic valves, where they would be mixed with powdered coal from the feeder. In this way no heat would be lost and reduction would begin at once. I soon found that I had made a serious mistake in trying to put two furnaces into one, for I had neither a roasting nor a metallizing furnace. With all six hearths for either purpose, I would have obtained better results. The spaces for the passage of hot gases under the muffles were too small. In order to maintain the temperature that was desired on top of the muffle, the heat directly opposite the fire boxes was high enough to soften the clay tiles and cause them to warp. This allowed the calcine, already reduced to ferrous oxide, to drop into the joints and form a fusible slag which soon made a hole through the muffle and admitted air and products of combustion just where I wanted a reducing atmosphere. My greatest trouble probably came from air leakage through the bottom or cooling hearth and around the central shaft. The bottom hearth was made of brick arched in the usual manner. It was plastered on the under side with cement, but with the constant contraction and expansion of the furnace, it was impossible to make it air-tight. I would frequently get metallization well started on the middle muffle hearth and the iron would oxidize again before discharging. The luting rings around the central shaft, which were supposed to seal by dipping into the ore on the hearth, were not satisfactory for this purpose.

FURNACE TEMPERATURES

I endeavored to overcome these difficulties by producing a gas pressure inside the furnace from the combustion of coal. In this I was partly successful, and for short periods of time, until something broke or temperatures fell, I got encouraging results. The highest temperatures I was able to obtain on the muffles were as follows: top muffle, 1000°F.; second muffle, 1320°F.; third muffle, 1460°F.; cooling hearth, 1040°F.; but these were maintained only a short time before a muffle gave way. When reducing with coal, I should have had higher temperatures or at least 1400° on all the muffles. The soft coal used I thought had a tendency to deposit soot on the calcine at low temperatures, which retarded the reducing action. I tried lignite coal, but with so many other adverse conditions to contend with, I could not notice any difference. I also tried powdered coke, but at that time other conditions were unfavorable and the test was not completed. I was anxious to use producer gas, but had no opportunity to do so. My own laboratory experiments and those of all other investigators have proved that iron oxide can be reduced much more easily with gas than with solid carbon, and producer gas made from lignite or oil (which would be the cheapest fuels obtainable at Ajo) would contain the most active reducing agents known for this purpose.

I regret that my work in this direction was stopped before it was carried to a conclusion, but enough was

learned to satisfy myself that it will be entirely feasible to metallize calcine for copper precipitation at a cost of not over $5 per ton of metallic iron. Our estimated costs at Ajo were not much more than this, and they included half the cost of the pyrite. I believe a muffle type of furnace can be made practicable for metallizing calcine continuously, but it must be made gas-tight.

Pig Iron for Precipitation of Copper

When iron is mentioned for copper precipitation, no one in this country seems to consider anything but scrap iron as available for this purpose. It takes but a small amount of investigation, however, to find that pig iron is not prohibitive in cost at almost any point in the United States not remote from the railroad. It is reported that pig iron can be delivered on the Pacific Coast from China or India at a cost of $10 to $12 per ton.

The use of ordinary pig iron requires long launders and more or less handling of the iron to effect complete precipitation of the copper. Of course, the rapidity of precipitation depends upon the surface exposed, so I granulated the pig iron I used. This can be done best by shattering a small stream of molten iron with a jet of steam, and then cooling in a stream of water. The product was very hard and compact, and most of it was in the form of shot or pear-shaped drops. It contained 93.5% iron. A screen analysis gave the following results:

Mesh.	Individual, %.	Cumulative, %.
+ 4	2.0	100.0
+ 8	20.0	98.0
+16	31.0	78.0
+30	28.6	47.0
+60	12.4	18.4
—60	6.0	6.0

The relative precipitating values of the different sizes of this product were obtained by treating equal weights of each size with equal quantities of pure copper sulphate solution and also with lixivium obtained from leaching the oxidized ore. Each test covered the same period of time, at the same temperature, and was made under the same conditions:

Mesh.	Copper sulphate sol.:		Lixivium:	
	Grams Cu pptd.	Relative speed of pptn.	Grams Cu pptd.	Relative speed of pptn.
+ 4	0.050	1.0	0.06	1.0
+ 8	0.105	2.1	0.11	1.8
+16	0.385	7.7	...	...
+30	0.540	10.8	0.59	9.8
+60	0.925	18.5	1.05	17.5
—60	1.175	23.5	1.31	21.8

At the Gumeshevesky mine in Russia 12 tons of granulated iron is reported to have the same precipitating capacity as 120 tons of iron plates. The method of using granulated iron as a precipitant was also a small problem. Sponge iron from calcine or even from iron ore is attacked inside and out by the copper solutions, and each particle, large or small, is soon a mass of cement copper. Granulated iron is attacked only on the surface and unless agitated continually during precipitation it soon cements together into a solid mass which retards further action.

To overcome this difficulty, I made a tube-mill out of an iron pipe 10 ft. long and 20 in. diameter. It was fitted with 6-in. openings at each end for the admission and discharge of solution. It was filled to these openings with granulated iron and revolved at the rate of 12 r.p.m. The solution going into this tube-mill was a neutralized lixivium from leaching the oxidized ores. It contained

	Per cent.
Cu	1.64
Fe	0.34
Free acid	trace

It was passed through at different rates of speed to get the precipitating capacity of the mill. The results obtained from the solution passing out of the mill were as follows:

Rate, gal. per min.	4	6	7	10	12
Cu, per cent	none	none	none	0.06	0.09
Fe, per cent	....	....	1.98	1.88	1.84
Free acid, per cent	....	....	trace	trace	trace
Iron (100%) pounds consumed per pound of copper pptd.	....	....	1.00	0.97	0.97
Granulated iron, pounds consumed per pound of copper pptd.	....	....	1.07	1.04	1.04

The copper precipitate contained 73.6% copper. In a previous experiment, it contained 86.8% copper. By this method of precipitation the iron remained in the mill, always bright and clean, while the precipitated copper passed out with the neutral solution, from which it settled rapidly and could be removed by decantation. The operation is continuous. As seen by these results, the consumption of iron need not exceed 1 lb. for each pound of copper precipitated, provided the solutions are neutralized before precipitation. In a large plant these mills should be made longer and of less diameter than an ordinary tube-mill. The shell should be made of copper and lined with silex, to prevent abrasion. The galvanic current set up by the copper and iron would hasten the precipitation.

Electrolytic Precipitation

As usual, before starting a series of experiments, I compiled all the data available on this subject. These were obtained not only from published works, but from private notes and correspondence. The vital factors governing this method of precipitation are cost of power, material for anodes, and interference of other metals. The power required for deposition from clean copper sulphate solutions is about eight or ten times that re-

quired for refining purposes, or about 1 kw. per pound of copper deposited. The most economical current density is between 10 and 11 amperes per square foot, and the voltage required is about 2 volts, although with magnetite anodes it is said a current density of 15 amperes can be used. With an average cost of electric power of not more than 1c. per kilowatt the power costs for this method of precipitation need not be prohibitive. The anode material heretofore has been confined to lead or antimonial lead. Fused magnetite is now being tried and is said to be very satisfactory, although fragile and expensive. Its merits are yet to be demonstrated on a large scale. Lead anodes are gradually consumed, forming the peroxide of lead, which can be collected, reduced, and used over again if necessary.

Interference of other metals has proved the chief stumbling-block in most of the attempts to use the electrolytic method for the recovery of copper. Arsenic and antimony are troublesome, but are seldom found in appreciable quantities in leachable ores. Iron is the principal source of trouble, and with it may be considered manganese if present, for its influence is substantially the same as iron. Iron, by its alternate oxidation and reduction, consumes electrical energy without the deposition of copper. It must, therefore, be rendered innocuous by one of the following methods: Removal by precipitation, the use of diaphragms, or the use of depolarizers. Removal by precipitation on a large scale may be discarded at once as impracticable, for any effort in this direction would enable one to precipitate the copper direct by means of the same amount of chemical reagents and at about the same expense. The use of diaphragms has been tried repeatedly, but never successfully, on long-continued, large-scale operations. Under the conditions involved, it is improbable that they can ever be made to operate successfully, for diaphragm material that does the work required also increases the electrical resistance beyond commercial limits.

The use of a depolarizer seems to offer a way out of this difficulty. The most feasible depolarizer and perhaps the only one sufficiently cheap for this purpose, is sulphur dioxide. This has some advantages and some serious disadvantages. Theoretically, sulphur dioxide used in this manner will regenerate 3 lb. of acid for each pound of copper deposited. In experimental practice, 2 lb. has been the maximum obtained, owing to difficulties of manipulation. A certain amount of electromotive force is also generated in the direction of the current used, which reduces power consumption. These advantages, however, are more apparent than real. If much iron and alumina pass into solution from the ore, the actual acid regenerated in the electrolytic cells is relatively too small to be of any importance. On these Ajo ores, granting the best possible regeneration of acid from electrolytic cells, I estimated that 75% of the acid used will have to be made in an acid plant. In actual practice it would no doubt exceed this amount.

The mechanical difficulties in making the copper lixiviums absorb sufficient SO_2 gas to produce the desired results have not been solved. Introduction of the gas into the electrolytic cells at the anode secures a very small absorption and renders the electrolytic plant uninhabitable for human beings. Acid makers of experience do not offer much hope of success for absorption of this gas by means of scrubbing towers. Those who have tried to make SO_2 act as a depolarizer on a commercial scale report these claims a fallacy. Moreover, it has been found that when electrolytes containing SO_2 are used the current density must be reduced to the neighborhood of 3 amperes per square foot in order to get a satisfactory deposition of the copper. This means an electrolytic plant installation three times the size ordinarily required.

It has been found impracticable to deposit copper from electrolytes containing less than 1% copper. The average lixivium including enough wash water and acid to maintain a standard electrolyte will average between 1.5 and 2% copper. Assuming, then, for the sake of argument, that 35 to 50% of the copper can be deposited in good form by electrolysis (35% is actually the case in the only plant in operation), if relatively large quantities of iron and alumina pass into solution at each cycle of the lixiviant it will be necessary to discard the entire lixiviant in a short time or a portion of it at each cycle, in which the copper will have to be precipitated by a chemical reagent. This discarded lixivium will either be strongly acid or, if neutralized by fresh ore, will carry its full quota of copper. In any leaching operation, there will be also a gradual accumulation of wash water or weak solutions, which will have to be treated with a chemical precipitant.

The conditions governing the successful deposition of copper from solution by electrolysis have been determined quite conclusively after long and careful experiment by men skilled in the art. With ores that will yield lixiviums free from interfering elements, this method will no doubt prove a commercial success in spite of its expensive installation, but with ores like these where the iron passes into solution as readily as the copper, when the raw ore is leached with acid, it is almost a mathematical certainty that electrolytic precipitation cannot be made a commercial success and further experiment along this line is useless. A much more feasible method of overcoming this difficulty with iron would be to keep it from going into solution in the first place. This might be done by roasting the ore after crushing to the size required for leaching. The expense would be small. While there might be some danger of forming insoluble ferrites of copper, the iron and alumina would be rendered relatively insoluble in acid, the ore would be made more porous for leaching, there would be no argillaceous slime to absorb valuable constituents, the copper sulphides and cuprite would be rendered soluble, and the lixiviums might be clean enough for electrolysis. My work was finished before this was tried.

Phototopography

By J. A. MacDONALD

Topographic surveying, including phototopography, is the operation of determining and mapping the horizontal and vertical geographical features of the earth's surface.

Briefly, phototopography consists of photographing the country from prominent points and then plotting the data so obtained in the office. From this it is evident that it is only suited to rugged, irregular country, such that the various features may be easily recognized in the photographs. For these reasons it has reached its highest development in mountainous countries—

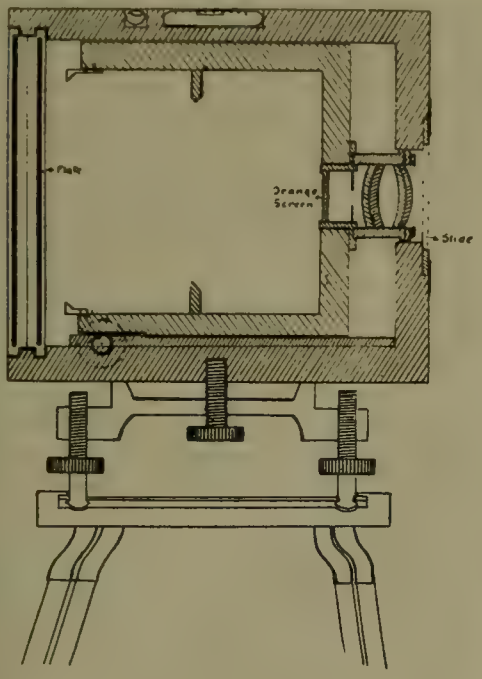

FIG. 1. THE DEVILLE CAMERA.

France, Italy, Switzerland, Germany, and Canada—and in no country has this method received such an extensive and practical application as in Canada.

In 1888, under the superintendence of our present Surveyor-General, Capt. E. Deville, who is an authority on this subject, an extensive photographic survey was commenced in the Rocky Mountains, in the vicinity of the Canadian Pacific railway, which was conducted with great success.

Encouraged by these results, the Department next employed it, in 1893, in making a topographic reconnaissance for the delineation of the Canada-Alaska boundary in southeastern Alaska; and since then, no other method has been used for that work.

The two instruments used are the camera and the transit. These instruments, in view of the fact that they are usually carried up steep mountain sides, and are often used under severe climatic conditions, in a very limited space of time, are necessarily of the simplest possible design. The standard Canadian camera, designed by Captain Deville, consists of an outer box made of mahogany inside of which is a second box, as shown in Fig. 1. The lens is attached to the inner box, which can be moved forward and backward by means of a milled screw projecting from the outer box, but which may be sprung in flush with the side when not

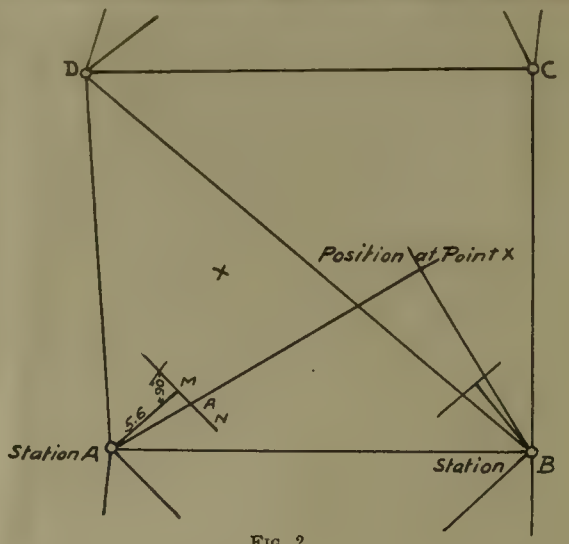

FIG. 2.

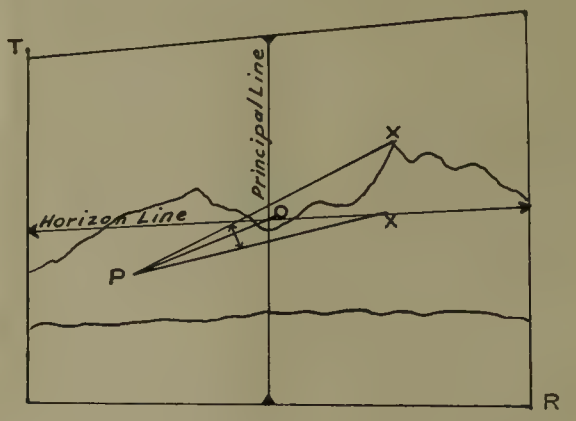

FIG. 3.

in use. The plate-holder fits into the larger box. When in use, the inner box is moved back so as to come in contact with the plate-holder (that end of the inner box, of course, being open), and the camera, having a constant focal length, is ready for exposure. The lens is a Zeiss Anastigmatic No. 3, of Series V, with a focal length of 141 mm. or about 5.5 inches.

An orange glass screen is placed behind the lens to fill the purpose of what in photography is termed a "ray filter."

A photographic survey is carried on, necessarily, in conjunction with a triangulation scheme, by means of which the positions of the camera stations are determined. The triangulation stations are so chosen that

they satisfactorily fill the function of such, and at the same time make good camera stations. The qualifications for this latter purpose are:

1. That they shall command a good view of the surrounding country, unobstructed by any close or higher peaks.

2. That photographs taken from these stations shall contain points seen from other stations.

3. That the angles of intersection at any points to be plotted from two camera stations shall not be too acute.

The judicious selection of stations requires a thorough understanding of the methods of plotting and also of the practical difficulties encountered in the field.

The signals used on the peaks for triangulation points are made of sheet iron, in 2-ft. lengths, fitting together like a stovepipe, and standing about 10 or 12 ft. high when complete.

Contour maps are made by showing 250-ft. contours. The number of points plotted to the square mile depends on the accuracy required, the topography of the space between the points being sketched in from the photographs.

Plotting Field Results

The method of plotting from the photographs is as simple as the field work. Fig. 2 indicates the principle of this method. The first operation in the office is to draw the horizon and principal lines on the prints. The horizon line is drawn so that all points having a greater elevation than the camera station will show above this line, while all points of equal or less elevation will show on or below it. The principal line is drawn vertically through points in the centre of the field of the camera. These lines are determined by joining the two sets of V-shaped projecting points which result from projecting teeth in the interior of the camera, near the plate, and carefully adjusted for that purpose.

After these lines have been drawn, the triangulation scheme is put on paper. In Fig. 2, assume that we wish to plot the topography between stations *A*, *B*, and *C*, which are three stations of the triangulation. Through *A* draw the line *AM* in the direction of that bearing, cutting off *AM* equal to 5.5 inches—the focal length of the camera—and at *M* draw *MN* at right angles to *AM*. Now, we wish to plot the position of point *X* indicated. Measure off, with dividers, the distance on the print of this point to the right of the principal line, and transfer it to *MN* such that *Ma* shall equal it. Through *Aa* draw a line and produce it. The position of the point *X* will lie along this line. Repeat the operation for the point from station *B*, and the intersection of the two lines so obtained will give the position of *X*. Similarly for all other points.

The elevations of the points are now required. In Fig. 3, where *TR* represents a photograph, and *OP* the focal length of the camera, it can be seen that the angle *XPX'* represents the angle of elevation of the point *X* from the camera. Now the horizontal distance of the point *X* may be scaled off from the plan. Knowing the angle of elevation, and the horizontal distance, it is a simple matter to calculate the elevation above or below the camera station, whose elevation is already known. This illustrates the principle of the method of determining elevations. In practice, however, a scale of heights is constructed on this principle, by means of which the elevations may be determined graphically in a much shorter time.

Sulphur Deposits of Southwestern Texas

By CLYDE M. BECKER

What is probably the greatest surface deposit of sulphur in the United States, lies in southwestern Texas, chiefly in Culberson and Reeves counties. The sulphur occurs in a disseminated condition in the heavy gypsum deposits of that region. The zone covers several hundred square miles.

The gypsum in the valley from Toyale north to the Delaware hills, a distance of perhaps 75 miles, contains sulphur, which apparently was taken into solution and not deposited until the sea went dry. But where the sulphur is in sufficient quantities for commercial consideration, it is found in a single stratum or deposit which has the appearance of having been thrown down immediately upon the injection of the sulphurous spring waters into the sea water already saturated with gypsum. The latter is intermingled with the sulphur in these deposits, the sulphur content ranging from 20 to 30 per cent.

During the past 15 years these deposits have attracted considerable attention, but no really serious effort has ever been made to put them upon a commercial basis. Some years ago, however, a company said to have been composed of Italians, attempted to refine sulphur at Maverick Springs and on the Cooksy ranch, at a point seven miles north of Rustler Springs. From appearances, operations ceased very suddenly. The retorts at Maverick Springs are still filled with a partly refined charge, and most of the equipment is still on the ground. From this abandoned plant, it is apparent that these embryonic developers had little conception of the work in hand. They attempted to refine sulphur in steel retorts in a country where there is no water fit for boiler use within a radius of 20 miles.

The question of tonnage does not enter into this proposition. The problem is to work a great number of deposits from 15 to 50 miles from railroad transportation in a desert land where no good water exists. While the fact has not been definitely proved, it is probable that there is no single deposit of sufficient tonnage to supply a large plant any great length of time. To be a success the deposits must be worked on the 'steam-shovel basis.' It will take a man of steam-shovel proportions to do the job.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Rand Banket

Reply by Mr. Horwood to Waldemar Lindgren's Discussion

I thank Mr. Lindgren for his kindly remarks and for his criticisms on my work.

I agree that detrital gold, and also traces of the platinum metals of detrital origin, would occur in these conglomerates. I stated in my paper[1] that there may be a small proportion of pyrite and gold of detrital origin in the banket, but that, in considering the genesis of the pyrite and gold, the amount was admittedly unimportant; and I said that the same remarks applied with regard to the metals of the platinum group.

With regard to his reference to waters charged with hydrogen sulphide, I would like to record that I have occasionally detected the smell of this gas in connection with water issuing under pressure from the West Reef dike in the lower levels of some of the Randfontein mines.

Mr. Lindgren points out that the whole series must have been so porous that hot magmatic waters would necessarily have permeated the whole. I particularly mentioned that traces of gold could be found throughout the series, but gave detailed reasons why the gold was mainly confined to the conglomerates, and laid stress on the importance of the retaining influence of the underlying shales. I showed that the bankets were more easily permeable than the quartzites and so formed the main channels of circulation for the mineralizers, and T. A. Rickard emphasized this same point in his discussion on my paper.

Mr. Lindgren is mistaken in thinking there is an absence of fissures: surely, the dikes have been injected into fissures, also the numerous fault planes mark lines of fissuring. The longitudinal dikes are usually accompanied by reversed faulting, the rule being that the banket is up-thrown on the side of the dike that is farther from the lode outcrop. Throughout the Rand there is abundant evidence of fracturing and fissuring.

Reply by Mr. Horwood to Kirby Thomas' Discussion and to H. Foster Bain's Discussion

I greatly appreciate Mr. Thomas' kindly remarks on my series of articles on the Rand banket.

I was much interested in the analogy which he draws between the Rand deposits and the silver veins of the Cobalt district of Ontario, the latter occurring mainly in a Huronion conglomerate and in the Keewatin metamorphic rocks, their origin having been attributed by the Canadian geologists to the direct influence of a diabase sill; also, in the further analogy with the gold-bearing veins, in the conglomerate of the Kirkland Lake district of Ontario, which are apparently related to neighboring dikes and masses of syenite. Mr. Thomas further points out that the copper in the conglomerate of the Calumet & Hecla mine in Michigan has its origin in the associated eruptive flows similar to allied deposits in the amygdaloidal flows of the same district.

With regard to his suggested theory of the genesis of the lead and zinc deposits of Missouri, northern Arkansas, and Wisconsin, this has been fully combated and discussed by Mr. Bain in the *Mining and Scientific Press* of February 14. I take this opportunity of tendering my thanks to Mr. Bain for his kind reference, in the final paragraph of his discussion, to my work on the Rand bankets.

Reply to F. H. Hatch's Discussion

I have read the two criticisms on my paper, dated London, November 21, 1913, and January 12, 1914, by Mr. Hatch.

In the first, with which I will now deal, he states that on main principles he agrees with me, but differs in some minor matters. He agrees with me that certain ellipsoidal pyrite pebbles, which are microcrystalline and entirely devoid of radiate structure, are pseudomorphs after quartz pebbles; and he admits that the pyrite which forms the pebbles that have radiate structure may be, in part, of metasomatic origin and have replaced a portion of the silica of the groundmass. He supposes that those showing radiate structure are ordinary concretions; and does not agree with me in regarding some of these as pseudomorphs after quartz pebbles. He says he does not understand my explanation of the radiate structure, which he contends is a property of the pyrite. However, no evidence is brought forward to substantiate any of his opinions. In my paper I showed that the metasomatic origin was indisputable, as the structure of the material replaced was frequently plainly discernible under the microscope; in many cases where quartz pebbles had been replaced, their original outlines and internal structure were readily revealed by the microscope. Moreover, Fig. 15, 16, and 17 showed pebbles actually in process of replacement by pyrite. My explanation of the radiate struc-

[1] In footnote 187.

ture was expressed as clearly and in as simple language as possible.

Mr. Hatch laboriously tries to show that the discovery of the metasomatic origin of the pyrite, and that it sometimes is pseudomorphous after quartz pebbles, is not entirely due to my researches; and concludes his remarks by referring to a short article written by himself in 1911 in which he tardily admitted that the pyrite of the banket is of metasomatic origin, and that both the pebbles and the cement of the banket are replaced by pyrite. Most people who read my paper will probably agree that I have tried to give full credit to others for the work done by them, as the very frequent references testify, and that I have in no way attempted to take credit to myself for work done by others.

In 1904, Mr. Hatch, conjointly with G. S. Corstorphine, wrote a short paper entitled 'The Petrography of the Witwatersrand Conglomerates, with Special Reference to the Origin of the Gold.' This was a very interesting little brochure in which the subsequent infiltration theory of the origin of the gold was upheld, but no attempt was made to explain how the process of subsequent mineralization had taken place. A few specimens and slides of banket had been examined, but beyond this there was no evidence of any research work; nor, as far as I am aware, has Mr. Hatch done any such work in relation to the ore deposits of the Rand.

He attempts to discount the fact that I was one of the first to call attention to the pseudomorphous origin of some of these pyrite pebbles by laying emphasis on the circumstance that I withdrew the paper in which I discussed this matter and which was read before the Geological Society of London on February 27, 1907. Unfortunately, I was in South Africa when this paper was read.[1] It dealt with an occurrence, at the Crown Reef mine, of pyrite pebbles that I had studied in great detail. In this paper I pointed out that, in July 1903, G. Denny called attention to the existence of calcite pebbles in the Main Reef conglomerate in the Meyer & Charlton mine; and that shortly after, in the same year, Julius Kuntz, in a brief article written for the Geological Society of South Africa, clearly showed that these pebbles were calcite pseudomorphs after what were originally quartz pebbles. Mr. Kuntz was careful to point out that they occurred near a break in the formation, which break was now partly filled with calcite, and from which a great amount of water was still flowing; also that these calcite pebbles diminished in number as distance from the break increased, and that as they gradually diminished in number and finally almost ceased to occur, pebbles could be found consisting of calcite and partly of quartz, the process of replacement becoming more and more incomplete the farther the distance from the break. I then described in detail a similar occurrence of pebbles of iron pyrite in close proximity to a diabase dike in the Crown Reef mine, and laid stress on the fact that they occurred immediately overlying an impervious band of shale, at the base of the Main Reef Leader conglomerate. The details of this occurrence as given by me in my treatise on the Rand banket[2] are from my paper that was read before the Geological Society of London in February 1907. Mr. Hatch criticized my paper adversely at the meeting when it was read; and as he was looked upon as an authority on Transvaal geology, he is doubtless aware of the reason why it was proposed that only an abstract should be published. Under the circumstances, I preferred to withdraw the paper entirely. I have in my possession the original typescript of that paper on which the date that it was received by the Society, namely, January 12, 1907, is marked, and each page bears the official stamp of the Geological Society of London.

In discussing the paper, Mr. Hatch stated that it did not contain any facts tending to show that any of the pyrite pebbles were pseudomorphs after quartz pebbles, nor was there any suggestion made as to how such a replacement might be supposed to have taken place; also, that the specimens exhibited contained examples of pyrite nodules with radiate structure which were evidently of concretionary origin. It may thus be as well to give the following verbatim quotation from the latter part of this paper:

"At the Crown Reef mine, pebbles of iron pyrites occur in close proximity to a dike, at the base of the Main Reef Leader conglomerate and immediately overlying a band of shale. The matrix of the Main Reef Leader is, here, very pyritic especially at its base. The dike is black in color, of a very basic character, is highly decomposed, and has developed (doubtless due to pressure) a shaly, fissile structure. The intrusion of the dike was accompanied by a normal faulting movement, which has thrown the reef up a distance of 76 ft. on the south side, so that the Main Reef series is, here, exactly opposite the South Reef series. At the bottom of the particular stope in which these pebbles occur, and at the contact of dike and reef, on the north side of the former, the dike is altered for a thickness of about three inches into a light bluish gray clay decomposition product. At, and for some twenty feet up from, the dike contact, the shale underlying the Main Reef Leader is changed into a yellow, brittle, flakey porcelainite; above this it gradually assumes its ordinary character.

"A few pebbles of pyrites occur at the immediate contact of dike and reef and for about ten feet up from the dike; above that they are then of frequent occurrence right up to the top of the stope.[3] This stope 4 B.W.E. (N.O.D.) is between the 600 and 700-ft. levels,

[1]I have a letter from L. L. Belinfante, the assistant secretary of the Geological Society, in which he informed me that the senior secretary read my paper practically *in extenso* at the meeting of the Society.

[2]Except those relating to the microscopic investigation, these having been worked out by me at a somewhat later date.

[3]They seem to be especially numerous about half way up the stope.

the latter being 630 ft. vertically below the surface. The length of the stope is about 130 ft., and it dips at an angle of about 38°. It is one of the richest portions of the mine. For the last nine months of 1905 it averaged 22.8 pennyweights over 21¼ inches of reef, or 12.4 pennyweights over a stoping width of 39 inches; and for the first six months of 1906 it averaged 20.0 pennyweights over 22.5 inches of reef, or 10.7 pennyweights over a stoping width of 42 inches. Almost the whole of the gold is contained in the narrow band of conglomerate in which the pyrite pebbles occur; for example, during the first six months of 1906 the Main Reef Leader averaged 41.6 pennyweights over 9.1 inches, while that portion of the Main Reef which was stoped only averaged 5.4 pennyweights over 13.4 inches, the two together thus averaging 20.0 pennyweights over 22.5 inches of reef. This band is known as the Main Reef Leader, and here averages between 9 and 10 inches in width. It is underlain by a thin but very persistent band of shale, which averages, in this stope, about 2.8 to 3.5 inches in thickness. Small stringers of quartz, running parallel to the bedding, occur here and there in this shale band, affording evidence of the action of mineralizing solutions. Immediately below this band is the bed of conglomerate known as the Main Reef which in this mine varies from about 10 to 15 ft. in thickness; except occasionally, in places, it contains only a little gold. In mining the overlying Main Reef Leader a portion of the Main Reef is also extracted, it being impossible to carry the stopes sufficiently narrow to deal only with the Main Reef Leader.

"Similar pyrite pebbles are also occasionally met with further away from the dike, on the western face of the stope, as also in the stope immediately below.

"The dike is here about 40 ft. wide, and passes through the lower end of the stope. It strikes approximately 16° north of east and south of west, is almost vertical, dipping about 88° north; can be traced throughout the mine, that is for a distance of about 3000 ft., and extends westward into the Langlaagte Estate mine. Its average width in the Crown Reef mine is about 35 feet.

"Today the quartzites and conglomerates of the Witwatersrand Beds form an almost impervious mass, owing to the action of dynamic metamorphism, and to the deposition of secondary silica, and to a less extent pyrite and other secondary products, in the interstices of the original sandstones and conglomerates. Pressure exerted in a north and south direction has bent and folded the beds into their present position. This was accompanied by considerable fracturing, and consequently dike intrusions; thus solutions, ascending through fractures and along lines of weakness produced by fracturing and the intrusion of these older dikes, would have encountered the beds in a sufficiently pervious condition to penetrate them. Presumably, in this particular case, the mineralizing solutions which deposited the iron disulphide, and probably some, if not all, of the gold, ascended along the line of fracture and weakness, produced by the intrusion of the dike and spread out laterally near the surface, choosing one or more of the conglomerates as offering the easiest channels. Combined with its lateral motion, it would also have had a downward component due to gravity. As previously mentioned, the Main Reef Leader here immediately overlies a band of shale. This is fine and close grained, and its lines of stratification are parallel to the dip of the conglomerates. It thus forms a layer which is almost impervious to solutions circulating above it. Thus it is an easy matter to conceive how such solutions would naturally have concentrated above this layer, and might have precipitated some of their contents along its junction with the overlying and more porous conglomerate, especially as here the rate of flow would be somewhat lessened owing to the fact that the downward component of motion would be checked. If this is actually what happened, one would expect to find the majority of the pyritic pebbles at the immediate contact of the conglomerate with the underlying shale, and if there were any above this, that they would be less in number; and, this is how they actually do occur, and, I have not found any pyrite pebbles below this shale band.

"The pebbles vary in size up to about one inch in length, they are mostly circular, but some are oval, and they are all well rounded.

"In cases where pebbles have been fractured, they sometimes show an internally radial fibrous structure, which of itself is sufficient evidence that they have been formed *in situ*.[4] Further, the fact that in some, the quartz of the original pebbles has not been entirely replaced,[5] and in others the pyrite may be seen entirely surrounding the quartz, and, so to speak, eating into it, so that if the pyrite were removed what were undoubtedly originally smooth water-worn pebbles would present irregular fretted and corroded surfaces, is convincing evidence that they are pseudomorphs by replacement of the quartz of which the majority of the pebbles of the conglomerates are composed."[6]

London, June 1. C. B. Horwood.

(To be Continued)

German Southwest Africa exported material worth $17,575,500 in 1913, against $9,758,750 in 1912. The value in 1913 was made up as follows: diamonds, $14,727,400; copper ore, $1,432,170; tin ore, $157,840; and marble, $7240.

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[4]They do not all exhibit this radial structure, and those which do may be concretions, or it is quite possible that they are pseudomorphs and this structure has been developed later, owing to a gradual molecular rearrangement.

[5]In the specimens marked A, B, C, and D (these were exhibited at the meeting) there are pebbles consisting chiefly of pyrites but also partially of quartz and in which the outline of the original quartz pebbles are distinctly visible.

[6]They have, in fact, been produced by a process similar to that by which the original material of many ammonites and other fossils found in the chalk of the Cretaceous system in England has been gradually replaced by marcasite.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

ALL UNDERGROUND AIR MAINS in the Mt. Morgan mine, Queensland, may be supplied with water under high pressure for fire-fighting purposes. The scheme is quite satisfactory.

COAL 'shot off the solid,' that is, blasted by powder without being previously undercut or sheared, in Pennsylvania in 1913, was less than 3% of the total output of 265,306,139 tons.

BOILERS using waste heat from furnaces of any kind should be arranged for the gases to pass through in a straight line, and with plenty of passage area, in order not to affect the draft.

TO REMOVE 35,000,000 cu. yd. of sand in the harbor of Toronto, Ontario, the dredge *Cyclone* has been constructed to handle 15,000 cu. yd. per day. The boat is 170 ft. long and 42 ft. wide, and the pump is driven by a 1750-hp. engine.

THE WOODEN STAY between the orebin and king-post of a battery is generally held in position with long bolts. In some instances these are being replaced with angle plates at each end of the timber. A firmer joint is insured and less attention is needed.

DESERT SAND makes it almost impossible in some places to haul ore or supplies in mining districts. To overcome this a mining company in Riverside county, California, has laid two miles of 3 by 12-in. Oregon pine planks for truck or wagon wheels, the space between being left bare.

DIPPER-DREDGES *Chagres, Mindi,* and *Cardenas* at Panama during the first five months of 1914, working 8-hour shifts, moved 290,996, 247,502, and 273,826 cu. yd. of material respectively, being increases of 61.5, 106.3, and 9.2% on the average of the past three years. These boats cost about $100,000 each.

AMALGAMATION of silver ores is less successful than with gold ores. The reason for this is in part that the specific gravity of silver is only about half that of gold. Gold occurs almost entirely in the native state, whereas silver is generally found in combination, argentite, a sulphide, being the principal ore.

CLASSES OF ORES suited for zinc-retort smelting are straight zinc ores, products from the concentration and separation of zinc-lead ores, and products from the concentration and separation of mixed and complex ores containing gold, silver, lead, copper, and zinc. At the present time the lower limit of zinc in ores or mill products suited to this purpose is about 25 per cent.

A NEW METHOD for the determination of hydrocyanic acid and the alkali cyanide is described by G. E. F. Lundell and J. A. Bridgman in *The Journal of Industrial and Engineering Chemistry*. They summarize the process as follows: The new method consists in making the cyanide solution ammoniacal, then adding a small amount of methyl glyoxime solution and finally titrating this prepared solution with a standard nickel ammonium sulphate solution until a permanent red precipitate is produced. Results show that the new method is accurate, free from ordinary interferences, usable in cloudy solutions, rapid, cheap, and of value in titrations of double cyanides.

LOW-GRADE SILICIOUS FLUE-DUST is a nuisance to smelt in reverberatory furnaces, forming a blanket on the charge. At the Steptoe plant, Nevada, certain dust in the flue contained 3% copper, 23.41% silica, 4.08% iron, 2.72% lime and magnesium oxide, 6.07% aluminum oxide, 19.94% free sulphuric acid, 25.10% sulphur trioxide combined as sulphate, and 10.67% water with the sulphates. By adding water to this, enough acid was obtained to leach the silicious flue-dust. As it is drawn from the dust chambers it is sluiced to vats or dams and settled. The clear solution flows to a 10 by 40-ft. wooden tank which is filled to 7 ft. with carbonate ore capping from the mine. This is leached over night. The copper-bearing solution is then precipitated by scrap iron. The cost of the complete process is about 8c. per pound.

FABER DU FAUR TILTING FURNACES are largely used for the retorting of zinc 'crusts,' a process which leaves a silver-lead alloy for pouring. The operation of retorting is a lengthy one, and condensation of the zinc commences at a comparatively low temperature. This allows ample time for the furnace to attain full heat, so that the whole of the zinc is expelled. The furnace has been largely adopted in Western Australia for the melting of gold precipitate in cyanide plants, with very satisfactory results. Elsewhere a neglect of important considerations has invariably led to a condemnation of the furnace for this work. It is imperative that the design of the firebox should be so modified that sufficient heat is obtainable from the commencement. For this reason ample fuel space should be arranged, and the thickness of graphite at the bottom of the crucible should not be so excessive as it often is, when the apparatus is used for retorting zinc crusts.

Salt Lake Meeting of the Institute

STAFF REPORT

Despite wars and rumors of war, though there was temporarily no market for copper, and an uncertain one only for most other metals, the meeting of the American Institute of Mining Engineers at Salt Lake City last week was the most largely attended and in many particulars the equal, if not the superior in interest, of any other in the history of the Institute. The differences of opinion as to the conduct of the Institute which developed in 1911 have had the effect of stimulating interest in it to a degree that is ample compensation for the friction then generated. There are strong disagreements now as to what should be the policy of the Institute in many particulars, such for example as to participation as a body in efforts to secure revision of the mining law, but there is no disagreement as to the value and importance of the technical sessions. The Institute members are coming to take a keen interest in its affairs and to recognize that its value to them lies as much in the opportunity to meet the leaders and the coming leaders of the profession face to face, as in the receipt of printed papers. No one is able to become very enthusiastic over being one of several thousand patrons of a publishing house, but when you have dined with a man there is a new bond, and when in addition you have spent several days with him visiting mines and smelters and discussing technical problems, he has become more to you than a mere name. It is this purpose that the Institute is coming to serve in a greater and greater degree. One of the most pleasant features of the meeting was the large number of private dinners and luncheons given every day to small circles of friends renewing acquaintance. Alumni of the Massachusetts Institute of Mining Engineers entertained R. H. Richards on the roof garden at the University Club, Wednesday evening, while at the same time members of the Sigma Chi retold college tales at a table on the beautiful roof garden at Hotel Utah, the official headquarters. The dinner was attended by C. L. Berrian, W. W. Case, Jr., L. C. Lennox, W. E. Greenough, Raymond Guyer, E. Pembroke, James D. Mooney, Fred Scibird, F. Faulkner, and G. T. Hansen. At a neighboring table, while the sun set beyond the Great Salt Lake, W. L. Saunders, D. W. Brunton, W. L. Clark, C. W. Goodale, and H. Foster Bain recalled pleasant days in Japan with Jintaro Kojima of the Furukawa Copper Company. Mr. Kojima is mining engineer at the Ashio, the largest copper mine in Japan, and though a member of the Institute since 1906, this was his first opportunity to attend a meeting in the United States. Excepting Willard S. Morse and Seeley W. Mudd, the Americans present included the whole of the little party which was so lavishly and pleasantly entertained at Ashio in 1911. There were many other reunions and these are but examples.

There have always been those who appreciated the value of the organization as a means of extending acquaintance, but the possibilities in this direction are apparently just beginning to dawn on the membership at large. Some came in private cars, some in Pullmans, and others mayhap in the day coach, but all felt that it was an opportunity not to be missed, one worth some sacrifice, and that is what made the meeting a success—that and the hard intelligent work of the local committee, the directors, and the regular officers of the Institute.

The general program of the meeting and the list of papers presented has already been published and will not be repeated. Technical sessions were held Monday, Tuesday, and Wednesday evenings and Thursday morning. Excursions were arranged to Bingham and Garfield Tuesday; to Murray, Midvale, and Tooele Wednesday; and to Park City Thursday. The trip to Tintic, planned for Friday, was given up, though the picnic in Provo cañon was carried through as planned. Monday afternoon the organ recital at the Mormon Tabernacle was followed by an auto ride around the city; Thursday noon the gentlemen were entertained at lunch at the Ata Club; the evening of the same day the whole party enjoyed a swim in Salt Lake, followed by dinner and dancing at Salt Air; and Friday night there was a hilarious banquet to 350 members and guests at Hotel Utah. Everything possible to ensure the success of the meeting and to add to the pleasure of the visitors was done by the local committees, constituted as below:

General—R. C. Gemmell, chairman; D. C. Jackling, C. W. Whitley, C. E. Allen, Fred Cowans, Wm. Wraith, Walter Fitch.

Transportation and Accommodation—Duncan MacVichie, chairman; L. Hanchett, C. F. Moore, Frank Anderson, Robert S. Lewis.

Program—Alfred Frank, chairman; L. S. Austin, R. H. Bradford, W. A. Wilson, Edward Zalinski.

Entertainment—C. W. Whitley, chairman; Henry Krumb, A. K. Tiernan, C. H. Doolittle, J. A. McCaskell.

Press—Ernest Gayford, chairman; G. W. Riter, G. T. Hansen.

Ladies' Entertainment—G. B. Wilson, chairman; J. C. Dick, J. C. McChrystal, Stanley C. Sears, Mrs. Edwin F. Holmes, Mrs. C. W. Whitley, Mrs. Stanley C. Sears, Mrs. J. C. McChrystal, Mrs. Herman A. Prosser, Mrs. R. C. Gemmell, Mrs. G. B. Wilson, Mrs. J. C. Dick.

The Welcome on Monday

The first technical session was held Monday evening at Hotel Utah, R. C. Gemmell presiding. D. C. Jackling gave the principal address of welcome, closing with a brief résumé of the history of mining in Utah, abstracted below:

Mining in Utah, by D. C. Jackling

The first mine was discovered in Beaver county in 1860, and was called the Lincoln. The first recorded location was that of the Jordan mine, on September 17, 1863, in what is now known as the West Mountain mining district, Bingham Canyon.

No active interest in mining was shown until after the arrival in Salt Lake in October, 1862, of General (then Colonel) Patrick E. Connor, in command of the California Volunteers. He was eager to promote the mining industry. In December, 1863, he drew up a set of mining laws, and called a meeting of miners at Gardner's mill, on the Jordan river. At this meeting these laws were adopted, and Bishop Gardner was elected recorder of the first mining district of Utah, called West Mountain, in which the town of Bingham is now situated. In the summer of 1864 the first company, called the Jordan Mining Co., was incorporated under the laws of California, and an adit was driven into the property at a cost of $60 per foot. At this time blasting powder cost $25 per keg, and there were instances of it having brought as high as $100 per keg.

Silver-bearing lead ore was discovered by the prospectors of General Connor's expedition at Wasatch, Little Cottonwood, and at Mountain lake, in the year 1864. Owing to the completion of the Union Pacific railroad in 1869, and the excitement attendant upon the successful, but in some respects unfortunate, exploitation of the Emma mine, which was sold to an English company for a large sum, there was a great revival of mining activity in Utah, and by the close

of the year 1870 the organization of mining districts had been extended well over the state. In 1870 and 1871 a number of small smelters were built, and by the end of the latter year the total capacity of all such plants in the territory was 666 tons daily.

It so happened that the West Mountain district, the first one organized, was destined to become the greatest metal producer of any district in the state of Utah. The Utah Copper Co. was organized in 1903, and in the early part of the year 1910 it acquired the properties of the Boston Consolidated Mining Co. The Ohio Copper Co. was organized in 1903 to take over the Columbia mine and some adjacent claims.

The total value of the metal production of the West Mountain mining district to the close of the year 1913 is estimated at about $215,000,000.

Park City is in what was formerly known as Parley's park, and the Parley's Park district was organized in July, 1868. The first location was made on December 23, 1868, and the first shipment of ore was made in July, 1870. The first important producer, the Ontario mine, was discovered and located on June 15, 1872. This mine immediately became famous for its high-grade silver ore. During its more active life its output of silver totaled over $34,000,000, and it paid dividends amounting to nearly $14,000,000. In general, the ores in Park City are lead ores, carrying some zinc and relatively high values in gold and silver. It is estimated that the total value of the metal production of this camp at the end of the year 1913 is about $150,000,000. The mines have paid in dividends something over $40,000,000.

The Tintic district was organized December 13, 1869. Two of the largest mines, the Mammoth and the Eureka Hill, were located in the year 1870. The value of its total metal production up to the end of the year 1913, according to data procurable, was about $150,000,000, and the total of dividends paid up to that time was about $30,000,000.

The Alta district was productive of a considerable tonnage of high-grade silver ore.

According to the reports of the United States Geological Survey, the production of copper in Utah has increased from 100,000 lb. in 1870 to 161,445,962 lb. in 1913, and the total production for the 44 years is 1,135,498,000 lb., valued at $167,168,711. Of the 161,000,000 lb. produced in the state during 1913, about 144,920,000 lb. may be credited to the Bingham district, and about 120,000,000 lb. to the single largest company operating there. It is safe to say that the total value of the metals that have been yielded by the mountains of Utah and added as new and permanent wealth of the country is more than $635,000,000.

The technical men, many of them members of this Institute, who have been associated in Utah with this industry and its development, have done much in the way of contribution to general knowledge in scientific mining and metallurgy, as well as in the application of advanced methods to operating practice. These men should share distinction with those of practical training and skill in mechanical and other lines, who have learned their lessons in the application of natural laws at the exacting but thorough school of experience. Among both classes are the honored names of many who have deserved and won distinction in their several lines of effort.

Utah engineers and industries have done much toward the development of concentration appliances and methods as they are now used in the concentration of the low-grade so-called porphyry copper ores here and elsewhere in the West, and in Utah there are by far the largest concentrating mills on earth. The engineers of Utah have developed and put into general use many appliances and methods which have become almost universal necessities in the commercial application of mining and metallurgical engineering. Altogether, Utah is proud of her mineral resources and history.

This address was followed by a number of papers dealing with leaching of copper ores, including particularly a series presented by Frederick Laist, 'Experimental Leaching at Anaconda' (Laist and Aldrich), 'Precipitation of Copper from Solutions at Anaconda' (Laist and Frick), and 'The Slime Concentrating Plant at Anaconda' (Laist and Wiggin). These papers provoked a brief discussion followed by an elaborate series of lantern pictures of sections of Butte ores, given by J. C. Ray of Stanford University. These views emphasized the large part in the study of ore deposits now played by polished sections and the progress made since William Campbell undertook to use the methods of metallography to solve problems in geology.

Smelting Problems on Tuesday

Tuesday evening the interest again centred on smelting problems. The session was presided over by William Wraith. The following papers were presented:

'Electrical Fume Precipitation at Garfield,' W. H. Howard; discussed by F. G. Cottrell, E. M. Dunn, and Lyman Bradley.

'Effects of the Bag House on the Metallurgy of Lead,' L. D. Anderson, with discussions by the author.

'Nodulizing Blast-Furnace Flue Dust,' Lawrence Addick; discussions by R. M. Draper and James H. Payne.

'Lead Smelting at East Helena,' E. L. Newhouse, with discussion by the author and G. C. Riddell.

'A Comparison of the Huntington-Heberlein and Dwight-Lloyd Process,' W. W. Norton; discussed by A. S. Dwight and G. C. Riddell.

'The International Lead Refining Plant,' G. P. Hulst, with discussion by the author.

'Smelting Lead Ores in the Blast-Furnace,' Irving A. Palmer, and 'The Bag House in Lead Smelting,' H. H. Alexander, were read by title.

'Chloridizing Leaching at Park City,' T. P. Holt, with discussion by F. S. Schmidt.

The use of sintering machines provoked considerable discussion. At the East Helena plant, according to Edgar L. Newhouse, 6500 tons of lead per month is made, and this is probably more lead than the output of any other lead smelter. Dwight-Lloyd sintering machines have been used since 1907. Gases from both sintering and blast-furnace departments are trapped in a bag house, being neutralized by use of zinc oxide. Blast-furnace matte is pre-roasted in Godfrey furnaces, mixed with the direct converting mixture, and blown in Huntington-Heberlein pots. On the whole, the Dwight-Lloyd machines are preferred. At the Murray plant both are used side by side, and were studied with much interest by the visitors the next day. An interesting comparison of the work of the two was made by W. W. Norton.

The chloridizing leaching process used by the Mines Operating Co. at Park City, and described by Mr. Holt, created much interest both at this session and on the occasion of the visit of the party to Park City on Friday. A full account will be printed later.

Zinc Losses and Treatment on Wednesday

Wednesday evening, C. W. Whitley presided. Before taking up the regular program, W. L. Saunders announced the plans of the entertainment committee that has been formed by cooperation of the five national engineering societies, to care for foreign visitors in 1915, and bespoke the active cooperation of all members of the Institute. It is planned to afford the visitors every opportunity to visit American mines and works while they are on their way to and from the Panama-Pacific Exposition at San Francisco. He was followed by H. Foster Bain, who told briefly of the progress of the Exposition and the International Engineering Congress, of which the Institute is one of the guarantors. The regular program centred on the problems of zinc mining and treatment, and the session was notable for the amount and variety

of the discussion invoked. The especial papers read were:

'Losses of Zinc in Mining, Milling and Smelting,' by Dorsey A. Lyon and Samuel S. Arentz.

'Separation of Lead, Zinc, and Antimony Oxides,' by R. D. Divine.

'Electrostatic Separation at Midvale,' by H. A. Wentworth.

'Treatment of Complex Ores,' by S. E. Bretherton.

Technology and Excursions on Thursday

Thursday morning, about 40 of the local members of the Institute met and formed a Salt Lake section, which promises to become one of the most active in the Institute. At the technical session following, the papers read dealt with a large range of mining and metallurgical problems. The list included the following, a part being presented by title:

'The Ajo Copper Mining District,' by I. B. Joralemon.

'The Occurrence of Bournonite, Jamesonite, and Calamine at Park City,' by Frank R. Van Horn.

'Descriptive Technology of Gold and Silver Metallurgy,' by A. W. Allen.

'Playa Panning on the Cauca River,' by W. F. Ward.

'The Dorr Hydrometallurgical Apparatus,' by J. V. N. Dorr.

'Discussion of James Johnston's Paper on the Mill and Metallurgical Practice of the Nipissing Mining Company, Ltd., Cobalt, Ontario, Canada,' by G. H. Clevenger.

'Tests of Rock Drills at North Star Mine,' by R. H. Bedford and William Hague.

'Draining Kerr Lake,' by Robert Livermore.

'The Design, Construction, and Cost of Two Mine Bulkheads,' by Sidney L. Wise and Walter Strache.

'Methods and Economics in Mining,' by Carl L. Allen.

'The Appraisal of Coal Land for Taxation,' by H. M. Chance.

'Mining Claims Within the National Forests,' by E. D. Gardner.

'Biographical Notice of Louis Janin,' by R. W. Raymond.

'Development of the Round Table at Great Falls,' by Arthur Crowfoot.

Mr. Clevenger gave a very interesting account of later developments in metallurgical practice at Cobalt and of the reasons back of each step. Messrs. Bedford and Hague showed how the Paynter rock-drill testing machine (described in the *Mining and Scientific Press*, August 2, 1913) enables an operator to weed out poor drills and to determine the conditions of maximum efficiency for those retained in service. In discussion, W. L. Saunders pointed out that the particular tests presented could hardly be regarded as fairly representing the drills under competitive conditions, since the drills were not all of modern type and the service required in a heading differs so greatly from that in a stope. He, however, commended the use of the machine and all other devices that lead to more intelligent use of drills.

A large party from the Institute spent the day at Park City, where the visitors were first taken to the Silver King to see both the mill and mine. Lunch was served in the new and really beautiful underground hoisting chamber in the Alliance tunnel. The Wellman-Seaver-Morgan hoist which here serves the lower levels, came in for close examination and will be later described. The underground chamber is remarkable for its size and the attention to detail shown in its construction and finish. Even the lighting is by the modern indirect system. From the Silver King a number of the visitors went to other properties, especially to the Ontario, where the Mines Operating Co., under management of George Dern and technical direction of T. P. Holt, is working the old stope fillings by an ingenious improvement upon old methods.

Friday and the Banquet

Friday there were no technical sessions, though there were numerous conferences and a picnic, as already noted, in Provo cañon. In the evening, the meeting closed with a complimentary banquet served to 350 people in the large grill room of Hotel Utah. The committee seated people as far as possible by colleges, so that between eating, drinking, and dancing college yells and college songs were frequent. W. L. Saunders, as toastmaster, was delightful after Messrs. Gemmell and Matthewson had argued him out of reading the whole of a 936-page speech he professed to have prepared for the occasion. Mr. Thayer as president responded to the toast to the Institute. Mr. Stoughton discussed 'Institute Ideals,' and the Governor of Utah, William Spry, spoke of the glories of his state. Colonel E. M. Allison spoke entertainingly of 'The General State of Affairs,' and the session closed with dancing while everyone hummed the catchy refrain of the song of the Utah University boys:

"They say that them Mormon boys ain't got no style,
But they've style all the while, style all the while."

The members registered were as follows:

J. O. Ambler, L. Addicks, L. S. Austin, J. B. Ambler, D. S. Arentz, C. W. Adams, Jr., C. E. Allen, L. D. Anderson, W. W. Atwood, Frank Anderson.

Linn Bradley, H. L. Brown, F. H. Bostwick, T. B. Burbridge, G. S. Brooks, P. F. Barnwell, J. J. Burt, F. B. Bodfish, D. C. Bard, C. H. Bowman, J. K. Bryan, R. H. Bradford, C. L. Berrian, L. E. Brown, Alex Bowie, Wallace D. Bowie, A. C. Boyle, Jr., C. M. Bell, E. S. Bordwell, F. C. Blickensderfer, J. L. Bordman, H. F. Bain, George D. Blood, Robert H. Bedford, R. N. Bell, W. A. Barnes, R. G. Bowman, J. J. Beeson, S. E. Bretherton, D. W. Brunton, O. E. Bradley, W. J. Bowdwin, T. P. Billings.

W. W. Case, Jr., R. C. Canby, W. E. Corne, G. H. Clevenger, W. J. Cox, W. R. Cody, W. L. Creden, T. B. Crane, G. W. Crane, H. H. Clark, David Cole, Will L. Clark, L. M. Cargo, J. H. Cooke, A. E. Carleton, William Coumerilh, E. W. Clark, Fred Cowans, H. E. Crawford, H. H. Chisholm, Joseph A. Carson, F. G. Cottrell, J. M. Callow, W. B. Cole.

L. A. Dunham, E. W. Durfee, C. H. Doolittle, J. C. Dick, R. C. Doggett, C. S. Drew, E. M. Dunn, B. H. Dunshee, J. V. N. Dorr, William Dempster, George H. Dern, P. J. Donohue, A. M. Day.

H. R. Ellis, F. B. Ely, R. Emanuel, E. C. Engelhart, R. J. Evans, C. W. Earl.

B. J. French, M. Fulnerty, Walter Fitch, Walter Fitch, Jr., Cecil Fitch, Howard Fitch, W. B. Fisher, F. R. Field, Alfred Frank, W. C. Ferguson, E. P. Fleming, C. R. Forbes, Allan J. Fairbairn.

A. O. Gates, R. J. Glendinning, E. Gayford, N. B. Gatch, Walter Gaby, W. E. Greenough, F. T. Greene, C. W. Goodale, H. C. Goodrect, L. D. Goodshall, C. H. Gibbs, Edw. Greenleaf, R. J. Goodwin, R. C. Gemmell, H. A. Guess, A. E. Gartside, R. Guyer, William W. Graves.

W. L. Henderrech, J. M. Hyde, J. B. Herreshoff, G. P. Hutsch, A. B. M. Hodges, V. C. Heikes, W. H. Hendrickson, J. B. Hastings, F. B. Hill, L. O. Howard, E. C. Hickman, W. H. Horton, H. J. Herman, G. T. Hansen, D. G. Hansen, J. S. Hauerman, William Hague, J. T. Hodson, Stuart Hazlewood, R. W. Hyde, V. A. Hart, R. H. Hawley, Barry Hogarty, L. Hanchett, H. W. Hardinge, Harloye Hardinge.

S. A. Ionides.

E. P. Jennings, C. W. Jewett, F. H. Jenks, M. M. Johnson, E. R. Jones, J. F. Johnson, Sidney Jennings, J. C. Jones, D. C. Jackling, Thomas A. Janney, Arthur W. Jenks.

G. R. Kittle, B. N. Kilbourne, E. W. Keith, J. Kojima, Henry Krumb, John McG. King, H. S. Knight, S. J. Kidder, M. P. Kirk, O. M. Kuchs.

F. G. Lazier, W. Lindgren, L. C. Lennox, D. A. Lyons, David Lemmon, F. A. Linforth, E. R. Lidvall, G. Lavagnino, Fred Laist, Alex Leggatt, G. W. Lambourne, C. B. Lakenan, C. L. Larson.

J. T. Milliken, J. D. Mooney, J. A. Mullin, M. Merriman, T. P. Maynard, K. E. Mason, Robert Miller, Jr., Dr. H. W. Morse, C. W. Murvill, A. J. Miller, H. J. Morgan, C. F. Moore, B. A. Mitchell, C. W. Miller, E. P. Mathewson, J. H. McClave, J. A. McIlwee, J. W. McKim, J. A. McCaskell, J. C. McCrystal, E. McCarrick, George T. McGee, Duncan MacVichie, L. B. McCornick, Bernard McDonald, Gordon McMillan, J. B. McIntosh, J. H. McCrystal.

Ralph Nichols, A. C. Nebecker, E. M. Norris, W. G. Nebeker, A. W. Newberry, R. C. Nowland, E. L. Newhouse.

H. C. Parmalee, E. R. Pembroke, H. M. Parks, Curtis Piggott, J. H. Portugal, C. Q. Payne, O. H. Pierce, E. H. Perry, C. Y. Pfoutz.

James C. Roy, J. C. Roberts, R. H. Richards, E. D. Richards, M. Roesher, G. C. Riddell, W. L. Reid, G. W. Riter, G. B. Rosenblatt, H. W. Reed, B. N. Richard, R. S. Rowe, J. A. Rule.

W. G. Swart, A. M. Swartley, R. D. Seymour, Jesse M. Smith, W. L. Saunders, G. E. Scarfa, G. Sessingham, C. G. Schirmer, Lyon Smith, O. J. Salisbury, S. C. Sears, C. E. Smith, George R. Sheldon, H. M. Spicer, C. H. Schmalz, Theo. Simons, Bradley Stoughton, Charles W. Stimpson, Arthur Smith, Leslie L. Savage, E. O. Sauerwine, Murray Schick, H. J. Stiebel, L. T. Sieka.

A. K. Tiernan, J. B. Tyrrell, B. B. Thayer, B. F. Tibby, W. E. Tracy, W. N. Tanner, C. J. Trauerman, S. W. Traylor, W. S. Thomas, Kirby Thomas, O. R. Turner.

C. S. Vadner, Charles E. Van Barneveld.

Thomas Weir, F. W. Whiteside, De B. Whitaker, Thomas R. Wilkinson, H. V. Winchell, R. P. Windsor, C. W. Whitley, G. B. Wilson, F. T. Williams, W. M. K. Woodward, Leonard Wilson, Edmund Wendell, V. A. Walcott, R. E. Wells, Jr., William Wraith, J. H. Winwood, E. H. Wilson, William A. Wilson, A. C. Watts, E. H. Walker, G. H. Williams, F. V. Westcott, Col. E. G. Wall, W. G. Wolf, George F. Waddell, E. M. West, Robert Wallace, H. D. Woolfenden.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

LONDON

PRODUCTION OF ZINC IN ENGLAND. WORKS OPERATED AND RESULTS OF AUSTRALIAN COMPANIES.—PRESTEA BLOCK A MINE OF WEST AFRICA. POOR RESULTS.

For some years the extraction of zinc from ore has been a decaying industry in England. The domestic supply of material has gradually diminished. Vivian's, of Swansea, continue to keep their works going at Morriston on imported ore; Williams, Foster & Co. have a modern plant near by, but the Company is owned by the Metallurgische Gesellschaft of Frankfort; and another neighbor is the English Crown Spelter Co., which smelts ores mined in the north of Italy. The only recent new venture has been the Central Zinc Co., which was formed eight years ago to establish smelting works in England for the purpose of treating zinc concentrate produced at the Central mine belonging to the Sulphide Corporation at Broken Hill. The idea was to avoid selling to German and Belgian buyers. The only other company at Broken Hill that treats its own product is the Proprietary. Whereas the policy of the latter was to make zinc on the spot, the Sulphide Corporation decided to smelt in England, where labor conditions were more favorable, supplies cheaper, and the market for the metal nearer at hand. Unfortunately, both enterprises have been comparative failures. The Proprietary produces 90,000 tons of zinc concentrate per year averaging 46% zinc, and treats about 12,000 tons locally. The number of furnaces in use depends on the labor supply. Anyone connected with zinc operations knows that they are not fool-proof, and that they require much closer watching and regular attention than most metallurgical processes. The Sulphide Corporation has been even more unfortunate than the Proprietary. The capital of the Central Zinc Co., £150,000, was subscribed in cash by shareholders in the Sulphide Corporation, and the whole of the money was used in building the works. A contract to last for ten years was made whereby the Sulphide Corporation would supply 50,000 tons of zinc concentrate per year, and would guarantee a dividend of 5% in consideration of receiving one-third of the profits. When the plant was first designed it was intended to have a capacity of 40,000 tons per year. These estimates have been hopelessly at fault, as the yield of metallic zinc, starting at 1118 tons in 1909, has increased only slowly upward until it arrived at 3486 tons, extracted from 9870 tons, during 1913. The local conditions during the last year have been all against the Company, as the cost of freight from Australia has increased, as also has the price of coal, while the price of zinc has fallen. One trouble all these years has been the scarcity of labor suitable for the work. As regards the shareholders in the Central Zinc Co., they have received the 5% as guaranteed, and the Sulphide Corporation has seen little for its third share in the profits; but as the shareholders in the two companies are largely the same, the relative position matters little. The point is that not a quarter of the expected amount has been smelted, and that no profit has been made on the smelting.

In the London letter of last week I referred to a large low-grade proposition in Rhodesia, the Shamva, that is providing food for critics. This week we have the Prestea Block A, one of the important mines in West Africa, that has absorbed immense amounts of capital and never paid a dividend. The Company was formed by Edmund Davis, one of our champion promoters, in 1903. Milling commenced in 1906, but was suspended from 1909 to May 1911, pending additional development. In 1909, Wernher, Beit & Co. subscribed for 200,000 new £1 shares at 24s., and later took 50,000 at 27s.6d. Subsequently 70,000 shares were taken by shareholders at 27s.6d. each, and 30,000 shares at 32s.6d. each. Part of these funds was devoted to the building of a new mill. In January 1911 the property of the Prestea company was absorbed in exchange for 199,876 shares. As still further capital was required, £150,000 was advanced on loan by the Central Mining & Investment Corporation and the Fanti Consolidated. Hugh F. Marriott is consulting engineer, acting for the Central Mining, and William Crosley is manager. During 1913, 229,990 tons of ore was raised and treated, an increase of 57,000 tons as compared with 1912. An average of 80 out of 110 stamps were at work. The yield by amalgamation was 64,593 oz., 4408 tons of concentrate was roasted and cyanided, yielding 19,324 oz., and 171,461 tons of sand was cyanided for 7122 oz., making a total of 91,039 oz., worth £386,918, or $8.06 per ton. The average assay of the ore treated was $9.96, so that the recovery was 81%. The gold left in the sand was $1.62, and in the concentrate residue $5.54. The slime, amounting to 54,121 tons, averaging $2.54 per ton was not treated, but is being accumulated for future consideration. The metallurgical difficulty at this mine is the presence of graphitic shale in the country rock. Experiments are being continued with a view to improving the extraction, and the advice of W. R. Feldtmann, who has had a similar problem at the Ashanti Goldfields Corporation, has been sought. During the year, the main shaft has been sunk to 938 ft., and the north shaft to 1024 ft. Development totaled 5560 ft., and 81,623 tons of ore averaging $7.32 was disclosed. Ore reserves on December 31 were estimated at 691,670 tons averaging $9.92, compared with 835,014 tons averaging $10.66 the year before. The cost during the year, including interest on loan and depreciation of plant, was £348,593, or $7.28 per ton. The balance of profit was £38,340, which was carried to the balance sheet. During the year, the loan was reduced by £25,000, and now stands at £125,000, which is to be liquidated as to £50,000 on or before December 31, 1915, and afterward, as to the remainder, in monthly installments of £2500. The issued share capital is £1,049,876. The lending companies have options on an additional 100,000 shares at par. The present state of this company gives much cause for anxiety, as may be judged by the fact that the shares of £1 nominal value, but subscribed many of them at 30s., stand at only 10 shillings.

JOPLIN, MISSOURI

PRODUCERS EXPECT BETTER ZINC ORE PRICES AS RESULT OF EUROPEAN WAR.—STRIP-PIT MINING ACTIVITIES—BELMILLE-KLONDIKE DISTRICT.—TECUMSEH MINE.—GRANBY COMPANY.—WEST MIAMI DISTRICT.

Zinc ore prices throughout the Missouri-Kansas-Oklahoma district are at low ebb, $38 to $40 being the basis price of blende carrying 60% metallic zinc, compared with $44 to $47.50 in the corresponding week of 1913. Producers, however, anticipate better offerings as a result of the European war. Its effect on the zinc industry, it is thought, cannot be deleterious. Reasons for this belief are that Europe produces approximately

66% of the world's spelter, the United States producing the remainder with the exception of insignificant tonnages from other countries. The annual production of spelter is close to 1,000,000 tons and while the production in European countries, especially Germany, will probably be decreased because of the war, the demand for spelter in the countries of Asia and Australia will doubtless continue, and the supply that has been furnished by Europe in the past cannot be expected to meet the requirements in the future. The United States produces barely enough spelter to meet its own requirements, but a greater production could be recorded if prices were high enough to enable the smelters to pay a higher price for zinc ore. This, in turn, would result in the opening of many mines in this district, which would produce a large tonnage at a profit, but which cannot be operated at present prices without a loss.

The first 'strip-pit' zinc mining operations in this district, in which there had not been a previous caving of ground which necessitated open-air work, have been launched by J. H. Moreland and associates, on a lease of the Oak Hill Mining Co.'s land, northwest of Joplin. Drilling showed a disseminated orebody beginning at a depth of 30 ft. and continuing down to 140 ft. The overburden was of such a character that it could not be expected to form a substantial roof, and as the orebody had every indication of being extensive, it was decided to put a steam-shovel at work excavating an open-pit, which will be 100 ft. wide by 200 ft. long, when operations are first started. The pit is now 100 ft. square, and has been excavated to a depth of 20 ft., the surface soil being removed. After 10 ft. more of excavation, the size of the pit will be doubled and active mining started, the ore being taken up an inclined tramway to the mill. A recovery of 3% is expected, although there are richer streaks that carry as high as 8% blende.

The Belville-Klondike district, five miles northwest of Joplin, once a famous producer of high-grade zinc ores, but in recent years of little importance, is being rejuvenated, and a number of pumping plants are at work draining the water to greater depths than previous mining operations. The Geronimo Land & Mining Co., operators of other large properties in the district, has a large pumping plant running. Several drill holes have been sunk into ore at this point. Another pumping plant is at the Walnut Hollow mine. The general depth of the ore seems to be about 120 ft. It was from the Walnut Hollow property that the largest piece of lead ore in the district's history was taken.

An unusually high mill recovery is being made at the Tecumseh mine, operated by Homer Seals and associates, on a lease of the Connor land at Thoms Station, the output of concentrate being better than 10% of the 'crush' ore treated. The grade of the concentrate is not high, but is improving as operations are extended deeper. The mine made its initial turn-in a few weeks ago. It was only a few months in developing from a drill prospect to a producing mine, and several drifts are now into ore carrying both blende and galena at a depth of 148 ft. Good ore still in the bottom of the drifts will result in this being stoped later. The Company is turning out concentrate at the rate of 15 tons per shift. The mill formerly was operated by the Rich-In-Ore Mining Co. on a nearby lease.

The Lynas Mining Co., of Kansas, is raising ore from a shaft sunk on Missouri land. The shaft is on an island in the centre of Spring river, seven miles west of Joplin, and the grade of ore is reported as good.

Drilling in virgin territory is being conducted by B. P. Ellis and associates who have a lease on the Reding & Clark land near the mouth of 'Touch-Me-Not Hollow,' 8 miles south of Joplin. Ore at two levels has been proved by two holes put down, the upper body being at 100 ft., and the lower at 250 ft. No mining of importance has ever been conducted near this tract.

The Granby Mining & Smelting Co. is operating a new concentrating plant known as the B & H. Heretofore the Company has confined itself to leasing operations exclusively. Its willingness to engage in active mining is considered a favorable argument in favor of the profits to be derived from zinc and lead development in this district.

One of the largest pumping plants in the district, that of the Dallas mine, west of Carl Junction, Missouri, which recently was suspended because of needed repairs, has resumed operations. The Company has a shaft to a depth of more than 200 feet.

Development in the West Miami, Oklahoma, district where ore is encountered within 50 ft. of the surface, is proving the necessity of extensive timbering. Several bad cave-ins have occurred. The ore is rich in zinc and lead and is found in unusually soft ground. One concentrating plant, that of the McConnell & Barnes Co., is in operation and another is planned to be erected by O. W. Sparks and associates.

PLATTEVILLE, WISCONSIN

JULY PRODUCTION HEAVY, BUT LITTLE PROFIT.—ORE PRICES.—CARBONATE OF ZINC ORES.—DISTRICT OUTPUTS.—FUTURE FAIRLY ENCOURAGING.

July has for years been noted as the banner month of the year for this field in production of zinc ores, and this year proved no exception, although as compared with former years more drawbacks were experienced than ever before. The general depression manifest in many industries over this country has affected ore prices to such an extent, that producers claim the margin of profit is almost negligible. The smaller independent operating concerns have almost all been eliminated from the calculation. The fairly good showing in output now being maintained is coming almost exclusively from smelter owned mines, or foreign corporations. Little ore has been offered for open market bidding, contract deliveries to smelters or production going direct from smelter owned mines to furnaces, now being the rule. Medium and low-grade ore suffered from the fluctuation in prices during the month, more than finished high-grade concentrate which seemed to be in good demand. Prices during the month ranged from $34 to $40 per ton of 60% zinc, and closed at $36 to $41 per ton, some premium ore going at the high figure. Production of raw concentrate showed a considerable increase over the output of the month preceding, and the reserve held at the beginning of the month, in excess of 6000 tons of all grades, was reduced considerably by heavy unloading on the part of the Wisconsin Zinc Co., which carried more than half of the surplus product. More high-grade separator product was marketed due to the activity during the month of an electro-static separating plant at Cuba, which had been idle for two years, and now the property of the Wisconsin Zinc Co. The Mineral Point Zinc Co. also showed increased activity in the refining of crude ore at the Company's works at Mineral Point.

Lead ore was in poor demand all the month, and sales were very light. Bids were submitted at $45 and $46 per ton, but producers preferred to hold this grade of ore, and the few sales reported were made by managements requiring funds to meet current obligations and payrolls. The production of pyrite fell off considerably, due to off markets, and only one producer endeavored to make any showing at all, the ore coming from the Wilkinson mine at Benton, and going to the Grasselli Chemical Co., East Chicago, Indiana. Producers of 'dry-bone,' as carbonate of zinc ore is termed in mining circles in this field, were not given a market for this grade product until the closing days of the month. The ore is used exclusively in the manufacture of oxide of zinc, and now finds increased demands from the automobile industry. The Mineral Point Zinc Co. is the largest manufacturing concern engaged

in the production of this commodity, and has secured control of the northern districts, where this ore is in great beds, by investments in lands, mines developed and in operating order and leaseholds, easily aggregating $1,000,000. A heavy production of carbonate zinc ore is looked for from these districts, in order that the new steel plant recently constructed at Mineral Point, Wisconsin, at a cost of $1,500,000, may be supplied. Much low-grade calcined blende ores, silicate of zinc from the Missouri districts, and carbonates of zinc from the western states are imported to keep the plant engaged in the manufacture of oxide moving. Besides, while blende has been battling with declining markets, prices on carbonate and calamine ores are as good as ever, and now that much of the imported material has been exhausted a big production is expected from the mines of the northern camps in this field.

Shipments of ores by districts, for this field, were reported during July as follows:

Districts.	Zinc, pounds.	Lead, pounds.	Pyrites, pounds.
Benton	7,782,000	80,000	1,948,200
Galena	4,908,000	152,400	.....
Shullsburg	2,926,000	.....	.....
Hazel Green	2,862,000	.....	.....
Livingston	2,670,000	.....	.....
Cuba City	2,452,000	.....	.....
Harker	2,156,000	.....	.....
Linden	1,080,000	61,490	.....
Platteville	984,000	.....	.....
Highland	738,000	.....	.....
Montfort	224,000	.....	.....
Mineral Point	120,000	.....	.....
Dodgeville	.....	80,000	.....
Mineral Point Zinc Co.	3,560,900	.....	.....
Total	32,462,900	373,890	1,948,200

The gross production of green concentrate reported from all mines during the month aggregated 25,492,590 lb. and net deliveries of refined ores from all separating plants direct to smelter 15,617,890 lb. The Mineral Point Zinc Co. delivered 45 cars of high-grade calcined ores to smelter at De Pue, Illinois. Exceptionally heavy deliveries were made from the Wisconsin Zinc Co.'s mines to separating plants at Cuba and Platteville. All the ores reported from these two points were high-grade finished product. Operators at several points, responding to interviews, claim that although still greater declines may be manifested in both ore and metal markets, the present production will be fairly well maintained.

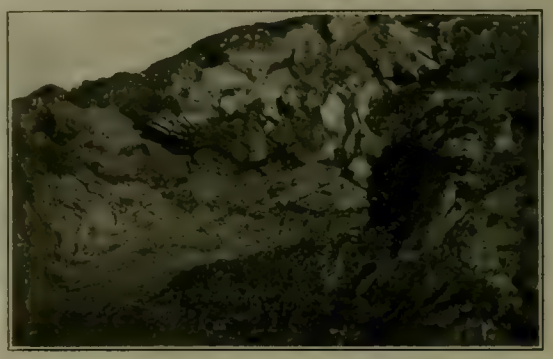
IRON RIVER, MICHIGAN

MINE ACCIDENT THROUGH QUICKSAND.—DISTRICT NEWS.—IRON ORE BUSINESS IMPROVING.—ORE TO NOVA SCOTIA.—IRON ORE LANDS.—ZIMMERMAN MINE.—TAXES.—MINE EQUIPMENTS.

A bad mine accident occurred at the new Balkan mine of Pickands, Mather & Co. at Alpha, in the Crystal Falls district, recently, when seven miners were caught and killed by a sudden rush of quicksand. A raise 60 ft. high gave way without any warning, letting in a great flood of quicksand and water from near the open-cut workings, which are being stripped by two steam-shovels. Twelve miners were working near the raise, of whom five just escaped to the shaft, one being rescued out of the quicksand after cutting away his clothes and boots. The mine is to be worked partly by open-cut and partly by underground methods, and a shaft 500 ft. deep has been sunk north of the open-cut with a main drift running south, and two cross-cuts in one of which the raise was situated. The seven miners killed were foreigners. Some years ago at the Mansfield mine, also in the Crystal Falls district, the bottom dropped out of the Michigamme river, flooding the mine and killing 29 men. During the past weeks, trouble has resulted at several of the Michigan iron mines due to heavy rains.

The village of Stambaugh in the Iron River district is to have a new $12,500 Carnegie library; Iron Mountain, on the Menominee range, already has one. Chase S. Osborn, who was the first governor of Michigan from the mining district of the upper peninsula, but who aroused enmity among the mine operators by his advocacy of the Finlay tax system, is again campaigning for the Republican nomination. Mr. Osborn, originally a newspaper man, has been connected with the mining industry of Michigan for a number of years.

As predicted, the iron ore business, which has been unusually dull this season, is beginning to pick up a little, and signs of a revival during the latter half of the shipping season are apparent. Several companies have now begun to



FOLDED PRE-CAMBRIAN ROCKS NEAR ISHPEMING, MICHIGAN.

ship their large stockpiles which accumulated during last winter, and additional miners are being employed to restore forces to their original number. Among the mines which are increasing in activity are: Ernst mine of Florence Iron Co. at Commonwealth, Wisconsin; Wickwire mine of Wickwire Mining Co. at Iron River; Baltic and Zimmerman mines at Iron River; the Newport mine of Ferdinand Schlessinger at Ironwood (which has employed 120 extra men); the Ashland mine of the Hayes Bros., also on the Gogebic range; the Pewabic mine at Iron Mountain; Portland mine of Rogers, Brown & Co. at Michigamme. The two largest operators in Michigan, the Oliver Iron Mining Co. (subsidiary to the U. S. Steel Corporation), and the Cleveland-Cliffs Iron Co., are still going light.

A trial shipment of 1200 tons of iron ore was recently shipped from Escanaba on Lake Michigan to Sydney, Nova Scotia, by a Canadian steamer, the distance being 1750 miles. It is proposed to mix the ore with Newfoundland ore for furnace use. Some prophets see in the disposal of the Republic mine and iron ore lands on the Marquette range by the Cambria Steel Co. to the Cleveland-Cliffs Iron Ore Co., a sign that a reaction has set in against the steel and iron manufacturers at the lower lakes owning iron ore mines, on account of the uncertainty and difficulties of complicated mining propositions. It is true that during the past ten years there was a scramble of furnace interests from Cleveland, Buffalo, and Chicago to take up iron ore lands at Lake Superior, preferring to produce their own ore rather than buy it in the open market; and it is also true that, in spite of several lucky developments by rather innocent arrivals, some of the newcomers became involved in doubtful propositions and in bothersome lawsuits, etc., but it is probably true that in spite of the increased difficulties of mining iron ore, due to exorbitant taxes, accidents, natural inconveniences, and in spite of reduction of ore prices in the

open market, the various furnace interests will hold on to what they have got. Eugene Zimmerman, of Ohio, who came to Lake Superior several years ago to look for an iron mine, and found a large and valuable one under the noses of operators at Iron River, has lost the lawsuit brought against him by Paul Schook, a saloonkeeper of Crystal Falls, whereby Schook will receive 4c. per ton (a one-third royalty) on all ore mined at the Zimmerman mine during the continuance of the 30-year lease, and will have a sum of $30,000 due from back royalties. If the Zimmerman mine comes up to expectations with several millions of tons of ore, Schook will receive eventually from $100,000 to $200,000. Schook claimed that he helped Zimmerman to secure the lease, and that the latter promised to 'whack' with him. This Zimmerman denies, but states that he would "like to whack Schook." He will appeal the case to the Supreme Court. The Zimmerman property has been in successful operation for a number of years and the present suit has attracted wide attention in the iron country.

The State Tax Commission, which is kept constantly on the move estimating the present value of iron ore deposits, according to expected profits and tonnage reserves, has scaled down the valuations of mines at Negaunee about $2,500,000, and the mines of the western Menominee range about $2,000,000. The mining companies are pleased, but the citizens and property owners in these districts are protesting.

Corrigan, McKinney & Co. will improve its Great Western mine at Crystal Falls, now idle for several years, by replacing the timber-lined shaft through 80 ft. of sand by a concrete shaft, and will replace the old head-frame by a new one with a crusher-stand built on a separate foundation, so the gyratory crusher will not shake the head-frame, as has been the case in the past. Jones & Laughlin will line the shaft at its Iron Mountain Lake mine, near Ishpeming, with concrete for a distance of 50 ft. to bedrock. The Thomas Furnace Co., of Milwaukee, a small iron manufacturer in an unusual location, has begun developments at the old Indiana mine near Iron Mountain, recently taken over from Captain Spencer, and has brought machinery from its old mine in the Baraboo, Wisconsin, district. The Huron Iron Mining Co., of Iron River, which went bankrupt, together with the McDonald mine at Crystal Falls of the same interests, is involved in settlement with claimants.

JOHANNESBURG, TRANSVAAL

RAND MINES, LTD., ANNUAL REPORT: VALUE OF ORE AT DEPTH, ORE MILLED, COSTS, EXTRACTION, DRILLS, AND AIR CONSUMPTION.

The feature of the second week in June was the annual meeting of the Rand Mines, Ltd., and the usual speech of the chairman covering the work, progress, and disappointments encountered at the mines, as this is the most important mining corporation on the Witwatersrand. The mines worked by this corporation extend from Roodepoort on the Western Rand to the last outcrop mine on the Far Eastern Rand, so that the chairman's annual review is to all intents and purposes a review of the year's mining on the Rand. The fact that this Company either controls or is interested in almost every mine of importance on the Rand also adds interest to the meeting, which is emphasized by the knowledge that the 12 mines under its control made last year a total working profit of £4,898,380. The ore reserves in these mines total 32,153,560 tons, and the estimated gold content amounts to £48,903,000. In his address the chairman attempted to minimize the importance of the following paragraph contained in a recent report issued by the Consolidated Gold Fields of South Africa: "There can be no doubt that there is a gradual decline in the average values over large areas of the ore developed as deeper sections of the Rand are opened up" a statement he pointed out was only true in a limited degree. He further stated that it does not apply to the whole of the Rand, where in many large areas little or no impoverishment has so far taken place. In proof of his assertion that gold content does not always decrease with depth, the following two examples were quoted:

Level No.	Vertical depth, feet.	Footage sampled.	Average width of reef, inches.	Average value, dwt.	Inch dwt.
City Deep					
2	2137	1705	21.6	44.9	970
3	2263	840	16.8	62.6	1052
4	2407	1640	21.5	28.8	619
5	2542	3215	35.0	19.2	672
6	2725	5680	30.6	13.8	422
7	2875	4980	31.7	15.8	501
8	3001	7125	33.7	16.0	539
9	3208	6440	34.7	13.3	462
10	3360	1997	35.8	11.2	401
11	3519	322	45.4	10.0	454
Village Deep					
6, 7, and 8	2500 to 2700	10,665	38.2	10.4	397
16, 17, and 18	3760 to 4120	8,945	44.4	8.6	383
19	4189	280	39.3	8.1	318

It may be pointed out that both these mines are situated in the same part of the Central Rand, and that the details given above, while indicating a considerable area of profitable ground at a good depth from the surface, do not, on careful scrutiny, prove that Rand ores do not decrease in value with depth, but rather tend to confirm the generally accepted view that this is so as greater depths are reached. It is quite true that good ore is sometimes found as stated by the chairman at vertical depths of 4000 ft. and over, but taken over considerable and truly representative areas, it is the exception rather than the rule to find that the gold content is maintained in depth. The Cinderella Deep and Brakpan mines, quoted by the chairman as well known instances, are equally unfortunate with the City Deep and Village Deep; while the Hercules average value of 17 dwt. over 26 in. at a depth of 4361 ft. lies close to an extensive proved area where at a depth of 4000 ft. the average over a stoping width is only about 2 dwt. per ton, the Hercules shaft, as a matter of fact, intersecting the reef where it was admitted to be unprofitable. From one end of the Rand to the other, lower gold content with depth, as compared with the outcrop mines, can be seen wherever extensive mining operations have been carried on; but even then, there are numerous instances where limited areas contain a fair amount of profitable ore.

An interesting table quoted in the chairman's speech was that with regard to the marked reduction effected during the last four years in the costs of treating ore, the figures being as follows:

Year.	Tons milled.	Total cost.	Cost per ton.
1910	6,752,448	£1,505,381	$1.08
1911	7,595,192	1,681,953	1.06
1912	8,244,944	1,709,655	0.98
1913	8,444,480	1,549,034	0.88

This reduction is still being continued, and reflects considerable credit on F. L. Bosqui, the consulting metallurgist to the Rand Mines, Ltd., and also on his staff. The lowest cost on this group of mines was at the Crown Mines, where it averaged 72c. per ton milled. Extraction averaged 95.73%, the New Modderfontein plant being the highest with 97.2%.

One of the features in connection with the new plant to be erected at the New Modderfontein mine is the proposed abolition of the sand-collecting tanks, F. L. Bosqui being of the opinion that with the good classification of sand and slime now obtained by means of cones, the sand can be collected and treated in the same tank.

With regard to the efforts being made to reduce working costs on the Rand, mention was made of the increasing use of the lighter drills of the hammer type with the object of displacing not only natives, but the heavier piston drill. The comparative lightness and higher speed of drilling possessed by the hammer type are no small advantages, and when a suitable detachable bit has been devised, the superiority of these light hammer drills should be more pronounced than ever. It is estimated that, on grounds of economy, detachable bits ought not to cost more than 8c. each. Mention was also made of the saving effected in machine-drill maintenance amounting to £17,000 in 1913 compared with the previous year, while the saving in drill steel and sharpening represented another £13,000. Then again, for 1912, 137,044,567 units of compressed air was required for 931,978 drill shifts, an average of 147 units per drill shift, while in 1913, 133,435,038 units sufficed for 957,350 drill shifts, being a reduction to 139 units per drill shift. The contract price arranged with the Victoria Falls Power Co., Ltd., of 1.05c. per electric and air unit has been reduced by rebates given on account of the reduction in railway charges for carrying coal, and further savings are expected when a 25% share of the surplus profits of the power company become available to the mines.

WASHINGTON, D. C.

LEASING OF COAL LANDS OF ALASKA INCLUDED IN NEW CONSERVATION PROGRAM.—RADIUM BILL.

The conservation program, on which the House of Representatives has entered by a special wish of the Wilson administration, embraces no legislation detrimental to mining, but not at all what the mining world has had more at heart, the creation of a commission to codify the mining laws of the land. This must take its chances in the ruck of legislation. The conservation scheme includes five bills, and all of them are at least somewhat related to mining by propinquity, such as the bill to provide for the development of water-power, and the use of public lands in relation thereto; and the bill extending the period for the payment on reclamation projects. The mining bills were three in this program. One provides for the leasing of coal lands in Alaska, and the House arranged six hours of general debate on this.

The known coal-bearing ground of Alaska includes 16,000 square miles, and 1210 miles of this is asserted by the U. S. Geological Survey to be workable coal beds, 12% of the coal lands being anthracite. There are some valuable bituminous areas. The most important field is the Bering River. The United States reserves to itself 5120 acres of this field, and 7680 acres in the Matanuska field. The leased lands are to be divided into blocks of 40 acres each, and in no case exceeding 2560 acres in any one block and these blocks will be leased through advertising and competitive bidding. The leasing, it is hoped, has been made in such form as to permit the most economical mining of the coal. Provided the combined areas do not exceed 2560 acres, there may be new leases for additional lands. There may be also a consolidation of leases within the 2560 acres limitation. The Secretary of the Interior will fix the royalty which shall not be less than 2c. per ton, and the royalty will be turned into a fund for the benefit of Alaska. The lands withheld for the United States will be for the purposes of the army, navy, and other Government uses.

The radium bill, previously described, was the second of the mining bills on the program, but it stands little chance of passage in the Senate, whatever the House may do with it. There has ceased to be any considerable enthusiasm over radium since it has not been found the cure for cancer. The third bill takes up the authorization of exploration for and disposition of coal, oil, gas, potassium, and sodium.

NEW YORK

HOW THE METAL SITUATION IS REGARDED IN THE EAST; NOTES ON COPPER, SPELTER, TIN, ANTIMONY, FERROMANGANESE, ALUMINUM, AND LEAD.

The effect the war is having on the normal course of trade is clearly shown in the exports of copper. Between August 1 and 14 these amounted to 6058 tons, as compared with 17,518 tons in the same period of last year. Sales of copper go on at around a price level of about 12 to 13c., but the dealers refuse to admit that these establish a daily market price. As a matter of fact there is as much of a market now as there often is in the normal course of business, for the buying of copper is characteristically irregular, and there are often weeks at a time when not enough is being sold to establish a market price. The stopping of quotations is perhaps justified as a war measure, for no one can tell what will happen under such abnormal circumstances, and in a month from now copper may be in fair domestic demand, or it may be impossible to almost give it away. As soon as things steady a little, working quotations for the missing days can be established. Meanwhile the smelters have to hold up their settlements for copper and silver, a not unwelcome necessity. Copper for immediate delivery has been bringing a good premium in London, sales having been made last week at £72 (15⅝c. per pound).

The stocks of copper in England and France were 22,314 tons according to James Lewis & Sons, of Liverpool. Several shippers to Europe will probably divert their copper to the United States, the Braden having already taken that step. The Chile Copper Co., by the way, has had to divert its orders for equipment to the U. S., and the General Electric Co. will proceed to furnish the electrical equipment ordered from the A. E. G. of Berlin. The two companies are allied, so this merely means a shift of contracts from one plant to another.

Several of the other metals are much disturbed also. Spelter has gone up, in the expectation that shipments to England can soon be dispatched, while the former supply of England is likely to be indefinitely interrupted as the chief district is now the battle ground of the contending armies. Tin has gone up, as shipments through the Mediterranean are interrupted. The Chinese tin, which is shipped from Hongkong can easily be sent by way of San Francisco, but it takes some weeks to establish new trade relations, and Straits tin would have a longer journey if sent over the Pacific. Antimony has fallen in price, as it practically all comes to this country by way of England, and the business of forwarding it here has come to a standstill. Platinum is up and is likely to go higher, as the Russian supply may be cut off for a long time. Ferromanganese has almost tripled in price, but as soon as some of the companies here can get one of their stacks running on ferromanganese a plentiful supply will be assured, though at an advanced price, as manganese ores obtainable in Cuba, or elsewhere in our territory, are likely to cost the smelters more than they have been paying. Aluminum is not likely to go very high, as the new plants in the south will greatly add to the domestic supply before the year is out. Lead remains typically unmoved.

Of ordinary mining news there is none. All are standing by their guns to see what will happen. The large companies have given out their reports as usual. Estimating the profits of a copper company is risky business just now, as the first copper made in the beginning of a quarter is only just getting sold at the end of the quarter, and June 30 copper has not reached the market yet.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

Juneau

Mine development, power schemes, and mill construction at the Alaska Gold Mines property is going on with good progress. On the 13th or Sheep Creek tunnel level, the full drift, which is 16 ft. wide, is being driven west. The whole face of this drift continues in excellent ore, and is now in a distance of nearly 600 ft. beyond No. 1 shaft. That is to say, this Sheep Creek tunnel, driven primarily to furnish a transportation way from the mine to the mill, and which has already passed through nearly 10,000 ft. of the property, continues to show that the lode at this depth is in place and of good value, as it had previously done at several points in its course. As this tunnel has been driven at an average depth of 2200 ft., as against the previous lowest workings on the Alexander level of 1500 ft., the continued development of ore on this level may, in a sense, be said to have increased the vertical dimensions of the orebody by 50%. At another point, a diamond-drill on one of the upper levels, No. 5, has been prospecting in the hanging wall. At this point, a width of 100 ft. had already been proved, and the drill had passed through 17 ft. additional good ore, with the hole still in ore at the last report.

CALIFORNIA

Amador County

On the occasion of starting the new mill at the Pacific mine at Plymouth, a banquet was held on August 6 at the new hotel. It was quite representative of all interests, and among the guests were W. J. Loring, Albert Burch, James Parks, Fay Chadbourne, Moise Roos-Norman, T. Levaggi, and others. Mr. Loring spoke hopefully of the property, and Mr. Burch promised to aid the people in starting a bank at Plymouth.

Eldorado County

More men have been added to the force at the Rising Hope mine near Placerville. G. W. Englehardt is manager.

Placer County

It is reported that S. P. Soyster, representing Goldfield and Tonopah people, is negotiating with the Placer County Land Co. for 200 acres of dredging land along the Bear river.

Plumas County

An English syndicate has bonded the Arcade mine, near Greenville, from D. McIntyre.——English holders of the Bellevue mine at Gibsonville, and the Farmers' Home mine at Howland Flat, have ordered the temporary suspension of work.——The Scott mine at Seneca is said to be opening well.——Ten men are working two shifts driving an adit 1500 ft. at the Antlered Crest mine near La Porte. The adit is in 400 ft., and it is hoped to open a gravel channel.

Shasta County

(Special Correspondence.)—A new electric hoist, of 2500-ft. capacity, has been installed in the Ohio adit at the Gladstone mine. The mill is treating $10 ore. I. O. Jillson is manager and E. Young superintendent.——The Western Exploration Co. has decided to prospect its Milkmaid properties with a diamond-drill. The plant consists of a 10-stamp mill and four vanners. H. F. Musser is manager.——A number of other properties in the French Gulch field are receiving attention, including the Five Pines, and Washington.——It is reported that heavy shipments of gold-bearing ore from the Reid mine to the Mammoth smelter will soon start. The Reid is in the Old Diggings district, and contains large bodies of low-grade ore. James Sallee is managing owner.——W. W. Feltz and I. Smith, of Redding, are developing a large body of ore containing small shoots of rich quartz, west of that place. They are contemplating erecting a small mill.——The Delta Consolidated Co. has secured patents to its gold-copper claims in the Delta district. A small amount of work is going on. S. D. Furber is superintendent.

Redding, August 16.

The Dry Slide mine has been bonded by A. M. McCarthy to I. Washburn and D. W. McCleum, of Los Angeles, for $25,000. It has been opened by a 1500-ft. adit, and has produced up to 1906 about $400,000.

Sierra County

At the City of Six quartz mine, a new adit is being driven to cut the vein which occurs in a contact of serpentine and porphyry.——The Fruitvale mine was recently examined by Andrew Fitzgerald.——Larger flumes are being constructed for the Brandy City Hydraulic Mining Co.'s gravel property.

Trinity County

(Special Correspondence.)—An examination of the Headlight mine, at Carrville, was made recently by the president, H. W. Miller, and general manager, D. W. Shanks. A small amount of work is under way at the mine, where a large body of sulphide ore is exposed. The Company is still endeavoring to develop a successful metallurgical process. The mine is adjacent to a national forest area, and regulations prevent roasting of the ore.——Driving of No. 6 adit at the Globe Consolidated mine, near Dedrick, continues. The 20-stamp all-sliming mill is running steadily and treating about 120 tons per day. E. E. Harrigan is preparing to install a small mill at the Democrat mine, two miles from Weaverville. The ore is free milling.——The Trinity Consolidated, La Grange, and other hydraulic mining companies are busily preparing for the winter season. Numerous improvements are being made to flumes and pipe-lines, and the great siphons of La Grange are being strengthened to avoid a repetition of last winter's trouble.

Trinity Center, August 16.

The Poverty Slide gravel mine, once worked by hydraulicking, has been bought by the Alta Bert Dredging Co., which will dredge the gravel.——The annual clean-up is under way at the Nash mine.

Tuolumne County

The company owning the Harvard mine is to be sued for $50,000 on account of the death of Giovanni Picatto on October 12, 1913. It is alleged that the stope at 500 ft., where he was working, was dangerous and the compnay was negligent.

COLORADO

Clear Creek County

A 50-ton cyanide plant is to be erected on the Oneida and Stag claims in the Lamartine district.——Operators at various properties, and lessees at the Capital mine are busy, and generally satisfied.

Lake County (Leadville)

Leadville producers of silver and lead are considerably upset over the effect of the war on their products, especially

the former, and the Lake county chapter of the Colorado Metal Mining Association is urging the U. S. Government to buy silver at or about 50c. per oz. The American Smelting & Refining Co.'s local plant is advancing 25c., per oz., the balance to be settled when the market reopens. The new zinc smelter is shut down as there is no market in Europe for the oxide product.

On No. 3 level of No. 1 shaft of the Jonny mine, rich oxidized gold ore was again opened.——Three feet of ore in the Lancaster lease assays 1.44 oz. gold, 219 oz. silver, and 32% lead.

SAN MIGUEL COUNTY

At Telluride, additions to the Tomboy cyanide plant are well under way. The aerial tramway has greatly lessened the work of hauling the equipment.——The Reinohl process at the Suffolk mill is said to be giving good results. Officials of the Smuggler-Union and Liberty Bell mills have investigated its work.——A new cable was strung on the Alta tramway in a week.

TELLER COUNTY (CRIPPLE CREEK)

The quarterly report of the Doctor-Jack Pot Mining Co. contains the following: Seven groups of lessees during the quarter shipped 2478 tons of $12.29 ore. The Wilson lease is the most important. On Company account was done 345 ft. of work at $4.45 per foot. The ground is very hard at present. Seepage water has been troublesome. Royalties amounted to $3509, and total revenue $3897. The profit was $1245, and cash on hand $59,950, including ore in transit.

The Roosevelt drainage tunnel, which is 7 by 8 ft., with an 18 in. ditch at one side, is being driven at the rate of 6 ft. per day. A cave of ground necessitated driving around the débris, the heading being again in hard ground.

IDAHO

SHOSHONE COUNTY

The Coeur d'Alene district mines produce about 28,000 oz. of silver per day from the lead, zinc, and copper ores, and the action of the U. S. Government in buying silver has resulted in general satisfaction. A few lead producers are doubtful whether work will be profitable under present conditions.

F. A. Heinze and associates have purchased 550,000 shares of the Stewart company held by the Assets Realization Co., thus giving them control of the property, with further opposition of little use.——At the Marsh mine, the raise in the three-compartment vertical shaft, connecting No. 3 level with the main adit, is expected to be finished on September 10. The shaft will be 700 ft. deep. A large double-drum electric hoist is being made by the Nordberg company of Milwaukee. The mill is being remodeled, and a flotation process installed. Ore production will resume in November. Total output is $500,000.

MICHIGAN

HOUGHTON COUNTY

The Winona, Hancock, La Salle, and Tamarack copper mines are entirely closed. At the Copper Range Consolidated mines, the Baltic, Champion, and Trimountain, men are working half time, and wages are reduced 10%. Calumet & Hecla expects to work full time underground for another month. About 5000 men, out of the full force of 16,500 in the district, are affected by curtailment of work, and the county is to make a bond issue of $300,000 to help relieve the situation.

MONTANA

FERGUS COUNTY

The Barnes-King Development Co. has issued a report for the first half of 1914, containing the following remarks by the manager, Geo. T. McGee: Development in the North Moccasin totaled 1567 ft. in ore., and 1781 ft. in waste; also 34 ft. of shaft-sinking and 2272 cu. ft. of skip pockets. The Santiago three-compartment shaft is now used as a main working shaft in place of the one-compartment Barnes-King shaft. No new orebodies were found. Above 400 ft. the ore-shoot is nearly 200 ft. long, with a maximum width of 16 ft. Ore was mainly stoped from west of the old Barnes-King mine bottom levels. The output of 24,435 tons was mined and treated for $4.42, with a profit of $4.20 per ton. At the Piegan-Gloster no further ore development was made, as water-level was reached, and the steam plant cannot cope with it. Tests made on the ore show that a scheme of moderate fine grinding with cyanide solution in Chilean mills, leaching sand and agitation, etc., the slime, is suitable. It is hoped to finish the mill at the end of the year. The surplus is $66,537, against a deficit of $7559 at the end of 1913, but it will take about $75,000 to bring the Piegan-Gloster property to the productive stage.

MISSOULA COUNTY

Owing to the metal situation, work at the Iron Mountain mine and mill at Superior has been curtailed. The plant has only just been overhauled and enlarged. Recent developments have shown 7 ft. of zinc ore in one part of the mine, also 3 ft. of high-grade lead silver ore.

SILVERBOW COUNTY

The Butte & Superior Copper Co.'s report for the second quarter of 1914 contains the following information:

Mine development, feet	4,885
Additions to ore reserves, tons	113,784
Ore treated, tons	95,500
Average zinc content, per cent	18.28
Average silver content, ounces	9.85
Zinc concentrate output, pounds	57,824,296
Average zinc in concentrate, per cent	53.24
Average silver in concentrate, ounces	26.36
Mill recovery, per cent	88.17
Cost of mining, per ton	$ 3.14
Cost of milling, per ton	2.02
Total net value all products	805,866
Operating costs	492,882
Profit, including metal inventories, etc.	372,984

Labor troubles interfered with the tonnage slightly. Metal content of the ore was a little lower, recovery 2.67% lower, costs 29c. lower, and the profit $25,000 lower on taking out the item $60,000 for metal inventories. The latter item represents concentrate not fully settled for.

NEVADA

ESMERALDA COUNTY

The mining force at the Silver Pick Consolidated has been reduced somewhat, and work concentrated on a winze below 500 ft. Ore in this assays from $18 to $38 per ton over 12 to 6 in. width. Under the new superintendent, Weldon Morris, a new south drift is being driven at 700 ft. in the Oro.

Development in the Jumbo Extension continues satisfactory, and the August output will be about 600 tons of ore. The Company has issued a report covering operations during the 17 months preceding June 1, 1914. In 1913, there was 11,210 tons of ore treated at the Bonnie Claire mill, there being a loss of $17,111. Development totaled 3564 ft., at a cost of $6.28 per foot. Milling cost $3.65 per ton. Cash at the beginning and end of the year was $37,838 and $9350 respectively. The present directors and officers took charge early in 1914. The first five months of the current year show 8653 tons treated at a profit of $53,342. Of this amount, 2418 tons went to smelters. Development totaled 1698 ft., at a cost of $5.72 per foot. Cash on May 31, 1914, was $40,752. It was deemed necessary to purchase the Merger company's Velvet claim, costing $85,000 cash and 171,000 Jumbo Extension shares. Of this, $30,000 has been paid, and $5000 per month until the amount is liquidated. This was a profitable deal in every way. Ore developed on two or more sides is valued at $250,000. An arrangement was made with the Goldfield

Consolidated to treat about 100 tons per day at a cost of $3 per ton, including freight.

EUREKA COUNTY

According to the manager, L. R. Thatcher, the Union Mines Co. is to erect a 50-ton concentrating plant at its mine 35 miles south of Palisade. About 25,000 tons of silver-lead ore has been opened by adits.——The Buckhorn mill is now well up to capacity, with a monthly output of $40,000 of gold.

HUMBOLDT COUNTY

Rochester is active in spite of the war and low price of silver.——Survey of the pipe-line for the new mill is finished, the length being 27,000 ft. A 4-in. pipe will be laid.——High-grade gold ore is being extracted from the Blowback claim on Lincoln hill.——In the lower adit of the Buck and Charley lease silver-lead ore is being opened.——A good ore-shoot has been developed in the Octopus.

LYON COUNTY

The Mason Valley smelter is receiving no more high-grade silver ore for the present. During the week ended August 13 the plant treated 4199 tons of copper ore, 1744 tons from its own mines, 503 tons from the Nevada-Douglas, and 1952 tons from other mines in the district.——The tailing at the old Wheeler mine at Pine Grove has been secured by Ross and Knox, who will concentrate the material and ship the product to the smelter. Pope and Talbot of San Francisco own the property. The lessees will pay a royalty of 50c. per ton, the tailing containing $5 to $6 per ton in gold.——Development at the Constantine copper claims is promising, also at the Silver State and Smith Valley mines.

Some good copper ore has been opened recently in the Casting Copper section of the Nevada-Douglas property, and also in the Ludwig. A carload of 50 tons of ore gives a net profit of $500 over and above mining, freight, and treatment charges. Work on the millsite is under way.

MINERAL COUNTY

(Special Correspondence.)—The Wagner Azurite Co., under management of Frank Everett, is working on the leaching of copper ores. The plan of dry crushing has been abandoned, and material is now crushed wet. Sulphuric acid is obtained from San Francisco. There has been some difficulty in filtering and a hundred blocks of 'Filtros' has been ordered for trial.

Luning, Nevada, Aug. 17.

NYE COUNTY

A great electric storm, not accompanied by rain, interfered considerably with the power lines of the Nevada-California Power Co. last week. Wires between Silver Peak and Millers were down for a day. The storm in the White mountains was severe. In places the large insulators were shot to pieces. Lightning arresters worked well.

Work has been suspended at the MacNamara mine and mill, owing to the state of the silver market. The Company has no great financial resources. Lately the mill has been treating ore for the North Star company, along with some from its own mine.——In July the Tonopah Mining Co. produced 200,015 oz. silver bullion and 101 tons of concentrate, the whole being worth $171,325. The profit was $71,175.——The Extension treated 5636 tons of ore yielding $74,474, with a profit of $28,526.——Several of the companies are storing bullion for the present.——Owing to suspension of work at the MacNamara, Merger, and North Star mines, and interruption to electric power, the district's output last week was 10,464 tons valued at $198,810.

STOREY COUNTY

On account of the war no work is being done at the Ophir and Con. Virginia mines on the Comstock.——At the Yellow Jacket mill 748 tons of dump and 327 tons of mine ore was placed in bins.——The Pumping Association is holding the water below 2500 feet.

WHITE PINE COUNTY

(Special Correspondence.)—The testimony given, at the inquest over the killing of five, and injuring of three, from an accidental and premature explosion of powder, in Eureka Pit, of the Nevada Consolidated Copper Co., on August 4, showed that four men were using a 1-in. water pipe, with a 3-ft. stick driven in the end, tamping. The wooden block, used to gauge the depth of powder in the sprung hole, was in the hole, because the rope attached had become broken. The electric exploders had been placed previous to the accident. The jury rendered a verdict of carelessness on the part of the American foreman in charge of the powder gang. It was a very hot day, and the black powder packed in 25-lb. black iron kegs was exposed to the sun's rays for a long time. The hole had been recently sprung, but was drilled six weeks earlier. It is thought quite probable, from the warmth of the powder and the sprung hole, that sufficient friction may have been generated with the heavy tamping rod to have caused a premature explosion. The Company has since adopted the plan of cooling the powder during hot weather by placing it in a barrel of water.

The Giroux Consolidated mine is shut down temporarily.——The Railroad Valley Co.'s drilling outfit was recently sold to the county commissioners, who are allowed by a recent law to spend $5000 per year in drilling for artesian water on county-owned lands. The first work will be done in the White River valley, two miles northeast of Preston.

Ely, August 11.

During July there were 24 disabling accidents at the Nevada Consolidated mines and works, one being fatal, and the others generally of minor importance. The fatality was at Copper Flat, where a foreigner attempted to board a moving train.——The Consolidated Copper Mines Co.'s mines are shut down.

TENNESSEE

POLK COUNTY

The Tennessee Copper Co. is reducing its copper production by about one-third. This Company is better off than most of

ACID PLANT OF THE TENNESSEE COPPER CO.

the other copper producers, as it makes over 600 tons of sulphuric acid per day from fume at the smelter, and has a steady sale for the product. The acid plant cost $1,905,000.

UTAH

The U. S. Bureau of Mines rescue car No. 2, with J. C. Roberts and John Boardman in charge, has the following itinerary in this state:

Leave Salt Lake City August 15, arrive Sunnyside, August 17 and remain till August 22; then, Hiawatha, August 22 to August 29; Black Hawk, August 31 to September 5; Mohrland, September 5 to September 12; Kenilworth, September 12 to September 19; Standardville, September 19 to September 26; Storrs, September 26 to October 10; Castlegate, October 10 to October 17; Panther, Cameron, and Scofield, October 17 to October 24; Winterquarters, October 24 to October 31; Clear Creek, November 1 to November 7, and reaching Salt Lake City on November 8.

Juab County

Among the Knight properties at Tintic the Iron Blossom will be kept open, but the Brooklyn, Rico-Wellington, and Rico-Consolidated in Colorado will be closed. At the Loose properties at Tintic the Gold Chain and Grand Central are shut down. The Gemini, Chief Consolidated, May Day, and Eagle & Blue Bell are still working.——Development is being continued in the Yankee Consolidated. A raise from 1700 ft. has opened 4 oz. silver and 2 to 3% lead ore.——The Mines Operating Co.'s output in July was about 33,000 oz. silver. During the past week, 18 bars weighing 16,000 oz. were sent to the National Copper Bank of Salt Lake City. The metal is 975 fine. There are 100 men employed in the Ontario mine and mill operated by this Company.——The Daly-Judge mine has been closed.

Summit County

A shipment of ore from the American Flag mine was settled for last week at 1.41 oz. go'd, 83.2 oz. silver, 24.7% lead, and 0.77% copper. This was taken from 400 tons of mill ore which had been sent to the stockpile of the Park City mill. This ore averages $15 per ton in gold and silver.——Foundations are in, and machinery for the new hoist and mill of the Daly West mine is arriving at the property. Lessees are still mining ore at 1200 feet.

CANADA

Ontario

There will be no curtailment of work at the Nipissing property on account of the silver situation. In July the high and low-grade mills treated 166 and 6700 tons of ore respectively, the refinery producing 415,831 oz. bullion. Prospecting by hydraulicking is still being done. At shaft 73 work on No. 4 level was satisfactory. Beyond the main fault vein 98 is as wide, but lower in value. At 900 ft. vein 64 has been opened for 145 ft., the best part being 24 in. wide, assaying from 12 to 18 oz. per ton. Stoping 2 in. of ore at shaft 63 is yielding 2200-oz. ore. Work at shaft 86 has been stopped as No. 2 level was unprofitable.

The Dome mine produced $82,984 from 17,780 tons of ore in July, the average being $4.19 per ton.——The Hollinger mine produced 16,343 tons of $13.62 ore. Mill recovery was 91% on account of changes in the plant. Costs of mining, milling, and general totaled $4.32 per ton. The gross profit was $132,712, and the surplus amounts to $901,938. Vein 41, cut by diamond-drill, has been opened by a cross-cut at 300 ft., where it is 10 ft. wide and of good value.

KOREA

The Oriental Consolidated mills in June treated 23,932 tons of ore for bullion worth $127,900. A decrease on the May output was expected, while that for July will also be low, as the rainy season is now on. At the Maibong mill, concrete mortar blocks are being put in.

MEXICO

Sonora

Because of the unsettled condition of the copper market, the mines and works at Cananea were to have shut down at the end of last week. This means the discharge of 1900 employees.—There has been some fighting at Quijano in this state between Governor Maytorena and the Colonel P. E. Calles party. Four hundred volunteers left Nogales on August 17 for the scene of trouble.——The Minas Pedrazzini Gold & Silver Mining Co. with mines at Arizpe, held a meeting of stockholders in San Francisco on August 17. A new board of directors was elected, E. L. Dufourcq of New York being president; F. Montijo, San Francisco, vice-president and treasurer; and F. A. Denicke, San Francisco, secretary. The Company hopes to resume work as soon as conditions in Sonora are stable.

PERSONAL

J. C. Ray has gone to Butte.

E. L. Dufourcq was at San Francisco.

C. W. Purington is at Bodaibo, Siberia.

W. P. Hammon has returned from Boston.

F. G. Cottrell went East from Salt Lake City.

A. E. Boynton was in Salt Lake City last week.

F. Peter is in San Francisco from Salt Lake City.

D. C. Jackling is expected at San Francisco Sunday.

Charles Janin has been at his ranch near Gaviotta.

H. V. Winchell went to Tonopah from Salt Lake City.

W. W. Mein returned from Alaska and has gone to New York.

G. H. Clevenger returned from Colorado by way of Salt Lake City last week.

George I. Adams, professor of geology at the Pei Yang University, Tientsin, was married in June.

H. C. Hoover had expected to leave London for the United States August 13 but has been indefinitely detained.

H. D. McCaskey has been called to San Francisco on account of the death of his father, Major General McCaskey.

Herman Goodall of Helena, Montana, has been appointed assayer in charge of the United States assay office at Helena.

Kirby Thomas examined properties in Nevada and California after attending the Institute meeting at Salt Lake City.

C. B. Lakenan has gone East to undergo an operation and H. A. Guess will manage the Nevada Consolidated in his absence.

Hennen Jennings and E. H. Benjamin have been in Mariposa county for a few days. Mr. Jennings left for Washington Friday.

J. Nelson Nevius of Pasadena, is candidate for state senator from the thirty-sixth district which comprises Pasadena and vicinity.

J. R. Buchanan has accepted the position of general superintendent for the Imperial Reduction Co., at Ogilby, Imperial county, California.

Mark Lamb, representative of the Allis-Chalmers company, accompanied by his wife, was at Lima, Peru, recently, and left for Santiago on July 29.

Daniel Guggenheim, S. R. Guggenheim, and Isaac Guggenheim, of the American Smelting & Refining Co. are in Europe. When last heard from the former two were in Munich.

M. K. Rodgers and party is touring the West in a motor car visiting the Granby properties at Grand Forks and at Phoenix. From Phoenix they will visit the mines at Hedley, after which they will go to Vancouver en route to Anyox.

Obituary

Jacob Langeloth, chairman of the board of directors of the American Metal Company, died suddenly last week of heart disease at his country home in Riverside, Conn. Mr. Langeloth was born in Germany and worry over the war made acute the weakness from which he had suffered for years. He was born in Mannheim, and after engaging in the metal business for several years was sent here 27 years ago by the German parent of the American house to found the American Metal Co. Since then his business influence had grown until he was a director in many important concerns, among them being the Balbach Smelting & Refining Co., the Corn Exchange Bank, the General Development Co., the Metallurgical Company of America, the Mexican Bank of Commerce and Industry, the Miami Copper Co., and the Wetherill Separating Company.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, August 20

Anthony	No quotes
Electrolytic copper	15¼
Pig lead	3.90
Quicksilver (flask)	No quotes
Tin	" "
Spelter	7¾
Zinc dust, 100-kg. zinc-lined cases	No quotes

There have been some sales at the above prices. While there is practically little doing in quicksilver, the price remains at $85 per flask, although it is reported that 50 flasks were sold at $80 each early in the week. The New Jersey Zinc Co. is to make zinc dust, which should relieve the situation later on. Stocks are low, and quotations are around 15c. per pound.

EASTERN METAL MARKET.

(By wire from New York.)

NEW YORK, August 20.—Lead is quiet at 3.85 to 3.90c., spelter strong at 5.55 to 5.65c., while the copper market is still at a standstill. There have been small copper sales, but no quotations. The copper companies are supporting the market. The Granby Consolidated company of British Columbia has passed its regular quarterly dividend of $1.50 per share. The Federal Mining & Smelting Co. has reduced the quarterly dividend on preferred stock from $1.50 to $1 per share.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.	
Aug. 13	No quotes
" 14	" "
" 15	" "
" 16 Sunday	
" 17	" "
" 18	" "
" 19	" "

Average week ending	
July 8	56.42
" 15	55.60
" 22	54.14
" 29	53.42
Aug. 5	No quotes
" 12	" "
" 19	" "

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

There is still no regular quotation for silver in New York, and this will continue indefinitely, any prices arranged being only by special sales, or requirements of the United States Mints. Smelters in Utah settled for the metal up to August 11 at 52c. per oz., and from that date until the market is regular, only 25c. per oz. will be paid as part payment. Writing on July 30, Samuel Montagu & Co. state that stocks of the metal in London were low, and there was an absence of speculative commitments, with a small amount of business. On July 24 an Indian currency return showed an increase in the holding of silver rupees (1 rupee = 30 cents).

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.	
Aug. 13	3.85
" 14	3.85
" 15	3.85
" 16 Sunday	
" 17	3.90
" 18	3.90
" 19	3.90

Average week ending	
July 8	3.90
" 15	3.90
" 22	3.90
" 29	3.85
Aug. 5	3.85
" 12	3.85
" 19	3.88

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	....
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May.	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

COPPER

Exports of copper for the week ended August 13 totaled 1846 tons, a decrease of 6273 tons. Since January 1 the total is [illegible] tons, an increase of 21,291 tons compared with 1913. There have been sales of electrolytic in London at £[illegible] per ton, or 14½c. per pound. This was for immediate delivery. Standard was quoted nominally at £59 15s. to £60 15s. for spot and three months' deliveries respectively.

The following yields (in pounds) for July have been declared by the respective companies, compared with those for June:

Mine.	July.	June.
Arizona Copper	3,400,000	3,742,000
Braden	1,332,000	662,000
Calumet & Arizona	5,940,000	5,862,300
Chino	.....	6,068,052
Copper Queen	7,355,070	7,184,928
Detroit	1,966,526	2,129,100
Granby	.....	2,706,595
Mammoth	1,950,000	1,725,000
Mason Valley	1,108,000	1,068,000
Miami	3,257,300	3,124,759
Moctezuma	2,866,527	3,340,807
Nevada Consolidated	.....	4,483,175
Old Dominion	2,962,000	2,937,000
Phelps, Dodge & Co.	12,650,371	13,113,626
Ray	.....	6,226,536
Shattuck-Arizona	1,348,069	1,226,987
Utah Copper	.....	13,268,106

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending	
July 16	37.50
" 23	37.50
July 30	37.50
Aug. 13	85.00
" 20	No quotes

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

Notes under the heading of 'Local Metal Prices' cover this metal for the past week.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.	
Aug. 13	5.55
" 14	5.55
" 15	5.55
" 16 Sunday	
" 17	5.65
" 18	5.65
" 19	5.65

Average week ending	
July 8	4.75
" 15	4.75
" 22	4.75
" 29	4.75
Aug. 5	4.75
" 12	5.55
" 19	5.60

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	....
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

Joplin, Missouri, zinc people expect a rise in this metal, as Europe supplies 66% of the world's total, this being cut off for the present.

TIN

The tin situation seems to be easier, as prices in New York, which were up to 65c., have dropped to 50c. per pound.

CYANIDE

There is little to add to last week's notes on this salt. Stocks are low, and the price is 25c. per pound. Roessler & Hasslacher are able to take care of all contracts in force, but cannot supply the entire American demand. They hope soon to receive a large supply by way of Belgium. The cyanamid company of Niagara Falls probably will be unable to supply any cyanide whatever.

Midyear Spelter Statistics

By C. E. SIEBENTHAL

Figures compiled by the United States Geological Survey, from reports by all zinc smelters operating during the first six months of 1914 show that the production of spelter from domestic ore in that period was 171,496 short tons and from foreign ore 3562 short tons, a total production of 175,058 tons, compared with 166,463 tons for the last half of 1913 and 180,213 tons for the first half. The spelter made in Illinois increased about 9000 tons, that made in Kansas declined about 8000 tons, and that made in Oklahoma increased about 5000 tons, compared with the quantities of spelter made in those states during the last six months of 1913. The stock of spelter held at smelters on June 30, 1914, was 64,039 tons, against 40,659 tons at the beginning of the year and 21,856 tons at the middle of 1913.

	Jan. 1 to June 30, 1913.	July 1 to Dec. 31, 1913.	Jan. 1 to June 30, 1914.
Supply:			
Stock at beginning.....	4,522	21,856	40,659
Production—			
From domestic ore....171,135		166,117	171,496
From foreign ore.....	9,078	346	3,562
Imports	5,533	567	506
Total available 190,268		188,886	216,223
Withdrawn:			
Foreign exports	8,724	4,672	2,048
Domestic exports	6,615	1,168	773
Stock at close.....	21,856	40,659	64,039
Total withdrawn	37,195	46,499	66,860
Apparent consumption 153,073		132,387	149,363
Spelter made in—			
Illinois	53,524	53,130	62,062
Kansas	42,645	31,461	23,737
Oklahoma	43,253	39,961	45,443
All other states.....	40,791	41,911	43,816
	180,213	166,463	175,058
Zinc ore imported	19,994	11,422	9,052
Zinc content	9,204	4,293	2,949
Zinc ore exported	9,745	7,968	8,042

From the foregoing figures and the records of the Bureau of Foreign and Domestic Commerce it is calculated that the apparent consumption for the period was 149,363 tons, which, compared with 132,387 tons for the last half of 1913 and 153,073 tons for the first half, seems not much below the normal.

The imports of spelter were 506 short tons, compared with 567 tons during the last half of 1913 and 5533 tons during the first half. The exports of spelter of domestic origin were 773 tons, against 1168 tons in the last half of 1913 and 6615 tons in the first half. The exports of spelter of foreign origin, including spelter exported from bonded warehouse, as well as articles manufactured from spelter of foreign origin and exported with benefit of drawback, were 2048 tons, compared with 4672 tons in the last half of 1913, and 8724 tons in the first half. The imports of zinc dust were 1272 tons, of which 269 tons came from Australia.

The imports of zinc ore were 9052 short tons, containing 2949 tons of zinc, compared with 11,422 tons of ore, containing 4293 tons of zinc, in the last half of 1913, and 19,994 tons of ore, containing 9204 tons of zinc, in the first half. Of the imports of zinc in ore in 1914, about three-fourths came from Canada. The exports of domestic zinc ore were 8042 tons, compared with 7968 tons in the last half of 1913 and 9745 tons in the first half.

The price of spelter at St. Louis started at 5.125c. and rose to a maximum of 5.35c. on February 4 and 5. A gradual decline, followed by a sharp break in April, brought the price down to 4.875c. on April 28. A slight recovery was again followed by a decline, and the period closed with spelter at 4.825c. per lb. The average St. Louis price for the first half of the year was 5.1c. The London price of spelter opened at £21 10s. a long ton (4.648c. per lb.) and reached the highest point in the latter part of January, at £21 12s. 6d. a long ton (4.675c. per lb.). The price was nearly stationary for the next five months, closing the period at the same figure at which it began, £21 10s. a long ton (4.648c. per lb.). The minimum price of the year, £21 5s. a long ton (4.594c. per lb.), prevailing during the latter part of June, was less than one-tenth of a cent below the highest price of the year.

At the average St. Louis price for the first six months of 1914 the value of the spelter from domestic ore was $17,492,592, and the value of the total output from both domestic and foreign ores was $17,855,916, compared with $17,608,402 and $17,645,078 for the last half of 1913 and with $20,193,930 and $21,265,134 for the first half of 1913.

COMPANY REPORTS

ORSK GOLDFIELDS, LIMITED

The dredging property operated by this Company is in the Orenburg district, Southern Urals, Russia, and the report is for the year to January 31, 1914. The Kolchan dredge worked from May 8 to November 13, 1913, handling 382,800 cu. yd. for £29,727. The Pokrovsky dredge worked from June 28 to November 13, 1913, handling 117,500 cu. yd. for £15,464. Tributers recovered £3740. The total gold yield was £48,933. Operating costs were £10,314, and the working profit was £36,533. Winter upkeep of the boats, royalty, etc., reduced this to £18,373. Depreciation and loan interest left a net profit of £680. During the current year the boats started on April 30 and 28, respectively. During June 1914 the two dredges treated 102,400 cu. yd. for £5311, and tributers £3316. Generally considered, the result for 1914 will be about the same as the previous term.

MOUNT MORGAN GOLD MINING COMPANY, LTD.

The financial year of this Australian company ended on May 31, 1914, and the annual meeting was held on July 17. The reports of the directors; general manager, B. Magnus; mines superintendent, A. A. Boyd; and works superintendent, J. W. Moule, contain the following information:

Work from the 363 to 950-ft. level totaled 4630 ft., of which only 17 ft. was at the lowest point. Lately the cost of development has been 68c. per ton of ore mined, compared with 24c. in normal times. Ore reserves amount to 1,211,000 tons of high grade, and 1,914,000 tons of low-grade copper material. A large amount of preparatory work was done during the year, and it was necessary to send concentrating ore to the smelter in preparing this ore for stoping. Conveyor-belts have proved a success in handling filling from the open-cut, and their use is to be extended underground. The fire in the Many Peaks property is under control. The smelter treated 303,428 tons of ore, including 60,075 tons of basic ore from the Many Peaks mine, yielding 18,957,120 lb. of copper and 102,848 oz. gold. Total revenue was £956,542; working costs, £3 per ton; expenditure, £680,190; surplus, £276,352; balance from 1912, £121,298; total available balance, £397,650; depreciation, maintenance, experiments, etc., £77,297; four divi

dends, £200,000, and surplus for current year, £120,353. Another dividend of £50,000 was paid on July 1. The reserve, contingent, insurance, and undivided profits total £360,989.

At the Company's coal mine the shaft is down 245 ft., and a tramway 1½ miles long is to be constructed.

ASSOCIATED GOLD MINES OF WESTERN AUSTRALIA, LIMITED

At Kalgoorlie, Western Australia, this Company owns 52 acres of mining property. The output to date is 1,514,953 tons of ore yielding 970,767 oz. gold worth £3,516,537, and £728,000 in dividends. Results during the past few years have been poor, those for 1913 showing 127,856 tons for £152,105, and £24,764 in dividends. The report of the general manager, D. F. McAulay, shows that development totaled 3959 ft., of which 1419 ft. was in unprofitable ground, and 316 ft. in ore over $4.80 per ton, the width of profitable ore being 63 in. There is nothing of value below No. 19 level, but there remains a large area of promising ground from that point to the surface. Malcolm Maclaren examined the mine during the year. It is impossible to estimate ore reserves in set quantities. Broken ore in reserve was 33,306 tons averaging $5.40 per ton. The dry-crushing, roasting, and cyanide plant treated 350 tons per day, averaging 3.78% sulphur, with 93.35% recovery. The bullion output was 35,804 oz. gold and 197 oz. silver.

SURFACE EQUIPMENT OF ASSOCIATED MINE, KALGOORLIE.

Costs were as follows: mine development, 50c.; mining, $1.82; treatment, $2.66; general, 17c.; insurance, 5c.; and disposal of bullion, 3c.; a total of $5.23. Development cost $16.70 per foot. Wages were increased somewhat, also fuel advanced 6c. per ton. The turbo-generator was stopped, and the Kalgoorlie Power & Lighting Corporation now supplies power for motors. Steam power cost $1.04 per ton of ore treated.

The Associated company is developing the Keeley and North Thompson mines near Porcupine, Ontario.

ZINC CORPORATION, LIMITED

This Company buys zinc-bearing tailing from certain mines at Broken Hill, New South Wales, and treats it by flotation methods; also, operates the South Blocks mine and mill. The flotation plant treated a total of 350,120 tons, including some from the Company's own mine, yielding 102,850 tons of zinc concentrate averaging 44.2% zinc, 12.5% lead, and 12.1 oz. silver per ton. This was further separated into 81,839 tons of zinc concentrate assaying 47.1% zinc, 7.7% lead, and 10.5 oz. silver; and 12,623 tons of lead concentrate containing 55.4% lead, 15.4% zinc, and 31.8 oz. silver. The Horwood selective flotation process produced 4580 tons of concentrate, which will treat 3442 tons of by-product slime from the zinc plant. The Horwood and Lyster processes are a success. The South Blocks mill treated 162,956 tons of ore, yielding 30,680 tons of concentrates assaying 66.2% lead, 6.4% zinc, and 9.27 oz. silver; and 36,536 tons of zinc tailing containing 15.6% zinc, 5.1% lead, and 1.9 oz. silver, which was sent to the flotation plant. Total revenue was £628,505, and profit £187,684, from which the preferential, and preference and ordinary shares received dividends of 20 and 30% respectively. The mine's reserves amount to 971,784 tons of 14.8% lead, 9.5% zinc, and 2.4 oz. silver ore.

MINING DECISIONS

UNFENCED SHAFTS—OWNERS NOT LIABLE FOR INJURIES

In a state where there is no legal requirement that shafts or pits upon mining claims be enclosed, the owner of live stock which have fallen into such unfenced shafts or pits while straying on the public domain, cannot recover damages for their loss against the owner of the mining claim.

Strong *v.* Brown (Idaho), 140 Pacific, 773. April 15, 1914.

MINING CONTRACT—SALE OF ALL MINERALS CONSTRUED

A contract of sale of all the oil, gas, coal, sulphur, and other minerals in and under a described tract, that may be found by drilling and mining operations which may be conducted on the land, is a valid contract of sale, which the purchaser may not destroy by failing to drill or mine. As between the purchasers the contract is joint and several, and each is liable for the contract price, and the vendor may sue all or any number for such price.

Whited *v.* Johnson (Texas), 167 Southwestern, 812. June 17, 1914.

LEASED MINE—LIABILITY OF OWNER

One who performed work on and furnished materials which benefited a mine, cannot recover from the owner on the theory of an implied contract, because the owner acquiesced in the furnishing of work and material where the mine was rented to a third person, and the owner could not object; but if the owner encouraged the doing of the work and the furnishing of material, or allowed it without objection, knowing that plaintiff was looking to him for payment, there is an implied contract.

Reynolds *v.* Norman (Colorado), 141 Pacific, 466. June 1, 1914.

LEASED MINE—WHEN NOT SUBJECT TO LIENS

The mere relation of lessor and lessee, where the lessee has an option to purchase, is not of itself sufficient to subject the lessor's interest in the property to a lien on a contract for materials furnished at the instance of the lessee. It must also appear that at the time the material was furnished, there was a mutual understanding that it was to be used in the improvement of the particular property to which a lien is sought to be attached therefor, and that the lessor knew that the materials so furnished were used or to be used for such purpose.

Milwaukee Gold Mining Co. *v.* Tompkins-Christy Hardware Co. (Colorado), 141 Pacific, 527.

FOREIGN MINING CORPORATIONS—ASSESSMENT WORK

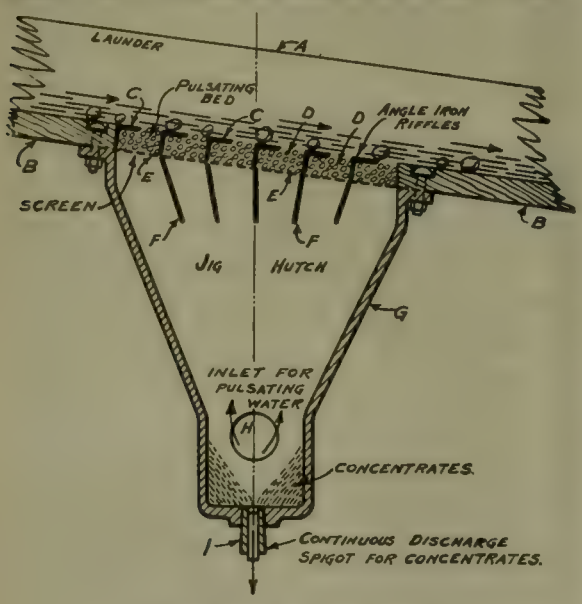
Where, under a state statute, a foreign corporation is required to file copies of its articles of incorporation, and designate a state agent before it can hold title to real estate, conveyances of mining claims to such a corporation prior to its filing such articles are invalid and vest no title. While an affidavit as to performance of annual assessment work is *prima facie* evidence of such performance, it is by no means conclusive and may be rebutted by a counter-showing that $100 worth of work was not done. Not even a showing that $100 was actually expended for that purpose is sufficient. There must be proof that the work was actually done and not merely paid for.

Dickens-West Mining Co. *v.* Crescent Mining & Milling Co. (Idaho), 141 Pacific, 566. June 2, 1914.

New Machines and Devices

The Richards Pulsator Riffle

The Richards pulsator riffle is the result of the application of an intermittent pulsating current of water to the Hungarian riffle, which will be recalled as that angle iron shaped riffle which has been so largely adopted in the working of placer deposits with sluice-boxes and also used on gold-saving tables on dredges. The riffle consists of a series of standard angle irons usually $1\frac{1}{4}$ by $1\frac{1}{4}$ in. to $2\frac{1}{2}$ by $2\frac{1}{2}$ in., which are spaced at various distances, depending upon the character and amount of gravel to be treated. One leg of the angle is at right angles with the bottom of the sluice and the other leg is parallel with the bottom of the sluice. The present riffle with automatic discharge is obtained by apply-



LAUNDER WITH PULSATOR RIFFLE.

ing the pulsating current, which is the underlying principle of the Richards pulsator jig. The water pressure required is 7 lb., equivalent to a head of 16 ft. The quantity of water required is approximately 40 gal. per minute per sq. ft. of riffle surface. The only adjustment is the water-supply, which is controlled by an ordinary globe or gate valve in the water pipe.

The construction and operation of the pulsator riffle will be understood by reference to the accompanying diagram, where *A* is a suitable launder; *B*, bottom of launders; *C*, common angle iron riffles; *D*, openings between the angle iron riffles which may be $\frac{3}{8}$ in., $\frac{1}{4}$ in., or $\frac{1}{8}$ in., depending upon the size of gravel to be treated; *E*, a screen preferably of brass with openings to allow the passage of fine gold or mineral; *F*, guide plates inside of the jig hutch; *G*, the jig hutch which together with the guide plates is fastened to the under side of the launder or tables and under the screen; *H* is the inlet for the pulsating water current from the Richards pulsator valve; *I* is the spigot at the bottom of the jig hutch for discharging the gold particles or mineral concentrate. It is said that the riffle will not pack and therefore requires no clean-up, and has many other advantages over the Hungarian riffle. This device is made by the Denver Engineering Works Co., of Denver.

Commercial Paragraphs

Fort Wayne Electric Works of General Electric Co., recently published Bulletin No. 46203, which is devoted to single-phase watthour meters. The type K5 meter shown in this bulletin has several features novel to this type.

The B. F. Goodrich Co., Akron, Ohio, is manufacturing a rubber bucket that will stand alone. The bucket holds $2\frac{1}{2}$ gal. water and when not in use folds up to about $\frac{1}{2}$ inch in thickness. It has a strainer spout with no springs or metal parts.

Eberbach & Son Co., Ann Arbor, Michigan, has recently placed upon the market a recording jolly spiral spring balance. The balance was devised by Edward H. Kraus, of the University of Michigan, and is claimed to be especially well adapted for the rapid and accurate determination of the specific gravity of solids such as minerals, rocks, and coals.

National Tube Co., Pittsburgh, Pennsylvania, has for distribution the second edition of Bulletin No. 134, which contains a large amount of information regarding the various types of N. T. C. iron body and brass mounted wedge gate valves. The bulletin is fully illustrated with both halftones and line drawings showing details of construction and operation.

Busch-Sulzer Bros.-Diesel Engine Co., of St. Louis, with Pacific Coast agency in the Rialto building, San Francisco, California, will be pleased to distribute reprints of an address by Mr. Diesel before the American Society of Mechanical Engineers on 'The Present Status of the Diesel Engine in Europe' and a few reminiscences of the pioneer work in America.

The Terry Steam Turbine Co., Hartford, Connecticut, announces the appointment of Fidanque Bros. & Sons, of New York and Panama, with main office at 15 Whitehall street, New York, as representative for the Republic of Panama and the Canal Zone. The Cleveland office of this Company has been moved from 710 New England building to 503 Union building.

The Maas patent drill-hole compass, for which E. E. White of Ishpeming, Michigan, is agent, it is claimed can be used in the survey of drill-holes for both direction and inclination to a depth of 3000 ft. The compass is placed in a thermos bottle or glass tube with hot liquid gelatin and lowered in a water-tight phosphor-bronze case with a tube containing hydrofluoric acid. When the gelatin is cold the rods are removed and readings taken.

The Lunkenheimer Co., Cincinnati, Ohio, has recently issued a brochure entitled, 'Grinding,' in which the subject of grinding as applied to valves is fully described and illustrated. Many years ago, before it was realized that the life of a valve could be prolonged by regrinding when the seating surface was worn, a valve that was not tight or as near as was possible to make it, was replaced with a new one. The expense was considerable and created a great deal of dissatisfaction. Valves furnished with seating surfaces which are capable of being reground have resulted, and it is to this subject of regrinding valves that this little brochure is devoted.

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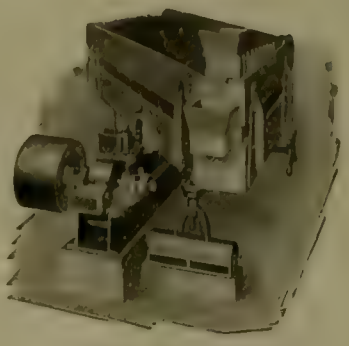

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INC. JULY 1912

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EDITORIAL

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SILVER is reported to have been sold in considerable quantities in New York, August 22, at 56 cents per ounce, that price being determined by a London quotation made August 21, the first 'official' quotation since the war opened.

FORTY-NINERS and their immediate successors will recall the 'Miner's Ten Commandments' mentioned in our letter from Angels, but to many they will be new. This early decalogue was written by James M. Hutchings and was first published in the *Placerville Herald* in 1853. It is a characteristic expression of the humor and philosophy of the men who dug gold from the sunny gravel beds of the new Eldorado and is well worthy of preservation. Last year Mr. Charles E. Hewes, of Murphy, California, sent us a copy which we are glad to reproduce in connection with the account of the Loring dinner.

CONFUSION has arisen because of identity of names, between Mr. James A. Barr, manager of the phosphate rock department of the International Agricultural Corporation and living at Mt. Pleasant, Tennessee, and the Mr. James A. Barr who is chief of the Convention Bureau of the Panama-Pacific Exposition. The Mr. Barr who lives in Tennessee, and will be remembered as the author of 'Testing for Metallurgical Processes,' a highly useful little book, has no intention of leaving his regular professional work even to father conventions at San Francisco; an important bit of work that the other Mr. Barr is performing admirably.

PASSAGE of the act permitting transfer to American register of American owned foreign boats may help to relieve the ocean freight situation, but is at best a makeshift. Our whole system of navigation laws must be rewritten if we are to compete for the carrying trade of the world. In such minor matters as boiler inspection we are placed at a serious disadvantage without any apparent corresponding increase in safety, and back of it all is the fundamental fact that American men and money are in normal times worth more on the land than the sea. Such problems are not to be hastily solved by emergency legislation, though even a little help in such times as the present is welcome. If ownership rather than flag be the test, the American merchant marine is now third, if not second.

WITH the gradual readjustment of market conditions many of the mines which suspended operations with the beginning of hostilities in Europe are again producing. Reports from Idaho and Utah are extremely optimistic and the production of silver, lead, and zinc is again almost normal. While the copper situation has not been determined, the position of zinc has been strengthened and lead and silver are in a much better position than they were ten days ago.

CYANIDE conditions in the United States are still bad and it is not yet apparent from whence an adequate supply of the salt is to come. The plant at Perth Amboy is running full capacity but is hardly likely to be able to carry the full load, besides which the supply of raw materials may become difficult. Large shipments of cyanide ordered by various firms shortly before the outbreak of the war may still come through, and while the excess carbon and calcium carbide will interfere with the use of cyanamid, it may still be possible to use that salt, of which there is an abundant supply, in special situations. It happens that arrangements were under way to manufacture cyanide from cyanamid when the war broke out. The right to use the necessary patents had been secured and the machinery was in Berlin ready for shipment. It is just possible that it may still come through. However, for the present there is a sufficient supply, and care and forethought may be depended upon to make the best of the situation. It is hardly likely that the shortage will, in the end, be as serious as was at first feared.

GRINDING pans, except in Australia, have not received the attention that they merit as machines for the part or complete reduction of ores preliminary to cyaniding or other treatment. The real merits of the pan were brought out at Kalgoorlie, where a large number are in operation in stage crushing of ores or sliming pulp and are giving every satisfaction. Pans are used in Broken Hill, where the object is not to slime the blende and galena, but to grind it preliminary to further concentration. A few metallurgists in other parts of the world have studied pans, and have found them to give good results; but while somewhat surprised at their work in Australia, others have held to the belief that the tube-mill is the right machine for fine grinding. During the past year there have been several articles

and discussions on grinding pans in the *Press*, which have attracted wide attention. One of the most interesting of the different types of pans in use is the Freeman, devised at the Great Fingall mine, Western Australia, and in favor also at the Sons of Gwalia, Lake View & Star, and other mines. It is of the standard size of five feet diameter, and about 30 inches deep, provided with dies on the inside bottom, and shoes on a revolving gear-driven muller. The speed is necessarily adjusted from experience with any particular ore, but between 50 and 60 revolutions per minute is generally desirable. The pan is centre-fed and has a classifying action, centrifugal force throwing the heavier and larger particles to the outside. About half way up one side of the body a three-inch pipe is fitted, this extending half way to the centre of the pan, ending with a short bend. The function of this pipe is to take off pulp of the grade desired. Particles of ore travel inward as they decrease in size, finally reaching the proper part of the pan for discharge. The pipe may, of course, be arranged to take the pulp at any point across from the periphery to the muller yoke; this depending on what grade of material is required. So far, in Western Australia, the Freeman pan has been used in stage crushing such as the following: five 1200-pound stamps crushing a fairly hard ore through about six to eight-mesh screens (a duty of 8.47 tons per stamp day in 1913), the pulp flowing to one Freeman pan, which only allows one product to escape by the pipe classifier. This product goes to Wilfley tables, is further classified, and the coarse material is finally ground in tube-mills with more concentration. As an intermediate grinder, such as described, this pan does excellent work. Shoes and dies last only from 20 to 30 days; but considering the work done, this is not excessive. The cost of preliminary grinding at the Lake View & Star mill in 1913 was 18 cents per ton of ore milled, stamping being 31 cents and tube-milling the same. An investigation into the working of this pan may prove beneficial to millmen in this country.

BUTTE AND LEAD—A CONTRAST

Most interesting comparisons and contrasts are suggested by the accounts of the hearings of the Commission on Industrial Relations at Lead, South Dakota, and Butte, Montana. In the one district no man can obtain employment from the principal company, the Homestake Gold Mining Company, unless he signs an agreement not to belong to the labor union; at Butte he cannot work for the Anaconda Copper Company unless he can show a union card. What the Commission thought of Lead after studying the situation was summed up by one of its members, Mr. John R. Commons, in the following well deserved compliment paid Mr. T. J. Grier, the manager:

"You have here the most remarkable business organization that I have ever come across in this country. You have developed welfare features which are beyond anything that I know of, and they are given with a liberal hand. You have a high scale of wages and reasonable hours—very fair hours. There has been evidently great progress made in taking care of the employees in the hospital service, and you have taken care of the cost of living, have kept it down below what employees in other communities have been forced to pay. You have practically been able by your great strength here as a huge corporation, dominating the whole community, to look out for the welfare of your employees, and to bring in an admirable class of citizens. It seems also that you are influential in politics, that you secure a good class of officials and that you have secured the enforcement of law, the reduction of immorality. It seems also that you make an effort to build up the religious life of the community and that your policy is broad and liberal in all respects. I take it also, that this policy depends solely upon your personality. Such inquiries as I have made here indicate that in all cases the stockholders leave all these matters to you personally, and that this broad policy has been carried out by you on your own initiative, and that you have felt that it was necessary, for the good of the community, the securing a fine class of labor here, which you have undoubtedly done, that you should hold the reins pretty tight on this community."

At first the Commission was inclined to blame the companies both at Lead and Butte for requiring seven days work per week, but its members soon satisfied themselves that this was at the wish of the men and involved no real hardship. The hospital service, costing the men the same amount at both places, was found to be superior at Lead, in that not only the men but their families are cared for, there is a medical inspection service, and all physical ailments are treated. At Butte tuberculosis is reported to be prevalent among the miners and is not treated by the hospital doctors, though the Company is spending large sums of money to improve ventilation and other working conditions.

At Butte, as is well known, the companies and the Western Federation of Miners have operated under a closed-shop agreement that became practically an alliance. Wages have been paid on a sliding scale governed by the price of copper, but the unworkable character of the contract is shown by the fact that, while since the system was started the companies have increased wages when copper was high, they have not, in general, decreased them when the price of metal went down, except for long periods. On the other hand, the men complain that the present wage scale represents an increase of but 7 per cent in 36 years, while in the meantime the plumbers, carpenters, and other workmen at Butte have increased wages to more than twice as much per day as the miners. The agreement between the union and the companies at Butte has secured to the latter a steady supply of laborers, while operations elsewhere have been interrupted by strikes, and the workmen of Butte have constituted an unfailing source of supply for funds

wherewith to finance strikes called by the Western Federation in other districts. Despite repeated failures these assessments were kept up until the Butte miners rose in a spectacular revolt and drove out the officials of the Federation. A new local union of 6000 or 7000 men, has been formed and it apparently dominates the situation. There have been various charges and counter charges, and public sympathy with the new organization has been modified by the fact that among its leaders, if not dominant in it, are men who are of I. W. W. affiliations. Among the charges brought out in the recent hearing was the one that the old Butte Miners Union was really dominated by the Anaconda company and that it was impossible for the men in general to control its course because of the dominance of a corrupt ring which was in turn dominated by the Company. Evidently the mine operators in Butte can find little cause for self-congratulation in having profited for a time by a course of action which gave them peace though it worked to the disadvantage of operators elsewhere. Evidently, also, the excellent results achieved at Lead are to be largely ascribed to Mr. Grier as an individual. The two cases reinforce the old observation that a benevolent absolutism gives the best government when the right man is in charge, while the most democratic form of government does not secure good conditions when control falls into the hands of a small ring concerned mainly with self-advancement. Our own sympathies are with the system of trade agreements, though we would not want to recommend any agreement with the Western Federation as we have known it. Mine operators, we believe, are not adverse to dealing with unions; indeed, at Homestake the men are organized, but they have been unfortunate in having had to deal with a union dominated by men and methods that cannot be defended.

In conclusion, lest we be misunderstood, let us reiterate our own views. It is a fundamental right of workingmen to organize to further their own interests. The modern employer is a powerful aggregation of units, in dealing with which the individual employee is at a disadvantage. In dealing with a corporate employer, the employees should be able to represent themselves as an aggregate body, so that there may be some parity between the forces involved. The specifying by a mining company that no man may be employed by it unless he be a member of such an organization, though undoubtedly legal, is as contrary to social justice as the specifying that no member of any organization will be employed, or the refusing to recognize any employee as representing anyone or anything except himself as an individual. The right line of action is that followed by the management of the Homestake mine in encouraging its employees to form an organization, officered by respectworthy men, that might adequately represent them in dealing with their corporate employer. Individual workers in dealing with million-dollar corporations are no more effective than painted warriors on a beach shaking spears at a visiting battleship. It has now been clearly established that great corporations are not above the law, when it is equally clearly established that organizations of workingmen are also not above the law a long step will have been taken toward the quieting of the present social interest.

THE STATE GEOLOGISTS

The excellent practice of getting together in the field is receiving a further impetus this week in a meeting of the American Association of State Geologists in the Lake Superior country. The party was to assemble at Houghton, Michigan, on Thursday and to see the copper country under the competent guidance of Messrs. L. L. Hubbard and W. E. Hopper. The Michigan iron ranges were later to be inspected with Messrs. C. K. Leith and E. E. White as guides, and finally Mr. F. B. Taylor is to explain the glacial geology about Mackinac Island and St. Ignace. Next Tuesday the state geologists will join the members of the Lake Superior Institute of Mining Engineers in a trip by special steamer to Detroit. Last year, it will be recalled, the Association made a similar excursion along the Mississippi south of St. Louis, examining critical exposures in Missouri and Illinois. Such field conferences smooth out many a controversy, and it would be good economy for every state to require its official geologist to attend each meeting. The Association is finding a constantly increasing field of usefulness. It was the outgrowth of an earlier and smaller body called the Mississippi Valley Association of State Geologists, which was organized at a conference held at the Quadrangle Club in Chicago early in 1906. The director of the then newly created State Geological Survey of Illinois, when entering on his duties, felt the need of the advice of his more experienced confreres, and invited them to lunch. Then, there being more than three Americans together, there resulted a president, vice-president, and secretary, and so the Association was born. Later this gave place to the larger organization, which has formed a convenient medium for conference not only between state geologists, but as between them and the officers of the United States Geological Survey. It has mainly considered problems of administration and methods of work, but the later disposition to take up matters of correlation and nomenclature is to be commended, since, without disposition to criticise the excellent work of the United States Geological Survey, it may fairly be said that it is good for the country and for the science of geology in America, to develop a strong and independent body of opinion on professional matters. The great majority of the American states maintain geological surveys of some sort. They differ in character, duties, and strength, but all are concerned with applying geology to public uses, and mining men will save themselves much useless work if they will become familiar with what the state geologist has already learned, when they undertake investigations in new territory.

As It Looks in London

By T. A. RICKARD

*The statement made by Sir Edward Grey on Monday was a superb expression of Great Britain's attitude and prepared us for the inevitable ultimatum to Germany, whose brutal violation of Belgian neutrality left this country no possible course but to respond to the Belgian appeal. Last night England declared war. Personally, I hate the necessity for participating in this organized murder, I deplore the reversion to barbarism, and the destruction to civilized ways of living, but this country can do nothing else. And as it must be done, let it be well done.

My chauffeur is a military reservist; last night he was called to arms; I have offered my car to the Government. It may be of use in expediting the movements of officers. Our Mining Club was animated today by the discussion of means for organizing a volunteer corps. Undoubtedly a considerable number of professional mining men will offer their services, and it is thought desirable that they should be in the same company.

Just now we are hearing more of the distress among tourists than of the horrors of the battlefield. However, it is no laughing matter. This happens to be the height of the tourist season, and the number of Americans stranded in London is astonishing. Their troubles call for sympathy, but they are fortunate as compared with those that were unable to escape from the arena of warfare. I have met two or three men who were among the last to cross France or Germany in an effort to reach London, and the stories they tell suggest that those who are still there must be in a sad plight. H. C. Hoover, Edgar Rickard, and other friends of ours have taken organized measures to furnish assistance. As the banks are closed until Friday, it is next to impossible to get currency or to cash letters of credit. Meanwhile, the army of belated travelers is increased by the withdrawal of several steamers previously announced as sailing tomorrow, Friday, or Saturday. One man who had engaged a $5000 suite of rooms on a crack liner has been glad to get a berth in the second-class of the *Virginian*, scheduled to leave for Canada on Friday. R. W. Brock, Deputy Minister for Mines for Canada, deems himself lucky to have a second-class berth on the same steamer. The prompt action of the New York bankers and the President in sending $1,500,000 and the cruiser *Tennessee* will be intensely appreciated. It is estimated that 80,000 Americans are stranded in Europe, of whom fully 30,000 are in London. One of them, anyway, has volunteered in Britain's cause. Another tells me that the Germans will soon be throwing bombs into London, so, on my advice, he is going to the Cornish coast for safety, the granite cliffs on that side of the island offering an inhospitable aspect to an enemy.

Meanwhile, the temper of the people is fine. The soldiers going to mobilization are cheered, but there is no frothy vaporing of words. "England expects that every man this day will do his duty." Nelson's message lives yet and rings in the ears of his countrymen, from the Jack tar to Sir John Jellicoe, appointed yesterday to the supreme command of the home fleets. This appointment, and that of Sir John French to the military command, have given general satisfaction. It is a sad coincidence that two other Johns, both known in their time as 'Honest John,' have resigned from the cabinet. I refer to Lord Morley and Mr. John Burns. They disagreed with the policy of Mr. Asquith and his coadjutors. And these two worthy men represent the small but thoughtful minority unalterably opposed to war. They are pacifists of the impracticable type, like your Mr. Bryan.

August 5, 1914.

The Institution of Mining and Metallurgy has called for volunteers, and the War Office has expressed its appreciation of this offer. On the first day after the circular was issued by the secretary, over 150 enlisted, and among them are three well known Anglo-American engineers: J. Power Hutchins, Peter Nissen, and C. S Herzig. To be accurate, Mr. Nissen is a Canadian, but he is regarded here as one of the clever and energetic American group of technical men.

A friend of mine present in the House of Commons on Thursday afternoon tells me that Asquith's statement of the diplomatic negotiations immediately preceding the rupture was intensively impressive. With his white hair, his clear-cut features, and beautiful enunciation, he told the story quietly, without any expression of rancor, and the House listened in dead silence until he came to the proposal made by Germany that England should betray France and acquiesce in the violation of Belgian neutrality, on the promise that she herself would not be molested. When he called that "an infamous proposal" there was a response that showed that all parties were of one mind. As the Prime Minister said: We are fighting to "fulfill a solemn international obligation—an obligation which, if it had been entered into between private persons in the ordinary concerns of life, would have been regarded as an obligation not only of law but of honor, which no self-respecting man could possibly have repudiated." We are fighting also to "vindicate the principle that small nationalities are not to be crushed, in defiance of international good faith, by the arbitrary will of a strong and overmastering power."

August 7.

*In this and succeeding letters, the *Press* will print extracts from Mr. Rickard's personal letters from London, believing that an account of the war as seen by a mining man in that great centre will be of interest to mining men everywhere. Mr. Rickard is an Englishman who was born in Italy, passed his early boyhood in Russia, managed mines in France and Australia, and lived in the United States more than twenty years. His sympathies are naturally with the Allies, but he will endeavor to be as impartial as he may.

CAMEL TRAIN ON THE ROAD TO MARBLE BAR, WESTERN AUSTRALIA.

Northwestern Australia and Its Mineral Resources

By A. W. ALLEN

The Pilbarra and West Pilbarra goldfields, in the 'Nor' West' of Australia, account for some 50,000 of the million or so square miles covered by the western state. The 'Nor' West' occupies an intermediate position between the moister areas farther north and the more temperate regions farther south. Of natural beauty it has little or none, and the scarcity of vegetation makes a breeze in summer, which in similar latitudes elsewhere might be refreshing and welcome, seem like the blast from a furnace. In winter the climate leaves little to be desired, although the lack of water and almost entire absence of vegetation gives the country an uninviting aspect. Rain occurs in periodic downpours of short duration and over a very limited season. The only trees of any kind are found near the river beds or alongside water courses. There is no running water in this part of the state, but artesian bores are proving the fact that water is obtainable at depth, and this circumstance will tend to foster a pastoral industry which has hitherto suffered considerably from the effects of drought.

The Pilbarra fields are not without historical interest, since the district was among the earliest to produce gold, and mining was carried on for several years before the Coolgardie and Kalgoorlie fields were developed. The isolated position of the 'Nor' West,' the problem of transport, and the depressing summer climate, all contributed to delay its development. The chief township, Marble Bar, is situated some 75 miles from the nearest port, and, until recently, transport from the capital of the state was by means of steamer from Fremantle to Port Hedland and from thence inland by coach or other conveyance. The country is exceptionally flat, but there are long stretches of sandy waste which make locomotion by any means a tedious business. Of late a railway has been built from Port Hedland to various small townships inland, but in the earlier days the difficulties of transport were, in a measure, overcome by the use of camels. These animals are well able to stand the rigors of an arid region, and although slow in movement, they are able to manage, under pack load, a much longer stretch at one time than either the horse or mule. The camel 'pad,' generally off the main road, makes an ideal

COONGAN RIVER, MARBLE BAR DISTRICT, WESTERN AUSTRALIA.

cycle track. The camels are owned and driven by Afghans whose repugnance, based on religious scruples, to anything in the nature of pork is well known; and they not only refuse to touch it, but will not allow their camels to carry it. In an instance which came under my notice a party of prospectors inland ordered a side of bacon from Port Hedland and gave detailed instructions that it should be packed in the centre of a bag of flour so as to escape detection by the Afghans. They had not calculated on the prevailing temperature, however, and a spot of grease showing on the side of the sack aroused the suspicions of the Afghans when they were several days out. A jack-knife applied to the sack soon turned suspicion into proof and the whole cargo was immediately dumped alongside the road. The Afghans and their camels then returned to Port Hedland, and successfully disclaimed any responsibility in connection with the loss to the prospectors.

In climate the 'Nor' West' is certainly a district of extremes. The air is abnormally dry and a water bag is a constant companion, night or day. Luckily it works ideally in such a climate so that a cool drink is always available. When rain comes it makes up for lost time in a few minutes, and as much as 30 inches has been recorded in one shower. From December to March the district is visited by severe cyclones, the township of Port Hedland being in a belt of hurricanes which extends across Australia and occasionally play havoc at Townsville, on the east coast of Queensland. On such occasions a wind velocity of 120 miles per hour has been recorded; and in the earlier days at Port Hedland, before the houses were as substantially built as they are at present, it was customary to ensure against the removal of one's dwelling from one street to another at such times by the simple precaution of a chain stretched over the roof, which was affixed to a 'dead man' on each side of the house.

In a district where the atmosphere is entirely devoid of moisture for long stretches and where there is no shade to cool the air, the temperature may rise to an almost unbelievable figure. For obvious reasons I refrain from giving my own experiences or quoting the readings which I took from time to time of maximum shade temperature. I may say that the district held the palm, according to official reports, for the greatest number of consecutive days on which the shade temperature exceeded 100°F. During the season dealt with the number of such days in succession was 64. At such time the country is invaded with swarms of flies, similar to the common house flies. These little vermin positively attack one in their endeavors to get at any part of the face from which moisture may be sucked. So persistent are their efforts in this direction that they have literally to be wiped off. Fly nets attached to the hat are sometimes worn, but their adoption leads to much discomfort, and results in a feeling of suffocation to the wearer. As

an alternative to the net a number of corks are sometimes seen attached by small pieces of string to the brim of the hat. By perpetually wobbling the head the flies may be prevented from settling. This is a last resource however.

Local timber is used for fuel and mining purposes, but it is exceedingly scarce. The smaller 'mulga,' which is almost a scrub, is available, together with a small amount of eucalyptus. These woods are of high calorific value, but in view of scarcity are expensive for any purpose. There is little grass in the 'Nor' West' and feed for horses is almost exclusively confined to compressed fodder which is brought up, at great expense, from the south. Spinifex grass is to be found and the tired traveler who thinks it might form a comfortable cushion will be galvanized into new life if he uses it for the purpose. The spiny points have no difficulty in piercing the ordinary habiliments, and of going still further if given the least provocation.

Indigenous animal life is found in the emu, kangaroo, and dingoe. There are also quantities of the smaller varieties of the 'possum. Immense areas in the 'Nor' West' are used for sheep raising, but water is scarce and feed is of poor quality.

As a result of almost insurmountable difficulties mining has languished. Rich patches of auriferous quartz have been found in all parts, but the veins can only be worked when they carry high metal content. Operations are mostly confined to the oxidized zones, and several promising properties were dropped as soon as these were passed and a drop in recovery was indicated in following the simplest methods of treatment. The average yield from the Pilbarra field has been in the neighborhood of 2 oz. gold per ton milled and from this fact may be surmised expense of treatment and the difficulties of working generally.

In addition to gold, the 'Nor' West' possesses other mineral possibilities. There are immense iron deposits which in other places and in proximity to coal would be of considerable value. As it is they can hardly be called an asset. Copper is found throughout the field, and West Pilbarra contributes a large proportion of the output of this metal from the state. On the other hand, the general distribution of the metal throughout the 'Nor' West' has constituted one of the most serious drawbacks to simple cyanidation of the gold ores. Tantalum and asbestos are also found in small quantities, but the latter is too short a fibre, as yet, to be a commercially important asset.

At Nullagine an auriferous conglomerate, similar to the Rand banket, is in evidence. A mill was erected in the later nineties to treat this, but the yield proved too small to justify the continuance of operations.

Throughout the district there occurs iron stained seams of jasper. In places this approximates agate jasper in appearance and characteristics.

COPPIN'S GAP, MARBLE BAR DISTRICT, WESTERN AUSTRALIA.

Rejuvenating the Chloridizing Roast

By F. SOMMER SCHMIDT

At the Park City plant of the Mines Operating Co. the ore is delivered from the mine to a bin above the crusher, from which it discharges into a trommel with 1 and 1½-in. openings. The undersize passes through a revolving dryer, where the moisture is reduced to about 5%. The oversize of the trommel falls on a picking belt, where mine wood and waste are removed. It then passes through a No. 5 Gates gyratory crusher and, joining the dryer fines, is elevated to the crushed ore-bins of 400 tons capacity. Sections of this same bin are used for salt and coal. From these bins a mixture in the required proportions is delivered to the rolls, where it is crushed to ⅜ in. It is then elevated to the mix-bins above the roasters. The present scale of operations is about 150 tons per day, and all the crushing is done in 8 hours.

Roasting Department

There are 8 shaft roasters of the intermittent type, 10 by 10 ft. inside, and one continuous Holt-Dern roaster. The walls are reinforced concrete, 10 in. thick. There is a wood grate about two feet from the bottom, supporting a layer of coarse crushed rock. The space below the grate forms an air chamber. The grate supports the charge and distributes the air blast.

In starting the roaster, a mixture of one ton of coal-dust dampened with oil is spread over the gravel floor of the roaster and ignited. This is followed by a special mixture of ore, salt, and coal, richer in coal than the charge. The blast is then turned on and the roasting begins. When the layer is burning properly the air is cut off and a regular charge of 5 tons is added and spread by hand. When the roast has burned through this charge, a second charge of about 10 tons is added, and about 4 hours later a final charge of the same amount is added. This brings the total charge up to about 7 ft., which will roast through in from 8 to 12 hours.

When the roasting zone has reached the surface at all points, the air blast is shut off. The discharge door is opened and the hot roasted ore is sluiced out with mill solution under a 45-ft. head through a 1⅛-in. nozzle. The numerous small steam explosions makes it necessary to direct the stream with a rod from one side of the furnace. It takes from one to three hours to sluice out a roaster charge of 24 tons.

The new continuous Holt-Dern roaster has been in continuous operation for 6 months. The column of ore moves down as the roasting zone rises. The air blast travels in an opposite direction to the ore. The air blast coming in contact with the roasted ore becomes highly heated. It then passes through the roasting zone where combustion is taking place, whence it passes to the layer of moist unroasted ore above. It leaves the furnace cool and free from dust. Whatever loss there is in the process is due to the coarseness of the ore protecting the minerals from the chloridizing action of the furnace. It has been proved that this can be largely overcome by finer grinding.

Leaching Department

The sluiced roaster product passes to the leaching tanks. There are 6 of these 20 by 12-ft. tanks, having a capacity of about 135 tons each. In the bottom of each tank is a 12-in. round discharge hole for discharging the tailing. This is closed by a wooden plug having a 4 by 4-in. stem extending to the top of the tank. It is surrounded by a boxing provided at intervals with 12 by 12-in. sluice gates to regulate the rate of discharge. Four lines of 4-in. drain tile are laid in the bottom of the tank and cemented in position. This tile system connects at one end of the tank with a 3-in. wood pipe solution line. This line leads the solutions either to the silver tank or the weak-solution tank, depending upon the content. The weak-solution tank is used for further sluicing, while the silver tank solution is pumped over the precipitators.

The solution from the silver tank is first passed over the silver precipitator. This is an inclined cement runway covered with copper wire of various diameters and of short lengths. The silver and the small amount of gold is precipitated as a sponge which parts clean from the copper by simple agitation with brooms, the loosened silver being caught by a clean-up settling tank below. This precipitator reduces about 90% of the silver present in the solution. From the silver precipitator the solutions are passed through the iron boxes, which are similar to the zinc boxes of a cyanide mill. Here the solution, coming in contact with scrap iron, deposits the remaining silver, all the copper, and some of the lead. From these iron boxes the solution passes into the barren sump free from silver, gold, and copper.

Precipitating the Silver

The silver precipitate is allowed to settle in the clean-up tank, whence it is sluiced out into the filter-boxes and washed and dried. The silver in the precipitate is probably in the form of an oxide with some chloride and is in a rather flocculent form. In the bullion furnace impurities are slagged off and the silver obtained is in bright bars running 975 fine. The copper precipitate is cleaned from the iron with brushes, and when washed and dried is shipped in that form.

The object of the roast is to convert the metallic compounds to chlorides, in which form they are leachable. For this purpose common salt is added to the ore, forming about 8% of the charge. The amount of chlorine liberated depends not merely upon the amount of salt

added, but also upon the composition of the ore which causes the reactions. Thus the presence of sulphides and manganese in the ore is a great help to the chloridizing action. The reactions that take place in the furnace depend also upon the physical conditions such as fineness, moisture, and intensity of heat in the roast zone. The fuel is coal culm and forms about 2% of the mixture. This makes a very cheap fuel, costing only $1.96 per ton of fuel at the plant.

Acid Manufacture

There is no condensing tower at the plant at present, but should one be built the saving in cost of acid would be considerable. The cost of acid at present is about $1000 per month, and it would not be unreasonable to expect a saving of nearly all this amount if sulphide ores are available. The plant has actually run for months in the past on a more sulphurous ore without buying any acid. The presence of lime is not desirable, though small percentages can be handled. It uses up acid, but if there is enough sulphide present it may furnish sufficient sulphuric acid to compensate.

The mill solution that is used for leaching contains about 5 lb. of sulphuric acid per ton. There is also hydrochloric acid present, but this is a by-product of the leaching of the roasted mixture. No hydrochloric acid is added at any stage of the process. The main features of the process are chloridizing roast, sulphuric acid leaching, and precipitation on metallic copper and iron. The main improvements are in the roasting department and the favorable results are due to the following causes: The temperature of roasting is well controlled. The mixture is well disseminated and the mechanical features of grate bars, air chambers, and air blast, added to the proper composition of the charge, all conspire to give good results. The moisture in the ore is also a very important item, and this is carefully controlled at the dryer to give 5 per cent.

Types of Furnace

Of the two types of roasters in use at the plant, the new Holt-Dern type is the better, being an outgrowth of the old shaft type. It is continuous in operation, the roasting operation not being interrupted by either the feeding or tapping. There are movable grate bars operated by eccentrics. At regular intervals the mechanism is set in motion and the charge lowered a foot or two. The roasted product dropping out below is sluiced to one of the tanks. More charge is added at the top. The old type of furnace, on which all the present cost data given in this article were obtained, is completely shut down at the end of a roast and is entirely sluiced out. It requires the attention of several men in starting and also in sluicing and is completely shut down in starting and stopping and allowed to cool of necessity. The greater economy in the cost of operating this new furnace is apparent on slightest inspection. Added to this economy is the greater saving due to the fact that this furnace will handle a finer product which is amenable to chloridizing to a higher degree. The old type has been saving 78% of the silver and the Holt-Dern furnace will probably save over 90% with 10 mesh material. The extraction of the silver when once chloridized can be figured as 100 per cent.

About 50% of the present gold value is saved. More can be saved by adding lime chloride to the leaching tanks at a cost of 25c. per ton of ore, but as the present tailing is running just about that in value, the saving is not worth going after. Only a small amount of lead is saved, but there is only a small amount present. The saving could be increased by electrolytic precipitation if the return justified.

There is very little copper in the ore, but probably over 90% is saved. The Mines Operating Co. made a series of extraction tests on the small Holt-Dern furnace for a period of 5 weeks. The feed was the same as is at present employed in the mill, the coarseness being ⅜ in. For the period the extraction of silver made in the shaft type was 80.3, while with the H.-D. furnace it was 86.4. The percentage of salt in both types was 7.5 of the weight of the ore.

The advantages which this type of furnace has over other types are: No measurable volatilization loss of valuable metals; no dust loss; product is well adapted to leaching and sluicing, even when the ore contains considerable slime; requires only a low percentage of cheap fuel; high recovery without fine crushing; the roaster gases are cool and concentrated and easily condensed for leaching purposes.

The Holt-Dern Roaster

The Holt-Dern roaster is a new type of roaster introducing a number of attractive features, and the tests which have just been completed show that the furnace works as well metallurgically as it does mechanically. My investigations of the plant covered a little over a month's time, involving a trial run of 1500 tons. The data presented, I think, can be considered representative. This trial lasted 31 hours and treated 9.6 tons of ore crushed to pass a ¼-in. opening. The furnace is a small one, being constructed for the purpose of trying out the mechanical features. These have proved successful, and larger furnaces are now being designed.

Considering that the ore consists of stope fillings of the Ontario mine, its value runs surprisingly uniform, varying from 8 to 11 oz. silver from day to day. The ore is well adapted to chlorination with the exception of insufficient sulphur and occasional days of high lime, but is not adapted to any other process. The composition of the ore used in this test can be considered representative of the usual heads. The analysis is:

Ag, 9.52 oz.; Au, 0.029 oz.; Pb, 0.71%; Cu, 0.11%; SiO, 79.4%; insoluble, 83.9%; Zn, 0.57%; S, 1%; Fe, 7.9%; Mn, 0.89%; CaO, 1.20 per cent.

The silver is present partly as chloride and as a constituent of the galena and zincblende and tetrahedrite. The iron is mainly oxide and little pyrite. The manganese is in pyrolusite and CaO as limestone.

The composition of the 'mix' used was as follows:

	Per cent.	Figured without moisture.
Dry crude ore	83.4	87.2
Moisture	4.4	...
Salt	8.3	8.7
Coal dust	2.3	2.4
Pyrite, 70% pure	1.6	1.7
	100.0	100.0

This mix was roasted in the usual way, and the analysis of the product is as follows:

Au, 0.025 oz.; Ag, 9 oz.; Pb, 0.72%; Cu, 0.13%; SiO, 72.2%; insoluble, 75.8%; Zn, 0.95%; S, 0.7%; Fe, 7.3%; Mn, 0.93%; CaO, 0.73 per cent.

The silver is present as chloride, the gold one-half as trichloride, the lead as sulphate and chloride, the copper as oxide and chloride, the zinc as oxide and sulphate and chloride, the iron as oxide. The reduction in the CaO as shown by comparison between the crude and the roasted mix is possibly due to formation of insoluble silicate.

Loss of Weight in Roasting

From results obtained in an experimental roaster, it has been determined that the loss of weight sustained by the mix in roasting averages about 7%. The loss may be said to be the loss of weight of the coal, moisture, and one-half the salt. The percentage of sulphur is not much of an item. Using the factor of 93% of the weight and calculating the analysis from the crude heads for comparison with the above, we have:

Au, 0.027 oz.; Ag, 8.89 oz.; Pb, 0.67%; Cu, 0.11%; SiO, 74.5%; insoluble, 78.6%; Zn, 0.54%; Fe, 7.4%; Mn, 0.84%; and CaO. The sulphur naturally suffers reduction by volatilization.

It will be seen from this that there is no measurable volatilization of the silver or gold. As a further check, if the assumption is made that the SiO_2 is constant in weight, the relation of SiO_2 to Ag should remain constant with no volatilization. This calculation shows that in the crude ore 1 oz. silver corresponds to 8.34% SiO_2, while in the roasted mix 1 oz. silver corresponds to 8.20% SiO_2, which would indicate an actual increase in Ag, the error being due to cumulative inaccuracies and proving that there is no perceptible volatilization of the silver.

In order to determine the uniformity of the roast, 100-lb. samples were taken every 4 hours by cutting the discharge stream. Small samples of each of these were kept separate and a 24-hour leaching test was then made.

For this purpose 500 gm., without any further crushing, was leached in a percolator with solution leaving the iron boxes before regeneration with H_2SO_4. This solution has practically no free acid while there is a shortage of pyrite in the ore. The mill has run for months without adding any H_2SO_4 to this solution while there was pyrite available, but at present about 5 lb. per ton is being added.

Laboratory Tests

For the laboratory tests, in order to cut the mill practice time down from 48 to 24 hours, the amount of H_2SO_4 added was 10 lb. per ton. The solution contains about 27% NaCl. The temperature of solutions was about 62°C. In all the following leaching tests the extraction can be calculated direct on the roasted mixture to zero volatilization. Experiments were made to determine the loss in weight of the roasted mixture in leaching, and the results are as follows:

	Loss, %.
60-lb. sample	12.2
50-lb. sample	13.3
1000-oz. sample	12.0
	12.5

This average is 12.5, which can be checked by the comparison of the SiO_2 percentage in the roasted mix 72.2 and the leached tailing 83.2 giving a loss in weight of 13.2 per cent.

Extraction Test on Interval Samples

Interval.	Roasted mix, assay Ag.	Leached tail., assay Ag.	Extraction, %.
1	8.0	0.8	91.2
2	8.2	0.8	91.4
3	8.0	0.7	92.3
4	8.4	0.8	91.6
5	10.6	0.8	93.4
6	10.0	0.8	93.0
7	8.6	0.6	93.0
8	9.5	0.8	92.6
9	10.2	0.9	92.2
	9.06	0.78	92.4

These results show the extraction to be high and uniform and agree closely with numerous other tests as shown in the following.

Influence of Size of Particle

To obtain data on the best size for crushing, screen tests were:

Screen Test on Raw Mix

Size, mesh.	Weight, %.	Assay, Ag oz.	Value, %.
On 8	34.2	6.8	28.0
14	24.1	8.0	23.3
20	12.6	8.0	12.1
40	12.3	9.0	13.4
60	7.3	10.8	9.5
Through 60	9.5	12.0	13.8
	100.0	8.3	100.0
Composite		8.2	

Screen Test on the Roasted Mix

Size, mesh.	Weight, %.	Assay, Ag oz.	Value, %.
On 8	41.2	6.9	31.2
14	20.8	8.0	18.3
20	10.3	10.0	11.3
40	13.3	12.4	18.1
60	9.0	13.2	12.9
Through 60	5.4	13.6	8.1
	100.0	9.1	99.9

It will be noted that in the roasting the coarser sizes

have increased at the expense of the fine material. This is what would be expected from an inspection of the roasted product and is a very desirable result as an aid to subsequent leaching.

A leaching test was made on each one of these sizes separately, under conditions described above, to determine which size gave the best extraction.

LEACHING TEST OF SIZED PRODUCTS OF ROASTED MIX

Size, mesh.	Assay of tails., Ag oz.	Value, %.	Extraction, %.
On 8	0.80	45.9	89.8
14	0.80	23.2	91.2
20	0.60	8.6	94.7
40	0.60	11.1	95.7
60	0.60	7.5	96.0
Through 60	0.50	3.7	96.7
	0.72	100.0	92.3

It will be seen that while the fine sizes give the best extraction, the extraction on the coarser sizes is really higher than would have been expected.

A leaching test was made in a suitable filter-box to determine the relative velocity of leaching of the different sizes by interrupting the leaching action and making a screen test on the imperfect tailing. For this purpose the ordinary mill solution containing 22% NaCl and 5 lb. H_2SO_4 was used on a 60-lb. sample, leaching for 48 hours, but using only three times the weight of solution as compared to ore, instead of the usual mill practice of 6 solution to 1 of ore.

SCREEN TEST OF IMPERFECT TAILING

Size, mesh.	Ag assay.	Weight, %.	Value, %.	Extraction, %.
On 8	1.60	41.0	39.8	79.7
14	1.40	20.1	17.0	84.7
20	1.40	9.7	8.2	87.7
40	1.20	10.6	7.7	91.7
60	1.80	8.8	9.6	88.1
Through 60	3.00	9.7	17.6	80.7
	1.65	99.9	99.9	84.1
Composite	1.60			

These sizes were then leached separately for 24 hours, passing through 3 times the weight of solution to 1 of ore, making by this time a total of 6 solution to 1 of ore. The screening separation made at this stage of the leaching will not give the same results as if made after complete leaching, as shown in the following, and as this determines the percentage of value, this column must be considered with qualifications for the present.

LEACHING TEST ON SIZED PRODUCTS IMPERFECT TAILING

Size, mesh.	Ag assay.	Weight, %.	Value, %.	Extraction, %.
On 8	1.00	41.0	48.0	87.3
14	0.80	20.1	18.8	91.2
20	0.80	9.7	9.2	93.0
40	0.80	10.6	9.9	94.4
60	0.60	8.8	6.2	96.0
Through 60	0.70	9.7	7.9	95.5
	0.85	99.9	100.0	91.8

It will be noted that in the first stage of the leaching the coarser products were leached down to 1.8%, while the fine material still retains a value of 3.0%. The second leaching reduced the value of all sizes, but mainly the fine, which apparently resists the leaching most. This is logical and could have been predicted, but that the percentage of extraction on the coarser sizes should be so high is rather surprising. While the fine gives the highest per cent extraction, the difference is not enough to make good the expense of crushing finer and handling fine material in the mill.

One of the advantages of this roaster is the comparative ease with which it is possible to get an excellent physical constitution of the roasted ore for subsequent leaching. The gathering of fine material in roasting and its release only as the metal is leached out is well shown in the following experiment, in which 40 lb. was leached with the mill solution for 48 hours, duplicating mill conditions as nearly as possible:

A SCREEN TEST OF THE TAILING—PERFECT LEACH

Size, mesh.	Ag assay.	Weight, %.	Value, %.	Extraction, %.
On 8	0.80	36.8	38.0	89.8
14	0.60	22.2	17.1	93.4
20	1.00	9.1	11.8	91.2
40	0.80	10.1	10.4	94.4
60	0.80	6.3	6.5	94.7
Through 60	0.80	15.5	16.1	94.8
	0.77	100.0	99.9	92.6

The percentage of value in the fine in this test, 16.1, does not check that in the interrupted leaching test, and this discrepancy is not without reason. It will be seen that the percentage weight is the controlling factor in the distribution of value. In the crude ore mix the per cent of fine is 9.5; in the roasted mix, this is reduced to 5.4, showing the effect of gathering the fine particles. In the partly leached ore, some of the fine has been freed to the extent of 9.7%, while in the thoroughly leached mix it has been increased to 15.5%, thus containing 16.1% of the value of the metals.

An analysis of the tailing gave the following: Au, 0.005 oz.; Ag, 0.75 oz.; Pb, 0.41%; Cu, 0.06%; SiO, 83.2%; insoluble, 88.1%; Zn, 0.8%; S, 0.2%; Fe, 4.5%; Mn, 0.62%; CaO, 0.52%; chlorine, none.

The gold and silver are present as metallics or included in undecomposed sulphides; the Cu as silicate and undecomposed tetrahedrite; the Pb and Zn as sulphate; the Mn as oxide; and the CaO as sulphate.

It will be seen from the low tenor of copper in this ore that it is extremely difficult to get sufficiently accurate determinations for close figures on extraction, but it may be said that operations on Cu ores of better defined content gave extractions between 90 and 95% of the copper.

The mill solutions contain 8 lb. of metallic lead per ton, the profitable extraction of which has not yet been worked out. The lead is in the form of chloride. When removed from solution, more of the lead takes its place as far as the capacity of the mill solutions for containing this Pb compound permits.

While this ore is not in the least refractory to chlorination, there is no reason why more complicated ores cannot be treated to good advantage with this furnace, and it is my opinion that with a cheap and highly efficient chloridizing roaster of this kind the big field will be in the treatment of copper ores.

Any furnace that can make a chloridizing roast to yield an extraction of 92% and do this at a cost of 24c. per ton in a 10-ton unit, and do this for 16½c. per ton in a 35-ton unit, has to be reckoned as a valuable development in the field of metallurgy.

Cost Data

The following is a comparison of the cost of operating the two types of furnaces, but does not include salt, which item will probably be a little less in the H.-D. than in the shaft type:

Cost per Ton of Ore Roasted

	Shaft type.	H.-D.
Labor	$0.380	$0.054
Power	0.049	0.045
Repairs	0.026	0.020
Starting oil	0.038	.....
Coal-dust	0.046	0.046
Total	$0.539	$0.165

The great item in the saving is in the labor. In the new furnace one roaster man and one sluice man can handle 200 tons where with the present furnaces it requires 3 men and 2 sluicers.

Cost Data for Typical Month with Present Equipment
(Tonnage treated, 4356)

Department.		Total.	Per cent of total.	Remodeled.
Crushing:				
Labor	$0.083			
Power	0.020			
Supplies	0.050	$0.153	7.0	$0.153
Drying:				
Labor	$0.029			
Power	0.013			
Coal, etc.	0.050	0.092	4.0	0.092
Rolling and Mixing:				
Labor	$0.114			
Power	0.015			
Supplies	0.034	0.163	7.2	0.250[1]
Roasting:				
Labor	$0.371			
Power	0.053			
Supplies	0.088			
Coal	0.038			
Salt	0.350	0.900	40.1	0.540[2]
Leaching:				
Labor	$0.144			
Power	0.028			
Supplies	0.071			
Acid	0.217	0.460	20.5	0.360[3]
Tailing discharge:				
Labor	$0.037			
Power	0.005			
Supplies	0.019	0.061	2.7	0.061
Clean-up:				
Labor	$0.039			
Supplies	0.002	0.041	1.8	0.041
Assay:				
Labor	$0.010			
Power	0.001			
Product assay	0.004	0.015	0.7	0.015
General expense		0.357	16.0	0.357[4]
		$2.242	100.0	$1.869

[1]Finer grinding. [2]Saving in labor, starting oil, repairs. [3]Saving in half the acid estimated. [4]Includes royalty but not depreciation.

In the cost data quoted the improved conditions referred to mean finer crushing, to 10 mesh, employment of H.-D. roasters, employment of condensing tower for making acid which is now being bought, and access to bodies of sulphide ore.

The cost of crushing is high, due to the fact that this is part of the old Ontario mill equipment. The dryer is an old one of poor design and is too small for the work.

Grade of Ore That May Be Treated

Determination of no-profit grade of ore under present and hypothetical conditions:

Under present conditions the mining cost will be assumed as $1.40, silver figured at 55c. an ounce, and the copper, lead, and gold recovered pay for the marketing of the silver.

With the present plant and present ore, the no-profit grade is, with an extraction of 78%, 8.7 ounces.

With the improved plant, finer grinding, H.-D. roasters making half the acid used and paying royalty, the no-profit grade is, with an extraction of 90%, 6.60 ounces.

With improved plant as per above, eliminating royalty of 17.1c. per ton, the milling cost would be $1.698, the no-profit grade, with an extraction of 90%, 6.26 ounces.

Auto-traction drill rigs are said to give satisfactory service and are coming into more general use. One of these machines was recently used by an Eastern contractor in excavating rock on a power-house contract, near Turner's falls, on the Connecticut river. The work consisted in drilling 30-ft. holes in a broken sandstone formation, 10 ft. apart. The machine had a 5-in. cylinder, 8½-in. stroke, and a 10-ft. run. Four or five holes per day were put down with this outfit, the best day's work being 210 ft., or seven 30-ft. holes in 10 hours' time, according to the Sullivan Machinery Co. of Chicago. On an adjoining contract, in similar formation, the average work done with churn or well drills of the ordinary type was two holes per day. Of course, the churn-drill holes were larger in diameter, permitting the use of a larger quantity of powder in the bottom of the hole; but excellent blasting effects were secured with the auto-traction drill-holes by springing or chambering the hole before the final blast was exploded.

Gold output of mines in the Dutch East Indies in 1913 was as follows: Ketahoen (Sumatra), $166,000; Paleleh (Celebes), $346,000; Redjang Lebong (Sumatra), $970,000; Simau (Sumatra), $840,000; and Totok (Celebes), $221,000; a total of $2,543,000, against $2,760,000. A dividend of 15% was paid by the Redjang Lebong, and 20% by the Simau. Tin output of the islands of Banka and Billiton was 17,345 tons, compared with 17,202 tons in 1912. Coal output of the government mines at Ombilien (Sumatra) was 411,082 tons. A coal mine has been purchased by the government of the Indies in southeast Borneo containing 147,000,000 tons.

The Plymouth Mill, Amador County, California

By AN OCCASIONAL CONTRIBUTOR

HEAD-FRAME AND ORE-BINS.

On August 1 the new 30-stamp mill of the Plymouth Consolidated Gold Mines, Ltd., was placed in operation and has been running continuously ever since.

Ore from the mine is hoisted to a two-story hopper, the upper part being used for waste, and the lower for ore. From the latter the ore is fed to a No. 5 Gates gyratory crusher, the discharge of which falls on an 18-in. belt-conveyor which conveys the ore for a distance of 630 ft. to the top of the mill. The maximum slope of the conveyor is 21°15′. Another conveyor distributes the ore over the 1400-ton bin by means of a traveling tripper. The mill is situated at the top of a hill which affords ample mill head and storage for the tailing.

From the orebin, the ore is fed by a Challenge machine to 30 stamps of 1250 lb. weight. The stamps are crushing to ¼-in. size, and so far have given a duty of 14 tons per stamp per 24 hours, which capacity can be easily increased. Only 20 stamps are being used at present, 10 being kept in reserve. This makes it possible to make repairs to the stamps without curtailing the crushing capacity of the mill.

The discharge of all the stamps goes to a distributing box and automatic sampler, from where the coarse material is fed by Caldecott cones and settling cones to two 8 ft. by 22-in. Hardinge mills. The overflow of the cone and the discharge of the mills flows to 10 amalgamating plates 6 by 12 ft. in size. The plate tailing passes through amalgam traps, and is elevated by a 36 ft. bucket elevator to a sloughing off cone. The overflow of the cone goes to the slime vanners, and the discharge of the cone passes over a Richard hindering settling classifier which feeds two No. 6 Wilfley tables. The overflow of the classifier goes to the coarse vanners.

There are 30 Isbell vanners in the plant. Six of them work on fine sand, and 24 work on slime. The Wilfley tables are handling about 35 tons each. The feed to the vanners is automatically distributed by a series of distributing barrels, which cause an equal feed to all vanners, even when some of these are cut out for repairs.

Quicksilver is fed to the Hardinge mills, in which about 66⅔% of the total amalgamation takes place. Most of the amalgam remains in the Hardinge mill forming a coating of amalgam in between the pebbles, and this amalgam can be easily removed without emptying the Hardinge mills.

All the clean-ups of the mill, and the middling of the Wilfley table are returned to the Hardinge mills, and it is possible also to return the coarse tailing of the Wilfley for regrinding whenever this is warranted by the grade of the ore.

This combination of stamps and Hardinge yields a product 90% of which will pass a 40-mesh screen, and the production of slime and colloidal matter appears to be considerably less than is the case in the other Mother Lode plants, where the ore is crushed directly through a fine screen. The plant is crushing now approximately 300 tons per day, but its ultimate capacity is about 350 tons.

On August 15 the first part clean-up was made, giving satisfactory results. The metallurgical efficiency of the plant and other more specific data are not yet available, but the assay of the tailings indicate a satisfactory recovery. A detailed account of this mill, accompanied by plans and photographs, will be published in the *Press* later on. The Plymouth is one of the famous old mines of the Mother Lode which, after lying idle a number of years, was recently reopened through the efforts of Bewick, Moreing & Company.

GENERAL VIEW OF THE MILL.

A Study in Applied Geology

By C. A. STEWART

While it is generally conceded that in the important and hazardous task of estimating the value of the unexplored part of an orebody geological investigation is indispensible, only those engineers especially trained in geology appreciate the steps by which a geologist reaches his conclusions. When the old but ever-new question, 'What will it do in depth?' arises, owners and prospective investors are wont to summon an expert, propound to him the problem, and accept his answer with a blind faith, the completeness of which depends upon the expert's reputation or the questioner's disposition.

As a matter of fact, all such geological prophesying can go no further than a statement of the probabilities, and it is often impossible to convey in the summary of a geological report an idea of just how probable is this or that conclusion. Only by following the reasoning of the geologist as embodied in the whole report, noting the limitations under which his observations were made, and comprehending his qualifying statements and the reasons therefor, can a man appreciate fully the significance of a geologist's attempt to prophesy. Because mining men sometimes refuse to make this detailed study of a geological report, and insist upon a bare 'yes' or 'no' when 'it is probable' or 'it is not probable' is the only feasible answer, the geologist often receives unwarranted criticism.

In this article I propose to trace step by step the process of reasoning by which certain conclusions were reached in one specific problem, which is typical of those daily confronting mining geologists. I hope to indicate something of the possibilities as well as the limitations of geological work, and to show how details of apparent unimportance actually have great weight; how 'theoretical questions' are frequently the basis of practical answers; and how carefully the geologist has to guard against possible exceptions to his general rules. It will be unnecessary for my purpose to name or locate the property, or to deal in definite figures, and I shall describe only those features that bear upon the problem in hand.

The Problem

Intermittent work had opened a lead-silver vein along several hundred feet on both strike and dip. From these workings considerable rich ore had been gouged, while much low-grade material had been left. Poor management had lost the profit, and the property was put on the market. Prospective purchasers contracted for an examination by an experienced mining engineer, who, after careful sampling and exhaustive milling tests, concluded that if the rest of the vein along the strike and for a reasonable distance in depth were as good as that already opened up, the investment would be profitable, but that the ore in sight would not justify purchase unless there were a reasonable probability of the vein continuing to be valuable in parts yet unexplored. It was the old story of 'the mining chance,' but in this particular instance the investors wanted to know just how much of a chance there was. So the geologist was called in and directed to examine and report upon the possibilities of the vein along both strike and dip.

No question of this kind can be answered directly, for the occurrence and persistence of ore is dependent upon many factors. The vein must first be studied in respect to each of these, and the results then combined in the final answer.

General Statement

In this instance the question resolved itself into the following: 1. Is the formation in which the vein occurs favorable or unfavorable in the light of experience in a neighboring district? 2. Will the vein in depth pass into formations more or less favorable to good ore? 3. Is the fissure itself persistent or merely a small, localized fracture? 4. Granted that the fissure is persistent, did the primary mineralizing waters deposit in it in depth ore similar in kind and quantity to the primary ore in the present workings? 5. Is any of the ore in the present workings due to secondary enrichment? 6. What indications are there of troublesome faulting?

The vein occurs in the upper member of the same series of sediments that is found in a nearby district long famous for the persistence of its orebodies on both strike and dip. In this neighboring district, however, the production has all come from lower members of the series, and the upper member in which lies the vein discussed, has thus far shown little value. The prospective purchasers, therefore, feared they were dealing with a property in a 'barren formation.' Examination showed that this upper member is chemically and physically identical with the productive formations of the proved district, and could therefore be in itself an ore-bearer. That it is barren in the neighboring district is due not to the unfavorable nature of the formation itself, but to some extraneous geological condition. It was suggested that in the old district the solutions became chilled quickly enough to drop all of their metal content before reaching the upper members of the series, but that in the vicinity of the vein in question they had remained hot until they had risen higher in the series. In explanation of the different rates of cooling in the two localities it was pointed out that intrusive rocks are much more important in the vicinity of the new vein than in the old district. This last point of course reaches far into the realms of theory, but it shows how varying geological conditions may make a formation good in one district and bad in another, and drives home the fact that chemical and physical characters of a rock

mass are of more importance than its name or stratigraphic position.

Dip of the Vein

The vein, although lying almost parallel to the bedding planes, dips a bit more steeply, and therefore passes with depth into lower and lower beds of the formation, in which thin bedded shales predominate. The geologist feared at first that the vein, being so nearly parallel to the stratification, would upon passing into these shaly beds split up into numerous stringers, and the valuable parts become too widely spaced for profitable mining. But examination of the parts of the orebody exposed established the following facts: (1) the vein is not the result of filling a simple open fissure in massive beds, but is in large part the result of replacement working from a number of small parallel cracks; (2) the upper part of the formation, though in general more heavily bedded than the lower, contains some lenses of rock as shaly as any that the vein will meet in depth; (3) some of the best parts of the vein now exposed are the result of replacement of these shaly lenses. Recognition of this last fact required careful study of the details of vein structure, and its importance is obvious. Under the conditions obtaining in this locality, the shaly beds are evidently not unfavorable to the formation of good ore, and passage into thin bedded rocks in depth is not, therefore, an unfavorable indication.

The sediments of the district in question show many bedding plane seams or stringers of ore which are evidently not connected with any far reaching fissures, and which pinch out in all directions. One or two attempts to develop such seams have resulted disastrously. As the vein in question is similar to these seams in mineral content, and as it also is parallel to the strike of the bedding planes, and very nearly parallel to them in dip, the prospective purchaser feared that it would likewise prove only a seam and not a 'true fissure vein.'

A cover of soil prevented tracing the outcrop any great distance beyond the claim lines, and the requisite trenching has not been done. The deposit occurs in a definite bed of the sediments marked by a special color. It forms a distinct stratigraphic marker. In two other places, one a quarter of a mile, the other over half a mile away, openings have been made in the same distinctly colored bed on orebodies exactly like the one discussed, and parallel to the bedding planes in strike. There are, then, three veins, identical in character, 'lining up' with each other in strike. It might be rash to say that they are absolutely continuous, but it is safe to conclude that this particular colored stratum has been the locus of a well defined disturbance that has broken it along its strike for at least half a mile, and a disturbance of this extent is surely likely to affect the rocks to considerable depth. Moreover, the walls of the vein show slickensides and brecciation that are not found along the bedding plane seams that have proved unsatisfactory.

The conclusion, therefore, is that our vein lies along a line of extensive fissuring that is to be distinguished from the subordinate bedding plane slips in the vicinity, and that may with reason be expected to show the extent in depth that usually accompanies extensive fissuring. At the time of the examination no accurate locations or elevations were available, and the lining up of the widely separated veins was established largely upon stratigraphic grounds—another instance of the importance of general geology of the district.

Commercial considerations demand not only that the fissure persist in depth, but also that it carry ore; and in the case considered it was necessary that the fissure carry in depth ore of approximately the same grade as that exposed in the present workings.

Now ore minerals may be deposited in a fissure either (1) by meteoric waters that, having obtained their mineral content by leaching country rock, have entered the fissure from above or by seeping in from the sides, or (2) by hot waters (origin not stated) that have arisen from below, bringing ore minerals from an unknown source. Deposits of the first class are superficial in character, and, though sometimes extending hundreds of feet in depth, are likely to be rather shallow, and to lose value somewhat abruptly. They are characterized by low temperature and pressure minerals, and by the lack of certain alterations of the wall rock found in deposits of the second class.

Persistence in Depth

Modern theories of ore formation regard most of our veins as the result of precipitation by solutions ascending from great depths. While it is true that ores of this class do eventually grow poorer with deep mining, and while it is true this diminution in values varies so greatly from place to place that prophesying its results is impossible, the fact remains that such changes are usually gradual. Moreover, in some ore change in kind of ore usually precedes disappearance of mineralization.

The vein under consideration contains minerals characteristic of considerable pressure and temperature; it contains none of the minerals commonly the result of precipitation near the surface; and its walls are silicified and sericitized in a way that seems certainly the result of very hot solutions. It is therefore probable that it has been formed by waters ascending from great depths, and not by shallow infiltrations, and that its variations in depth will be similar to those of other veins formed by deep-seated processes. In the present workings the chief ore minerals are galena and tetrahedrite, the latter, here as so often, being richer in silver. Zinc is of minor importance. Experience teaches, however, that tetrahedrite usually does not reach as far in depth as galena, and that galena itself sooner or later gives place to sphalerite in most veins, but that these changes are gradual.

The conclusions drawn were: (1) there is no reason to expect the vein suddenly to become barren; (2) there is good reason to expect that at some depth silver will decrease because of loss of tetrahedrite, and that in-

creased proportions of zinc will change the value of the ore; as it is impossible to foretell the depth at which these changes will take place—hundreds of feet mark their limits in some districts, thousands of feet in others, and there is no local experience to furnish a guide.

It should be noted that these conclusions are based upon such 'theoretical' matters as critical minerals and alterations of the wall rock combined with empirical rules of experience, and that even then there is left a large element of uncertainty. But even with this uncertainty the conclusions are not without practical value. They show that there is a 'mining chance' justifying considerable expense for further exploration in depth, but they also emphasize the possible complications involved in abandoning the vein and running a long tunnel to meet it at great depths.

Effects of Secondary Enrichment

Any part of the value of the ore in the present workings due to secondary enrichment by descending waters is sure to disappear at comparatively shallow depths, and it is therefore of importance to determine the extent to which this process has been effective. Oxidation and leaching of the upper part of an orebody are prerequisite to the deposition of secondary sulphides at the water-level. This vein shows no oxidized capping, although it outcrops well on the top of a hill where recent river erosion has not been active, and it might be assumed that in this particular deposit there has been little or no oxidation and leaching of the orebody, and that therefore there has been no deposition of secondary sulphides. Such a theory is hardly tenable in view of the unmistakable evidences of glaciation found at the outcrops. It is probable that the sulphides reach to the surface, not because there has never been oxidation, but because the oxidized cap has been eroded by the ice-sheet. Moreover it is probable that the sulphides now outcropping at one time lay beneath the oxidized zone, and were secondarily enriched by waters descending therefrom. A careful study of the ore itself both in hand specimen and with the microscope, supports this view.

Galena, tetrahedrite, pyrite, and the gangue minerals are invariably intergrown in a manner indicative of simultaneous and primary deposition. Native silver, on the other hand, is found coating these other sulphides, and forming minute veinlets in them, an occurrence surely meaning secondary deposition; and probably by descending waters. Both theory and experience tell us that hot ascending waters are not likely to deposit films of native silver free from gangue or metallic sulphides.

The native silver, therefore, is likely to disappear at comparatively shallow depths, and the value of the ore to decrease correspondingly. Unfortunately it is difficult to give figures indicating the exact amount of this loss, for it is important to tell what proportion of the value of the ore where sampled is due to this particular mineral. Mineral separation and double assays of all the samples would answer the question roughly, but the expense would be prohibitive. Study of the faces sampled showed that native silver is not an essential mineral in the ore, so the conclusion is warranted that the value of the vein as at present developed is to a very small extent due to secondary enrichment.

Faulting

Displacements of a vein, even when not causing permanent loss of the orebody, entail additional expense in exploration, and often interfere with the plans for economical mining. A thorough examination of the surface was therefore undertaken to determine the possibility of the vein being disturbed in depth by intersecting faults. The well defined character of the sedimentary beds facilitated this work, and it was comparatively easy to ascertain that the areal distribution of the rocks was so conformable to the expectations based upon their depth and strike that faulting of serious extent is out of the question near the vein.

Some distance from the outcrop, however, there is a sharp depression with all of the ear-marks of a fault valley, and on the other side of this valley outcrop rocks which, according to the dip, should be thousands of feet below the surface. The valley evidently lies along a displacement so extensive and of such direction that its intersection with the vein would mean permanent loss of the ore. Unfortunately, the actual fault plane is concealed by the débris in the valley, and neither the direction nor the amount of dip is determinable. It is therefore necessary to fall back upon the slight knowledge available of the geodynamics of the district for a clue to the most probable direction of the fault plane. It so happens that even under the most unfavorable assumptions no projection of this fault will cut the vein at less than 1500 ft. in depth, so that our uncertainties in regard to it are not of great importance.

Summary

In view of the foregoing, it appears that the 'mining chance' in this property is excellent. Sudden change to unfavorable conditions with depth and interference of extensive faulting are extremely improbable; the vein is apparently the result of extensive fissuring and deep seated deposition, and not dependent upon localized conditions; loss of value due to disappearance of secondarily enriched ore will take place, but it will be slight; change in character and value of ore due to primary differentiation in depth is of course to be expected, but there is no indication that it will be especially sudden or more harmful than in other deposits of like character.

In spite of the favorable conditions for study in this particular deposit, there is still a deplorable indefiniteness about some of the conclusions, and there is always the possibility of meeting a condition as disturbing to geological views as was the persistence in depth of the chalcocite at Butte. Nevertheless the geological investigation has taken the investment out of the realms of mere chance. It has pointed out that certain things are

very improbable, and that others are probable, so that the investor is far better able to weigh the chances in his favor than if he merely stood at the bottom of the shaft and wondered what was below his feet. That, after all, is the basis of successful mining investment—careful weighing of possibilities, and judicious valuation of the 'mining chance' offered.

Prospective Growth in Output of Tin

The recent fluctuations in the price of tin caused considerable anxiety in the Malay Peninsula, as tin is the backbone of the country, and evoked much press comment on the subject. In this connection the following excerpt from an editorial appearing in the *Malayan Tin and Rubber Journal*, Ipoh, should be of interest:

"Mining methods are undergoing a gradual change in this part of the world by the introduction of the dredging system, which we believe is to have an effect upon the industry that at the moment is barely realized. We have gone carefully into the question and are led to the conviction that tin in the next two years will reach a level considerably lower than the average of the last two years. Nineteen dredges have been placed on various properties in Malaya and Siam. Dredges are to be laid down as follows: Malayan Tin, 4, probably 5; Chenderiang Valley, 1; Ipoh Tin Dredging, 1; Kampong Kamunting, 2; Kamunting, 1, probably 2; Larut, 1; Tekka Taiping, 2, probably 3; Pahang, 1, probably 2; Bruas, 1; Debook group, 1; Siamese Tin, 1, probably 2; Renong, 1; undesignated, 2. That gives a total of 19 certain, and an additional 19 likely to be laid down. The 'probables' actually number 24, for in addition to the Taiping and Siamese propositions mentioned, there is every chance of two other dredges being laid down in Taiping and three in Siam. All this in a way is a healthy sign * * * but it also means a greatly increased output, a conservative estimate of the monthly output of the average dredge being 400 piculs (26⅔ short tons). Now, above that we have to take into consideration the development in Nigeria, which, while not on the same scale as we are witnessing here, is still sufficient to make a good impression on the market. It is well known that some of the dredges are producing 600 piculs (40 short tons), and other methods are being pursued, including hydraulicking, lode mining, and calabashing. All that signifies a greater output. Bolivia, too, is reported to be showing excellent development work, and on the whole is systematically prosecuting the industry. The market, therefore, will not only have to bear an increased output from Malaya, but also from Nigeria and Bolivia."

Copies of a monograph issued by the Bureau of Foreign and Domestic Commerce as Special Agents Series No. 59, in which tin mining in the Federated Malay States is discussed at some length, may be obtained from the superintendent of documents, Washington.—*Daily Consular Report.*

Mineral Production of Virginia, 1913

By THOMAS L. WATSON

The statistics of mineral production in Virginia for the calendar year of 1913 were collected by the Virginia Geological Survey in coöperation with the Division of Mineral Resources of the U. S. Geological Survey. These statistics will be published later by the State Geological Survey in a bulletin which will review in detail the mining industry in the state for the year. The demand for the figures of production from all mines and quarries in Virginia in 1913 renders necessary their publication in abbreviated form in advance of the State Survey report. The latter, which will be ready shortly, will include figures for preceding years that will permit of full comparison.

Reference to the tabular statement below will indicate that the total number of productive operations for the year was large and included a variety of subjects; and that vastly the largest part of the total production is of non-metallic products. The returns indicate on the whole substantial gains in most of the products mined and quarried in the state. Some subjects showed very large increases, others remained nearly stationary, and others still showed decreases. The most noticeable increase was in coal and the most marked decrease was in iron ores.

While the iron ores showed a very marked decrease in 1913 over the previous year, the largest output of lead and zinc in the state for many years was indicated. The total value of gold, silver, copper, lead, and zinc in 1913 amounted to $386,244, an increase of $311,389 over the production of 1912. The total aggregate value of the mineral industry in 1913,* as shown in the table below, amounted to $19,144,997, as against $16,831,914 in 1912,* an increase of $2,313,083.

VALUE OF MINERAL PRODUCTION IN VIRGINIA DURING 1913

Product.	Value.
Clay products	$1,720,102
Coal	8,952,653
Coke	2,840,275
Iron ores	106,460
Lime	805,443
Manganese ores	40,480
Metals (gold, silver, copper, lead, and zinc)	386,244
Millstones	23,530
Mineral waters	298,473
Pyrite	587,041
Sand and gravel	239,591
Slate	175,830
Stone	1,063,782
Talc and soapstone	615,558
†Miscellaneous	1,289,535
Total	$19,144,997

†Includes barytes, cement (portland), gypsum, infusorial earth, manganiferous ore, metallic paint, mica, ochre, salt, and zinc oxide.

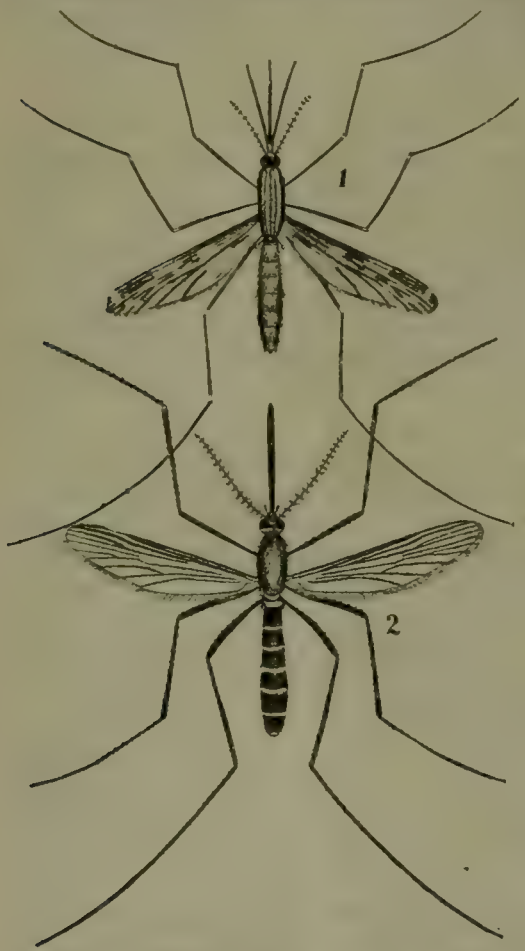
*Exclusive of briquettes (fuel), ferro-alloys, gems and precious stones, pig iron, and rutile.

The Menace of Mosquitoes and What to do About It

By THOMAS DARLINGTON

*To get rid of mosquitoes one must understand something of their life and habits. They breed only in still water, preferably dirty water. Some mosquitoes lay one egg at a time, while others lay as many as 300 eggs in the form of a raft. Such a raft measures one-eighth of an inch in length and can be seen with the naked eye. The eggs float on the water. Generally in about two days, depending mainly on the temperature, the eggs hatch and become the larvæ or 'wrigglers' so frequently seen in rain barrels. These 'wrigglers' breathe air through a small tube a little to one side of one extremity. If unable to obtain air at frequent intervals they die. In about a week the 'wriggler' changes into a comma-shaped creature called the pupa, from which in about two more days the mosquito emerges.

To exterminate mosquitoes they must be attacked in their breeding places. As mosquitoes breed only in water, it is necessary to remove or guard places where water collects. Tin cans, bottles, or any waste that may hold water should be removed. Tubs and barrels that are used to store water for household purposes should be covered. Roadside puddles, cup-like depressions in rocks, holes in tree trunks or stumps should be filled. Old ditches should be cleaned, gutters repaired, cisterns covered or oiled, water pans for chickens or other animals frequently emptied and cleaned. The edges of ponds should be kept free from grass. Marshes should be drained by ditching and the material from the ditches used to fill in the pools. Where it is impracticable to fill or drain, kerosene or crude petroleum should be used to cover the surface of the water. This will kill the 'wrigglers,' as the oil shuts off their air supply when they come to the surface to breathe. As fish feed upon the larvæ or 'wrigglers,' ponds should be stocked with fish. If necessary to secure action, legislation should be obtained to enforce the drainage of mosquito-breeding places. Mosquitoes in the house may be killed by burning sulphur, or, as with flies, pyrethrum powder, or a mixture of carbolic acid and camphor.



1. *Anopheles punctipennis*, WHICH CARRIES MALARIA. NOTE DAPPLED WINGS, ARRANGEMENT OF LEGS (FOUR IN FRONT OF WINGS), AND LONG PALPI ON EITHER SIDE OF PROBOSCIS.
2. *Culex pipiens*, WHICH IS ANNOYING BUT NOT DISEASE-CARRYING. NOTE PLAIN WINGS, ARRANGEMENT OF LEGS, AND VERY SHORT PALPI AT SIDES OF LARGE PROBOSCIS.

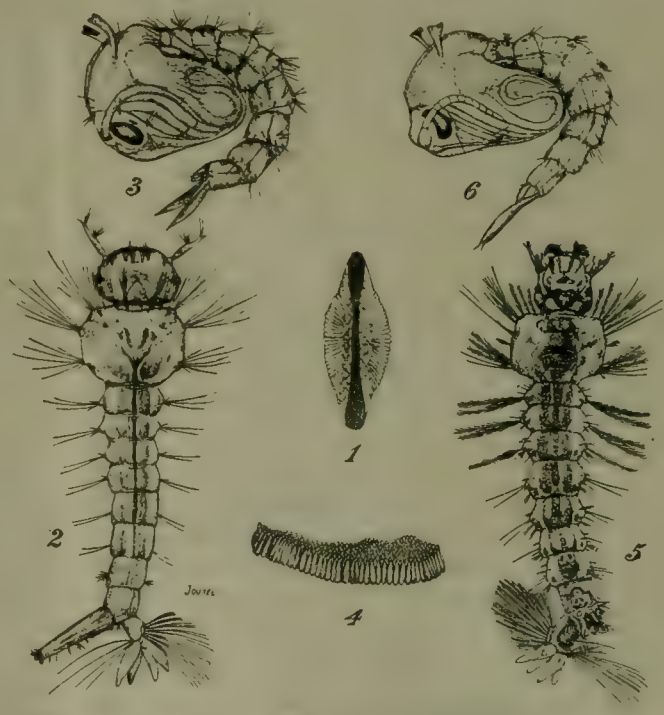


FIG. 1. EGG, *Anopheles punctipennis.*
FIG. 2. LARVA, *Anopheles punctipennis.*
FIG. 3. PUPA, *Anopheles punctipennis.*
FIG. 4. EGG RAFT, *Culex pipiens.*
FIG. 5. LARVA, *Culex pipiens.*
FIG. 6. PUPA, *Culex pipiens.*

*From the *Bulletin* of the American Iron and Steel Institute.

Fluorspar in Electric Smelting of Iron Ore

By ROBERT M. KEENEY

In connection with the general discussion of fluorite in smelting by Herbert Lang[1] in a recent number of this journal, some experiments that I have made show the effect of fluorspar in the electric smelting of iron ore to produce pig steel.

Fohs[2] states that the fluorine of fluorspar forms volatile fluorides with silicon, sulphur, and phosphorus of the charge, and that the calcium forms a silicate slag when fluorspar is used as a flux in the metallurgy of iron and steel, according to the following reactions:

$$2CaF_2 + SiO_2 = 2CaO + SiF_4$$
$$2CaO + 2SiO_2 = 2CaSiO_3, \text{ or}$$
$$2CaF_2 + 3SiO_2 = 2CaSiO_3 + SiF_4$$
$$3CaF_2 + 4S = 3CaS + SF_6$$
$$5CaF_2 + 7P = 5CaP + 2PF_5$$

As to the completeness with which these reactions actually occur, there is very little experimental evidence, and they appear to be based largely upon conjecture. But there is one indisputable fact regarding the effect of fluorspar: it thins a basic slag when used in small quantity, and on this, the assumption of its benefit was based in the following experiments.

Electric-furnace pig iron smelting differs from blast-furnace pig iron smelting in that the atmosphere of the electric furnace, while reducing, is less strongly so than that of the blast-furnace, because there is about three times as much carbon used for fuel in the blast-furnace as there is carbon for reducing material in the electric furnace. In the electric-furnace manufacture of pig iron, a slight excess of carbon is charged over that necessary for complete reduction. This results in the atmosphere of the furnace being completely reducing for all practical purposes and in the production of a pig iron. But there is not the great excess of carbon that is present in the blast-furnace. Sulphur is slagged as calcium sulphide as in the blast-furnace, with the possibility of slagging more of it owing to ability to operate the electric furnace with a very basic slag. Just as in the blast-furnace practically all of the phosphorus is concentrated in the metal in electric-furnace manufacture of pig iron.

When pig steel is produced from ore in the electric furnace, smelting conditions are somewhat different than when pig iron is the product. Carbon is charged in an amount sufficient to reduce the iron and carbonize the metal to the desired point. As pig steel is the product, which must contain less than 2.2% carbon to be a steel, no excess carbon can be charged over that theoretically necessary. Hence, while the atmosphere of the electric pig steel furnace is reducing, there is no excess carbon present, and conditions are much less reducing than in electric-furnace manufacture of pig iron.

The production of pig steel from ore in the electric furnace rather than making pig iron results in the following conditions: (1) There is greater loss of iron in the slag; (2) impurities are not so readily reduced to their metals which pass into the steel; (3) phosphorus is more easily forced into the slag; (4) it is more difficult to remove sulphur in the slag; (5) to produce a comparatively pure metal impurities of the charge must be slagged by use of a very basic slag; (6) to permit effective use of a basic slag for the removal of impurities, the slag must be fluid so as to allow intimate washing of the metal and charge by the slag.

Fluorspar was not used as a flux in these experiments in order to secure removal of silicon, sulphur, and phosphorus as volatile fluorides, but to thin the basic slag so as to permit absorption of these impurities as silicate, sulphide, or sulphate, and phosphate or phosphide. The work was performed in a furnace, lined with magnesite, having two upper vertical graphite electrodes connected in parallel, and a conducting hearth of iron rods imbedded in magnesite, the hearth and the graphite electrodes being connected in series.

Charge:	1.	2.	3.	4.	5.
Hematite, lb.	15.00	15.00	15.00	15.00	15.00
Coke, lb.	2.87	2.87	2.87	2.87	2.87
Limestone, lb.	6.00	5.87	5.81	5.56	5.43
Fluorspar, lb.	...	0.12	0.19	0.37	0.51
CaF_2 to CaO, %	...	4.10	6.75	13.50	18.50
Lb. CaF_2 per ton of steel	...	26.4	40.6	82.0	108.4
Product, steel:					
C, %	0.44	0.74	1.44	1.51	2.25
Mn, %	0.08	0.11	0.10	0.08	0.10
Si, %	0.14	0.16	0.12	0.07	0.06
P, %	0.057	0.055	0.053	0.030	0.070
S, %	0.063	0.027	0.035	0.049	0.060
Product, slag:					
SiO_2, %	29.48	29.28	29.44	28.00	27.00
CaO, %	46.70	44.90	49.60	48.10	50.10
MgO, %	2.22	3.15	1.03	3.24	3.66
FeO, %	7.29	8.18	6.12	7.29	7.00
Al_2O_3, %	12.17	9.73	10.11	8.97	9.57
Per cent recovery	94.10	94.20	95.90	95.30	96.00
Per cent iron slagged	4.92	5.73	4.08	4.70	4.36

The most marked result of the increased fluorspar charged in proportion to the lime is in the increase of carbon in the pig steel with each increase of fluorspar (Fig. 1). The amounts of ore and coke in the charge were kept constant in all of the experiments with the carbon at 27.4% of the iron in the charge. The lime was gradually reduced as the fluorspar was increased until the fluorspar was 18.5% of the lime charged as limestone. As the fluorspar increases the percentage of carbon in the steel increases from 0.44% carbon with

[1] Lang, H., 'Fluorite in Smelting,' *Mining and Scientific Press*, Vol. 108 (March 21, 1914), p. 492.

[2] Fohs, F. J., 'Kentucky Fluorspar and Its Value to the Iron and Steel Industries,' *Trans.* Amer. Inst. Min. Eng., Vol. 40 (1909), p. 261.

no fluorspar charged, to 2.25% carbon with 18.5% fluorspar. At this point the product was not a pig steel but was a pig iron.

The increase of carbon in the pig steel may be explained in two possible ways. The excessive thinning of the slag may have resulted in coke coming in closer contact with the steel, thus carbonizing it. Or, there may not have been any tendency to the formation of calcium carbide with the smaller percentage of lime in

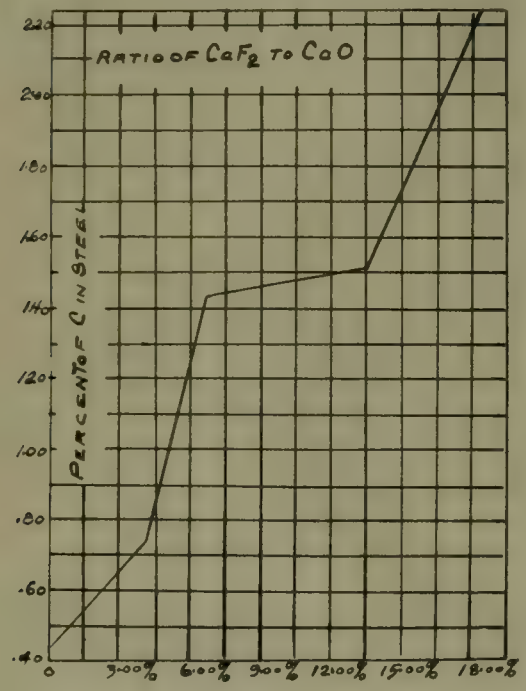


FIG. 1.

the charge, and the quicker fusion resulting from a more easily fused charge.

The effect of fluorspar upon the percentage of other constituents of the pig steel is shown in Fig. 2. There is a marked decrease in the percentage of silicon in the pig steel with increased fluorspar in the charge. The fluorspar has no apparent effect on the manganese. The percentages of phosphorus and sulphur in the pig steel decrease with a small amount of fluorspar, but the phosphorus increases in the steel with the ratio of fluorspar to lime above 13.5% and the sulphur with the ratio over 4.5%. In the opinion of the writer the elimination of silicon, phosphorus, and sulphur from the metal, is due largely to the thinning effect of the fluorspar upon the slag which permits intimate contact and washing of the metal by the slag. Silicon, phosphorus, and sulphur in this way have a greater opportunity of combining with lime to form silicates, phosphates or phosphides, and sulphates or sulphides. Either of the latter might form owing to the weakly reducing atmosphere of the furnace. The value of a very thin fluid slag for the removal of phosphorus in the reduction of iron ores and in the manufacture of ferro-alloys has been evident throughout the experiments I have made, and it was to get this thinning effect that fluorspar was tried in these experiments. The increase of impurities in the pig steel when the fluorspar is used in large excess is due probably to a reduction of these impurities after they have once been slagged, because of the thinness of the slag and the evident presence of excess carbon as shown by the increased percentage of carbon in the steel.

In summary, it may be stated that:

1. In the electric smelting of iron ore or the manufacture of ferro-alloys a small quantity of fluorspar in the charge assists materially in the production of a fluid basic slag for the absorption of impurities.

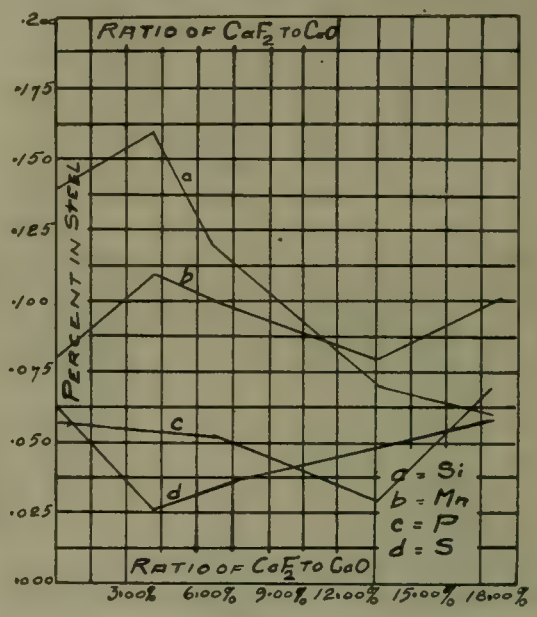


FIG. 2.

2. The use of fluorspar in excessive quantities causes a marked increase in the carburization of the pig steel.

3. The addition of fluorspar lowers the percentage of silicon in metal.

4. If a small amount of fluorspar is added to thin the basic slag, slagging of phosphorus and sulphur is assisted.

5. Fluorspar has no apparent effect on loss of iron in the slag, nor does it appear to affect the power consumption, although the experiments were on too small a scale to give definite figures regarding the latter.

GOLD PRODUCTION of some Rhodesian mines in June was as follows:

Mine.	Tons.	Yield.	Profit.
Cam & Motor	10,409	£15,204	.....
Giant	7,658	4,414	£ 805
Globe & Phoenix	6,117	41,820	27,000
Lonely Reef	5,750	16,815	8,715
Pigg's Peak	3,063	3,710	946

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Rand Banket

Reply to F. H. Hatch's Discussion—*Continued*

With reference to Mr. Hatch's statement that no suggestion was offered as to how such a replacement might have taken place, I showed that it had already been accepted, that very similar replacement had actually taken place in the Rand banket at the Meyer & Carlton mine. It was unnecessary to enter into the chemical questions of how this had occurred as, to students of ore deposits, it was already well known that pyrite could metasomatically replace quartz and often had done so. Petrologists had also been forced to recognize that quartz could be metasomatically replaced by pyrite. As long ago as 1877, Naumann[7] had recognized this. Mr. Lindgren in 1900 had also clearly shown that this process was quite a common one in ordinary vein formation.[8] I quoted the analogy of the pyrite replacements in the English chalk, and did so again in my paper on the Rand banket, where I pointed out that many of the pyrite nodules occurring in the chalk in the upper Cretaceous formation of England had been formed, or partly so, by the replacement of silica of sponge spicules.

Because some of the pyrite pebbles exhibited radiate structure, Mr. Hatch apparently thought that the mere statement of his personal opinion that they were of concretionary origin was sufficient explanation of their presence. In my paper on the Crown Reef occurrence I pointed out that the pyrite pebbles do not all exhibit radiate structure, and that those which do might be concretions, or quite possibly pseudomorphs, as this structure may have been developed later owing to gradual molecular rearrangement. Later, in my treatise on the Rand banket, I pointed out that to state an opinion that the pyrite pebbles owe their shape to growth by accretion, or that they are concretions, proves nothing and merely leaves the problem where it was before. I then showed that this radiate structure is a later development, doubtless due to contraction.

Mr. Hatch in criticizing my present paper stated that after the publication of the first edition of the 'Geology of South Africa,' written by G. S. Corstorphine and himself in 1905, they came across pyrite pebbles that showed no concentric or radiate structure and were curiously flattened or of ellipsoidal shapes; they admitted that these certainly recalled the appearance of true pebbles, and that the possibility of these being pseudomorphs after quartz pebbles suggested itself, but remained a mere supposition until proved by the careful microscope work of R. B. Young, which was embodied in a paper read before the Geological Society of South Africa, on March 18, 1907.

Curiously enough, Prof. R. B. Young, working in the laboratory, and I, in my daily underground work in the mines, had quite independently, and each in ignorance of the other's work, arrived at the same conclusions. It amounts to little that mine were embodied in a paper completed in the latter part of 1906, received by the Geological Society of London in January 1907, and read before that society on February 27, 1907, and that his were read somewhat later, on March 18, 1907, in Johannesburg. In my paper 'The Rand Banket' I think I have made full acknowledgment to Professor Young for his valuable work. Mr. Hatch says that the discussion was again dealt with in Mr. Gregory's paper on 'The Origin of the Gold in the Rand Banket,' read before the Institution of Mining and Metallurgy in October 1907, and that Mr. Gregory, while appearing to think that these pyrite pebbles are water worn, does not deny the possibility of their pseudomorphous origin. Mr. Hatch then proceeds to still further labor the burden of his theme by stating "that the idea of the pseudomorphous origin of the pyrite was in the air, prior to the reading of Mr. Horwood's paper, is further shown by the fact that Mr. Gregory also suggested it in a lecture at the Society of Arts which was given on February 4, 1907." Mr. Hatch omits to mention that Mr. Gregory was sufficiently generous to give me, in his paper, full credit for having contended that some of the pyrite pebbles from the Crown Reef mine are pseudomorphs after quartz pebbles.

Reply to Mr. Hatch's Second Discussion

In the latter part of my paper, when considering the genesis of the pyrite and gold in the Rand bankets, I stated that it cannot be too strongly borne in mind that the latter differed in no important *essentials* from ordinary gold quartz veins. The solutions had found these pebble beds sufficiently pervious to select them rather than fissures for circulation and precipitation of their mineral contents; and these channels finally became closed to further mineralization by deposition of secondary silica, which, I pointed out, is analogous to

[7]See 'Elemente der Mineralogie,' by C. F. Naumann, Leipzig, 1877, p. 115.

[8]'Metasomatic Processes in Fissure Veins,' by W. Lindgren, in 'The Genesis of Ore Deposits,' 2nd Ed., 1902, p. 502.

the vein quartz of ordinary lodes; and that in a similar way quartz veins had eventually been sealed by the deposition of vein quartz and other gangue material. I also pointed out that as long ago as 1890 J. S. Curtis realized that the gold and pyrite of the bankets was genetically associated with intrusions of basic dikes; and when he first visited the Rand in company with Gardner F. Williams, in 1887, the latter maintained that the gold was quartz gold deposited late in the history of the banket. Mr. Curtis, in 1890, as a result of his investigations, concluded that in many of their characteristics the bankets closely resembled lodes; and in 1908 he contended that if the theory of infiltration is accepted as accounting for the presence of gold in quartz veins, there seemed no valid reason why the presence of gold in the banket should not be accounted for in a similar manner.

I maintained that had the analogy not been masked by the fact that the lodes are composed of ordinary sedimentary conglomerates which have been considerably metamorphosed, the similarity would long ago have been recognized and their mineralization ascribed to the influence of the older, or longitudinal, series of dikes, or to the magma with which in depth the latter are connected. These dikes furnish abundant and *sufficient* evidence of former deep seated communications whereby the mineralizers ascended. I referred to various previous publications by myself, between the years 1905 and 1912 inclusive, in which I had laid special emphasis on these points. Thus, in 1905, I called attention to the genetic relationship between the dikes and the Ventersdorp diabase and the influence of the former on the mineralization of the bankets.[1] Again in 1910 I wrote as follows:[2] "Accepting the infiltration theory of the origin of gold in the bankets, the latter may be looked upon as differing in no important essentials from ordinary veins. In this connection the words of J. F. Kemp, in his paper 'Igneous Rocks and Circulating Waters as Factors in Ore Deposition', may be quoted. Having advanced several arguments in support of the importance of these factors, especially of the former, in ore deposition, he goes on to state: 'If, now, we add to the above considerations the further one of the almost constant association of eruptive rocks with veins and the usually very restricted occurrence of the latter, it seems to me that, areally considered, we have adequate reason to attribute to the former, and especially when there is no positive contradictory evidence, very great importance in vein production.' Dike intrusions are largely responsible for the faulting and fracturing met with in the mines of the Rand. Thus, if the infiltration theory be the correct one, we have here a sufficient explanation of how deep seated communications were produced, through which mineralizing solutions could have ascended; and possibly future work may show that the Rand owes a very great debt to that period of eruptive activity to which the Ventersdorp series is due." I again emphasized these conclusions in the later papers to which I made reference; and stated that the unprofitable banket veins are analogous to the barren quartz veins which so frequently occur in the neighborhood of gold-bearing quartz veins. In my treatise on 'The Rand Banket' I mentioned that since, in the papers quoted, I had emphasized the similarity of the bankets to ordinary gold quartz veins and had laid stress on the importance of the dikes in the general scheme of mineralization of the banket, others had gradually adopted the same view, and gave as an example that Mr. Hatch wrote in 1911, with reference to the Rand banket, that evidence was slowly accumulating to prove that its gold content has an origin similar to that of quartz veins.

Mr. Hatch now maintains that he had long previously held these views. As lending a curious color to his criticisms on my paper, I would mention that in this same brief article of his,[3] to which I referred, he made the following statement: "Another authigenic constituent which, though rarely absent, is only relatively abundant in a few mines, is a graphitic variety of carbon. C. R. Young has recently recorded observations which are opposed to the view that this carbon has been derived from original organic matter deposited during sedimentation; since, according to him, it has in some places replaced the carbon of the banket, thus suggesting that it has been introduced at a late period in the history of the rock, by the vehicle of the magmatic vapors accompanying the intrusion of the abundant igneous dikes." Against Young's name one is referred to a footnote, and it, together with footnote 14, are the only footnote references to papers where the name of the author is not given in the footnote itself. This footnote reads as follows: "*Trans.* Geol. Soc. So. Af., Vol. 13, 1911, p. 65." On looking up this reference it will be found to be to a paper entitled 'The Mode of Occurrence and Genesis of the Carbon in the Rand Banket,' written by myself.[4] As a result of considerable research work and numerous analyses, I showed in this paper that the carbon was not derived from original organic matter deposited during sedimentation, and that its occurrence in the banket is closely associated with that of the pyrite and gold and indicates a close relationship between its presence and that of neighboring basic dikes, which I proved contained carbon. I pointed out that the way it occurs in tiny spheroids scattered through the matrix, sometimes occurring in the body of quartz pebbles where no cracks are to be seen, and sometimes embayed into their edges, could

[1] 'The Witwatersrand and Associated Beds,' Esson and Perkins, Johannesburg (June 1905), pp. 35 and 62.

[2] 'Notes and Analyses of Typical Transvaal Rocks,' *Trans.* Geol. Soc. So. Af., Vol. 13, (1910), pp. 42-43.

[3] 'The Conglomerates of the Witwatersrand,' in 'Types of Ore Deposits.' 1911.

[4] Footnote 14 refers to the same paper, and the author's name is not given. [The reviewer is apparently in error here, as footnote 14 is as follows: "A. Crosse, *Trans.* Geol. Soc. S. A., Vol. XIII, 1910, p. 77." See page 214, 'Types of Ore Deposits.'—EDITOR.]

only be explained as a result of deposition from gaseous or very mobile liquid hydrocarbons in a similar manner to that of the carbon mineral at the Mary mine, as described by Mr. Kemp, before the final cementation and induration of the bankets by the deposition of secondary silica; and I attributed its origin to magmatic vapors or solutions derived from the neighboring basic intrusions before their final solidification. Professor Young also observed instances of the carbon occurring in the pebbles, and concluded that in such cases it had replaced quartz, and in discussing my paper[5] admitted that I had demonstrated the interesting fact that carbon occurs in dikes associated with the banket; but, far from him suggesting that it had been introduced by the vehicle of the magmatic vapors accompanying the intrusion of the abundant igneous dikes, he was so loath to admit that the dikes were the source of the carbon that he asked, supposing that it has a source other than the dikes, what there was to hinder the substance from which it was precipitated from permeating the dikes just as it had the sedimentary rocks.[6]

Mr. Hatch takes exception to my statement that since I have on several occasions emphasized the similarity of the bankets to ordinary lodes he, among others, gradually adopted the same view. He quotes from a paper read by him in 1897 in which he said: "The silicification, or more generally the mineralization, of these conglomerates is, in my opinion, the result of secondary processes of infiltration and crystallization. It is significant in this connection that when most mineralized the conglomerates are often seamed with veins of white quartz, and there can be little doubt that these veins were formed in connection with the mineralization of the conglomerates. There is no reason for ascribing a special method of origin to the gold; and I hold, therefore, that the gold has been introduced with the pyrite with which it is in intimate association, as a part of the general process of mineralization, and I cannot agree with those authors who describe the conglomerates as deposits in which the gold was either pre-existing (alluvial gold) or was introduced contemporaneously with the deposition of the pebbles and sand." From this statement he clearly holds the infiltration theory, and in my paper I have given him every credit as a supporter of this theory. Unfortunately, although he maintained that the gold had been introduced with the pyrite as a part of the general process of mineralization and called attention to the significance of the presence of veins of quartz and thought there was no reason for ascribing a special method of origin for the gold, yet he did not state what he considered the general processes of mineralization were. Such a non-committal statement is a very different thing to his much more definite statement in 1911 to which I made reference. The former is ambiguous, awaiting the outcome of what future work might reveal; the latter is more definite as the result of the meanwhile labors of others. Mr. Hatch now seems to suggest that as long ago as 1897 he considered the bankets analogous to quartz lodes. If so, he has had very numerous opportunities of definitely stating his opinion, in clear and unmistakable terms, notably during the discussion on Mr. Gregory's paper, written in 1907, on 'The Origin of the Gold in the Rand Banket.' Why did he not do so?

London, June 1. C. B. Horwood.

[5] *Proc.* Geol. Soc. So. Af., 1911, to accompany Vol. 13 of the *Transactions*, pp. 48 and 49.

[6] I dealt with Prof. R. B. Young's query in my paper on the Rand banket.

The Normal-Federal Suit

The Editor:

Sir—Will you allow me to offer a few words of explanation regarding the opinion of Mr. Justin Philbin, of the New York County Supreme Court, in the suit of myself and other minority stockholders of the Federal Mining & Smelting Co. against the American Smelting & Refining Co., which was published in part in your issue of August 8?

While the actual plaintiffs mentioned in the suit only owned 2% of the capital stock of the Company, my attorneys actually represented 130 stockholders with par holdings of approximately $750,000. They did not believe that a question of law could be decided by force of numbers, so that the additional plaintiffs were not added in the amended complaint. Three other stockholders, owning an aggregate of close to $1,000,000 worth of stock at par, complained in writing to the officials of the American Smelting & Refining Co., pointing out the unjust features of the contract and asking that it be revised to the same level as other contracts then in existence with other producers in the same district which were not controlled by the smelting company.

This was a representative form of action and it is therefore apparent that all stockholders would participate in any success that might attend our efforts, whether they contributed to the expense of the suit or not. It is this fact that accounts for the comparatively small amount of protesting stock, together with the further important fact that stockholders had lost such tremendous sums in decline of securities that many were absolutely unable to help in the fight. As a matter of fact, the present contract is strongly condemned by every minority stockholder who has any knowledge of the methods adopted to deprive them of a just return for the Company's ores.

The Circuit Court of Appeals will be asked to review the entire case, arrangements for appeal being now under way. I do not confess to be versed in the law, but I do believe that the higher court will rule that the amount of protesting stock has nothing to do with the questions of law involved in the action. If such a decision should stand, it is very evident that minority stockholders would have no chance to correct wrongs forced upon them by an unscrupulous majority.

Sidney Norman.

New York City, August 13.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

THE OTIRA TUNNEL through a portion of the Southern Alps of the South Island of New Zealand is now in over two miles of the total of 5.3 miles. The grade is 1 in 33.

SILVER CAPACITY of bullion molds in troy ounces may be calculated by multiplying the cubical contents, in inches, by 5.57. Fine gold capacity may be calculated in the same way, by multiplying the number of cubic inches contained by 10.1.

SUPERHEATED COMPRESSED AIR is the latest addition to the proposed remedies for cancer, others being surgical operations, radium emanations, and charges of high-frequency electric current. The air has an impinging or penetrating effect which it is hoped will be beneficial.

STEAM generated from waste heat of eight reverberatory furnaces at the Washoe plant, Montana, produces 30% of the 16,700 mechanical horse-power used in the entire concentrating and smelting plant. About 25% of the heating value of the total coal is made effective, while only 15% of this value is actually used for smelting.

RECOVERY OF ZINC from ores by ordinary wet concentration at several mines is as follows: Daly West, Park City, Utah, 50% zinc, 95% lead, and 75 to 80% silver; Daly-Judge, same district, 66% zinc, 92% lead, and 78% silver; Buffalo Hump, Burke, Idaho, 25% zinc, 90% lead, and 85% silver; and Joplin district, Missouri, 65.43% zinc. By flotation processes the zinc recovery may be increased to from 66 to 91 per cent.

ORE BROKEN per miner and shoveler per shift at the Mt. Morgan mine, Queensland, is 2.47 tons per 8-hour shift. The cost per ton of ore for underground employees and explosives is $1.14. Average earnings of miners on contract (stoping) is $3.84, and on development, $4.64 per shift. Horse traction of ore, from stope chutes to the main shaft underground bins, in place of electric locomotives, has expedited and cheapened haulage.

RUN-OFF from the watershed of Gatun lake, Canal Zone, during the dry season, January to April inclusive, was 16,953,000,000 cu. ft. This is 61% of the normal dry season run-off as determined by the average of 25 years of record. The lake was maintained at approximately normal elevation, 85 ft., throughout the season. The wastage of water through the spillway for lockages, and Miraflores lake was 4,854,000,000, 256,000,000, and 581,000,000 cu. ft. respectively.

MATTE found on the top of bars of cyanide bullion usually assays high in silver, even though the bullion itself contains but a relatively small proportion of the white metal. It has been stated that the matte contains, and oftentimes is principally composed of, a sulphide of silver. Apparently the sulphur has a greater affinity for silver than it has for gold, for bullion carrying 800 parts of gold and 100 of silver has yielded matte assaying 100 oz. gold and 5000 oz. silver per ton.

A MODEL PACHUCA VAT is a necessary apparatus in a metallurgical laboratory. It can be constructed with flat galvanized iron, afterward coated with paraffin paint. The diameter of the lift-tube should be about one-tenth the width of the tank, and arrangements should be made so that the air pressure necessary to operate the lift is at a minimum, otherwise excessive evaporation will take place. The quantity of air used should be arranged so that the pulp is in efficient agitation, and there is no settlement and accumulation of solids in the cone at the bottom of the vat. Particular care should be taken in this respect, otherwise very misleading results may accrue, due to an exclusion of richer and heavier portions of the pulp from any sample that is taken at the lift discharge. In such a model apparatus the pulp is in more vigorous agitation than it would be in a full-sized vat, and allowance must be made for this fact in any estimation of tank capacity required in practice which has been based on the results of such experimental work.

BASIC-LINED CONVERTERS have been used at the Old Dominion smelter at Globe, Arizona, since the first month of 1913. One has recently completed a year's run without repair. According to L. O. Howard, in the July *Bulletin* of the A. I. M. E., the record of a 12-ft. shell, provided with 24 1¼-in. tuyeres, and a mouth 5 ft. in diameter, was as follows over the period of January 6 to June 27, 1913: Total blowing time, 2689.66 hours; number of blows made, 664; average time of blow, 4.05 hours; matte charged, 18,157 tons; average content of matte, 43.9% copper; time blowing one ton of copper, 22.5 minutes; copper produced, 7250 tons; copper per converter hour, 2.66 tons; air used per minute, 9000 cu. ft.; blast pressure, 13.3 lb.; and ore fed, 3304 tons. The slag averaged 2.5% copper. A mistake was made on first working the converter in blowing large charges, which resulted in trouble. This converter, due to certain arrangements in the smelter, was often crowded to its utmost capacity by frequent fluctuations in the daily matte supply.

MINING IN THE FAR NORTH

Seward and the Kenai Peninsula

By E. E. HURJA

Kenai peninsula, in southwestern Alaska, has an area of 9000 square miles. It has been the scene of gold mining for many years. Recent work has been devoted to quartz prospecting, with the result that many promising properties are being developed. Gold was first discovered in Alaska in 1848 in streams tributary to Kenai river, by P. P. Doroschin, an engineer making an examination of the mineral resources for the Russian-American company. No work is known to have been undertaken at that time. Gold was discovered on Cooper creek in 1884, on Resurrection creek four years later, and at Anchor Point in 1889. It was not until 1896, however, that any great amount of attention was given the district, and then several thousand men stampeded into the new field. In 1898 another stampede to the Turnagain Arm district took place, and since that time placer mining has been carried on along most of the creeks of the district. Hydraulicking and dredging are superseding the old pick and shovel methods. Gold-bearing lodes were given attention as soon as the richest placer ground was taken out. John C. Gilpatrick found float in the Moose Pass district in 1896, but did not locate the vein until 1906.

The townsite of Seward was located in 1902, when the Alaska Northern railway started to build to the interior. The camp was lively and grew rapidly until 1906, when President Roosevelt's executive order withdrawing the coal lands from entry put a stop to the railroad. Since that time, until the present railroad activity, the town has been the supply centre for the peninsula and an outfitting point for cannerymen, hunters, and a few stray prospectors. It has a population of about 800. Government engineers are surveying along the route of the Alaska Northern railway, which runs 71 miles from Seward. No less than ten different parties are at work in the Seward and Cook's Inlet country. Toward the interior from Cook's inlet many prospectors have sought mineral for years. Promising prospects have been found, but nothing extensive in the way of development has ever been done. The recent resumption of surveying for a railroad into the back country has attracted attention anew to the possibilities of the region, and numerous parties of engineers and prospectors have gone in to look for mining properties. The productive activity in the Seward district at present is confined to the hydraulic plants near Sunrise and Hope, as well as the northern side of Turnagain arm. Some quartz mining is being done in the Willow Creek country and in the district between Seward and the present terminus of the Alaska Northern railroad at Mile 71.

The Teikell district, northeast from Seward, on the north side of the Chugach range, is demanding attention. Fred Reist, 2½ miles south of Teikell, has a lode varying in width from one and one-half to four feet, on which he is extending an adit already driven on the lode 100 ft. E. L. Dickey and associates are preparing to develop the Portland group of claims. Five tons of supplies are on the ground. Red Ellis and Nick Mickum are driving an adit on their property.

Only assessment work is being done for the present on the Seward Bonanza Gold Mines Co.'s property, situated on the mountain between Victor and Ptarmigan creeks. The vein was discovered in 1907, and development started four years later. An adit has been driven about 200 ft. on the lower vein, with an average width of 2½ ft. Surface work has been done on the upper vein. Pending a settlement of financial difficulties, the property of the California-Alaska Mining Co. is idle. It is situated at the head of the cañon on Falls creek. It was discovered by F. P. Skeen and John Lechner in 1905. It shows much promise and a 2-ft. vein has been opened with 180 ft.

*[Previous articles in this series by Mr. Hurja on mining in Alaska and the Yukon have been 'Mining Revival in the Ketchikan District, Alaska,' July 4; 'Wrangle, Alaska,' special correspondence, July 11; 'Developments of the Alaska Gold Mines Co.,' July 18; 'Juneau, Alaska,' special correspondence, July 25; 'Cordova, Alaska,' special correspondence, August 8; 'Valdez and Prince William Sound,' August 15. Mr. Hurja is now in the interior, and in subsequent letters will give our readers full accounts of present conditions in each of the great producing districts of the Far North.—EDITOR.]

SLUICE-BOXES, STEWART BROS. MINE.

BLUE BELL MILL.

of drift and a 40-ft. winze. A two-stamp Hendy mill and concentrator have been installed. The milling plant was the first on Kenai peninsula. It consists of a Ford crusher, an automatic feeder, and a Deister No. 2 concentrator. Power is furnished by a Pelton water-wheel operating under an 80-ft. head.

The mill on the Kenai-Alaska Gold Co.'s property on the north side of Falls creek will be in operation again by August 1, according to James R. Hayden, the manager. Water entered the workings early in July and put a stop to all mining. Plans for unwatering the mine are now under way.

COALFIELDS OF ALASKA, ACCORDING TO THE U. S. GEOLOGICAL SURVEY.

Pumping equipment will be installed. The Company owns five claims about 26 miles from Seward and five miles from Kenai lake. Underground work aggregates 1600 ft. in adits, raises, and drifts. The lode varies in width from a few inches to 2½ ft. The ore averages $50 per ton. The milling equipment consists of a Blake crusher for the oversize of a 1½-in. grizzly, a five-stamp Risdon mill with 1200-lb. stamps, amalgamating plates, and a Risdon-Johnston concentrator. Concentrate is shipped to the Tacoma smelter. A ½-mile Bleichert aerial tram connects the mine workings with the mill, which is at timber-line. Fuel is wood, costing $5 per cord delivered.

Reports are that the mill on the Skeen-Lechner property will resume operations within another month. The claims are on the north side of Falls creek and were located by F. P. Skeen and L. F. Shaw in 1907. Two adits on the claims, with an aggregate length of 1200 ft., have opened two veins 100 ft. apart to a depth of 155 and 300 ft. Each of the veins varies in width from 2 to 20 ft. and contains gold at the rate of $10 to $13 per ton. A Lane mill has been installed and is connected with the mine by a 2800-ft. aerial tram. Harry Johnson is prospecting a claim on Lechner peak, north of Ptarmigan lake. The adit on the lode has a length of 200 feet.

On Porcupine creek, 18 miles north of Seward, the Primrose mine is being developed under John F. Rea. The mine, made up of three claims, is owned by Derick Lane. A 6-ft. lode has been opened with 400 ft. of underground work. The milling equipment comprises a Little Giant mill. Depth on ore of 435 ft. has been attained. Plans for further development are under way. A crew of men is employed on the Case-Whitney property, at Grant lake, held by James R. Hayden under bond and lease. Three tons of selected ore was shipped to Falkenburg & Laucks at Seattle, from the three parallel veins last fall, and yielded $234 per ton. The veins are from 18 in. to 2 ft. in width. Two of the veins are 15 ft. apart; the third is 500 ft. distant. Present work is being done on the first two veins. The Skeen-Johnson property, opposite Mile 34 on the south side of Grant lake, is being opened up steadily. The two claims Sourdough and Chechaco are about to be bonded to an Eastern mining man. An arrastre is operating on the Moose pass property of John Gilpatrick. A mineralized porphyry dike 8 ft. in width, assaying $4 per ton, with from 12 to 14 in. of rose quartz stringers even richer, is being developed from adits now totaling 500 ft. in length. The claims are at an altitude of 3500 ft. The property has been sampled by engineers of the United States M. S. & E. Co., an English corporation. A mill test of one ton of picked ore, recently taken out by pack-horses, yielded $100. J. W. Slater is operating an arrastre in connection with his prospecting work on Colorado creek. Robinson & Calwell are prospecting on Pass creek. On Summit creek, below the Gilpatrick claim, Imhoff & Saulisberry are planning to erect a stamp-mill as soon as their present prospecting has demonstrated the value of their ground.

In the Willow Creek district, the Gold Bullion property is operated steadily. Budd and associates have the claims in charge under an option and lease. A seven-stamp mill has been installed and is connected with the mine by a 3400-ft. aerial tramway. Thirty men are employed. The 1913 production was $56,000. With the addition of a small cyanide plant with which to treat the tailing, it is expected that the 1914 production will be about $100,000. William Martin has a lease on the Free Gold property on Fishhook creek. Two veins are being worked. A Lane mill is in operation and another is being installed. Twenty-five men are employed. The 1913 output was $50,000, and the first clean-up this year brought $17,000. A 3000-ft. aerial tram connects the mine with the mill. The lode is 10 ft. wide. The Independence property adjoining has been taken over by a company of which T. W. Hawkins, of Seward, is president. L. S. Robe is engineer in charge. A prospecting plant, consisting of one Nissen stamp and two Hendy stamps, is operated. The ore is yielding from $40 to $50 per ton. Adit work totals 450 ft. A Lane mill will be installed this fall, which Mr. Robe expects will increase the capacity threefold.

A five-stamp Hendy mill is in course of construction on the Rosenthal property. Three hundred fifty feet of adit has been driven on a vein from 3 in. to 2½ ft. wide. Skeen, Babcock, and McCoy are open-cutting on their lode on Reed creek. Three thousand five hundred feet of surface work has been done on a vein varying in width from 2½ to 7 ft. William Bartholf is prospecting on Archangel creek. J. W. Hamilton and H. E. Ellsworth have taken a lease and bond for $32,000 on a group of claims near Mile 4 on the Alaska Northern railway. An adit was started to cut the lode, but after being run a distance of 195 ft., was abandoned. Two small levels have been started, one at a depth of 40 and the other of 60 ft. from the surface. A shipment of ore of 15 tons taken between the two levels yielded $31.80 per ton after freighting and smelting charges had been paid. Late in-

July a crosscut will be started on the Big Redmond property situated on Resurrection river 13 miles from Seward. The group comprises nine claims on which a proposed 150-ft. adit has been driven 40 ft. The lode is from 2 to 8 ft. in width. J. P. Stotko is the chief owner. F. P. Skeen and Harry Johnson found a lode on July 9 at the head of Afanasi creek, tributary of Resurrection river, after a discovery of float dug up by a bear hunting a ground hog. The Lucky Jean and Bearhole claims were located. Samples of ore from the 2½-ft. vein gave assays of $50 per ton. Development has been started. Henry Culliard is building a trail to his claims on Devil creek. He is preparing to run an adit on his lode, which has a width of 2 feet.

Placer gold has been found on nearly every stream of the mountainous region of northern and central Kenai peninsula. In few places, however, have the gravels carried sufficient gold to permit mining. Hydraulicking and dredging are the only methods of profitable mining now employed, and the single dredge of the district has been abandoned because of engineering difficulties. Eallaine & Nelson are operating a

SEWARD AND ITS HARBOR.

No. 2 giant on Canyon creek. Joe Wilson, Jr., is operating on the same stream with one nozzle. On Placer river John Dubreuil has 10 claims on which he has done considerable prospecting. The depth to bedrock is 14 ft. Two years ago he shoveled in gravel in the cañon at the rate of $1 per hour. On Gulch creek, Adolph Young is installing hydraulic equipment with the intention of starting work this fall. On Mills creek Robert Michaelson is working on a small scale. Jack Renner is engaged on the same stream with a small outfit. The entire stretch of Kenai river where prospects have been found has been bonded by J. R. Hayden. T. Mack, an engineer in the employ of the Guggenheims, is making an examination. Keystone drills are to be used in prospecting. The ground is looked upon as favorable for dredging purposes. Gold was first discovered on Kenai river in 1910, and the next year the Kenai Dredging Co. erected a small dredge. It did not save the gold anticipated, and another larger one of the same type was built. Both are idle.

The Kenai Mining & Milling Co. is operating five giants on Cooper creek. Its holdings take in all the ground from Cooper lake to Kenai river. A Ruble elevator is in use. Water for hydraulicking is obtained from Stetson, Wildhorse, and Kickinghorse creeks by 5¾ miles of ditch and 1300 ft. of flume.

The Fairman claims on Quartz creek, tributary to Kenai lake from the north, have been bonded to Herschell Parker, of New York, who is reported to have a crew of men engaged in prospecting the holdings with a view to dredging.

The Conant property on Sixmile creek has been taken under option by Herron & French. A small crew of men are making an examination of the claims. Resurrection creek is the westernmost producing stream which flows into Turnagain arm and was worked earlier than any other stream in the district. The Mathison Mining Co. has three nozzles at work and is reported to be making $200 per day above expenses of operation. Water is obtained by ditches from Bedrock and Rimrock creeks and 3000 ft. of pipe-line. Two No. 2 Hendy giants and one No. 1 giant are operated under 315-ft. heads. The Carstens Mining Co. operates one giant below the Mathison workings. Collins, Allison & Farrand, operating above Mathison, make use of two giants to carry the gravel into boxes and one to stack the tailing. Gust Selffert is working 30 men on Resurrection creek. Buildings have been erected, 1500 ft. of ditch has been built, and a pipe-line is being installed. Within ten days, the plant will be ready for operation.

The first clean-up of the season on Crow creek was made July 14. For a four days' run, $12,000 was obtained. The only plant working on Crow creek, which is the only producing stream flowing into Turnagain arm from the north, is known as the Nutter & Dawson outfit, owned by the Alaska Crow Creek Mining Co., of which H. L. Jaffe, M. B. Sollner, and R. B. Dawson are the principal owners. Twenty-seven men are employed, and as soon as a night shift is put on, within the next week, 15 more will be added. Present operations are being carried on three-quarters of a mile above the head of the rock cañon in Crow creek. Two giants, one No. 7 and another No. 9, are operated, and 4000 yd. of dirt is moved per day. One No. 4 giant is used to stack tailing. Three thousand inches of water is obtained with a ditch 1½ miles, and a pipe-line over 3000 ft. in length. The head varies from 300 to 350 ft. Gold-saving apparatus consists of 1100 ft. of sluice-boxes with 12-in. hemlock block riffles. For the first 100 ft. the blocks are covered with pieces of railroad iron placed crosswise at intervals of one foot, in order to protect the blocks from excessive wear from boulders. Where the boxes follow the bends in the creek, a ¼-in. sheet steel lining is used. The owners expended $200,000 in sluicing a channel 1800 ft. long and 225 ft. deep in order to reach the 'pay.' It is estimated that 8,000,000 yd. of gravel was moved, with a recovery of gold of $60,000. Plans for a dam 35 ft. in height, near the head of Crow creek, are being made, as part of a power project. The Girdwood company has holdings farther upstream, but is unable to work them because of lack of room for tailing.

A Keystone drilling outfit has been sent to Raspberry island to prospect placer ground. On Unga island, Frank Brown is installing a cyanide plant four miles from the town of Unga which will be used to work the tailing of the old Alaska Commercial company enterprise, the Apollo mine. The plant will have a capacity of 200 tons per day, and there are 800,000 tons of tailing to be worked. The Apollo mine is credited with producing over $4,000,000 with a 100-stamp mill in operation for years. Only a few stamps are being operated now. Beach placer mining is being conducted on Kodiak island, Uganik bay, Uyak bay, Red river, Alitak bay, and Tagidak island.

Pyrrhotite deposits are reported from Iron creek, in the Chulitna. The Wells brothers have uncovered a deposit of arsenical iron on Honolulu creek. George Perkins is developing a copper prospect on Indian creek. Finch and Campbell have gone toward Broad pass along the proposed railway route with a view to investigating mining properties.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

ANGELS, CALIFORNIA

HOME-COMING WELCOME TO A RETURNED CALIFORNIAN.—OLD NEIGHBORS AND FRIENDS WELCOME W. J. LORING.—MR. LORING TELLS OF THE PLYMOUTH AND THE POLICY OF BEWICK, MOREING & COMPANY.

Nearly 100 of the leading citizens of Calaveras county and operators along the Mother Lode gathered together at Calaveras Hotel, Angels Camp, on the evening of August 20 to extend a California welcome home to W. J. Loring, and to tender to him a banquet. While Mr. Loring was born in San Mateo county, he began his mining career in Amador and was millman at the Utica from 1888 to 1901. He went from there to become manager at the Melones and from there to Western Australia in 1902. From that state his activities have extended to all parts of the world, and his old neighbors and friends have watched with great interest his various successes. The recent completion of the Plymouth mill and the reopening of that famous old mine through his activities, were made the occasion for this reunion of his friends. The menu was elaborate and was thoroughly enjoyed from the cocktail, labeled "The Will Loring Welcome," to the "ice cream Martin (of Angels, not New York)." The fruit salad, of course, was "Melones", while the venison was naturally "sauce Bret Harte." The attractive menu cards were decorated with a reproduction of the famous 'Miners Ten Commandments' which will bear reprinting for the benefit of the present generation:

MINERS' TEN COMMANDMENTS

A man spake these words, and said: I am a miner, wandering "from away down east," to sojourn in a strange land. And behold, I've seen the elephant, yea, verily, I saw him, and bear witness, that from the key of his trunk to the end of his tail, his whole body hath passed before me; and I followed him until his huge feet stood still before a clapboard shanty; then with his trunk extended he pointed to a candle-card tacked upon a shingle, as though he would say, read, and I read the

MINERS' TEN COMMANDMENTS

I.

Thou shalt have no other claim than one.

II.

Thou shalt not make unto thyself any false claim, nor any likeness to a mean man, by jumping one; for I, a miner, am a just one, and will visit the miners around about, and they will judge thee; and when they shall decide, thou shalt take thy pick, thy pan, thy shovel, and thy blankets with all thou hast and shall depart seeking other good diggings, but thou shalt find none. Then when thou hast paid out all thy dust, worn out thy boots and garments so that there is nothing good about them but the pockets, and thy patience is like unto thy garments, then in sorrow shalt thou return to find thy claim worked out, and yet thou hast no pile to hide in the ground, or in the old boot beneath thy bunk, or in buckskin or bottle beneath thy cabin, and at last thou shalt hire thy body out to make thy board and save thy bacon.

III.

Thou shalt not go prospecting before thy claim gives out. Neither shalt thou take thy money, nor thy gold dust, nor thy good name, to the gaming table in vain; for monte, twenty-one, roulette, faro, lasquenet, and poker, will prove to thee that the more thou puttest down the less thou shalt take up; and when thou thinkest of thy wife and children, thou shalt not hold thyself guiltless—but insane.

IV.

Thou shalt not remember what thy friends do at home on the Sabbath day, lest the remembrance may not compare favorably with what thou doest here. Six days thou mayst dig or pick; but the other day is Sunday; yet thou washest all thy dirty shirts, darnest all thy stockings, tap thy boots, mend thy clothing, chop thy whole week's firewood, make up and bake thy bread, and boil thy pork and beans, that thou wait not when thou returnest from thy long-tom weary. For in six days' labor only thou canst not work enough to wear out thy body in many years; but if thou workest hard on Sunday also, thou canst do it in six months, and thou, and thy morals and thy conscience, be none the better for it; but reproach thee, shouldst thou ever return with thy worn-out body to thy mother's fireside.

V.

Thou shalt not think more of all thy gold, and how thou canst make it fastest, than how thou wilt enjoy it after thou hast ridden rough-shod over thy good old parents' precepts and examples, that thou mayst have nothing to reproach thee, when left alone in the land where thy father's blessing and thy mother's love hath sent thee.

VI.

Thou shalt not kill; neither thy body by working in the rain, even though thou shalt make enough to buy physic and attendance with; nor thy neighbor's body in a duel, or in anger, for by "keeping cool" thou canst save his life and thy conscience. Neither shalt thou destroy thyself by getting "tight," nor "slewed," nor "high," nor "corned," nor "half-seas over," nor "three sheets in the wind," by drinking smoothly down—"brandy slings," "gin cocktails," "whiskey punches," "rum toddies," nor "egg-nogs." Neither shalt thou suck "mint juleps," nor "sherry cobblers," through a straw, nor gurgle from a bottle the "raw material," nor take "it straight" from a decanter, for, while thou art swallowing down thy purse, and the coat from off thy back, thou art burning the coat from off thy stomach; and, if thou couldst see the houses and lands, and gold dust, and home comforts already lying there—" a huge pile"—thou shouldst feel a choking in thy throat, and when to that thou addest thy crooked walkings thou wilt feel disgusted with thyself and inquire "Is thy servant a dog that he doeth these things!" Verily, thou shalt say, "Farewell, old bottle, I will kiss thy gurgling lips no more; slings, cocktails, punches, smashes, cobblers, nogs, toddies, sangarees, and juleps, forever farewell. Thy remembrance shames me; henceforth, I cut thy acquaintance, and headaches, tremblings, heart-burnings, blue devils, and all the unholy catalogue of evils that follow in thy train. My wife's smiles and my children's merry-hearted laugh, shall charm and reward me for having the manly firmness and courage to say No. I wish thee an eternal farewell."

VII.

Thou shalt not grow discouraged, nor think of going home before thou hast made thy "pile," because thou hast not "struck a lead," nor found a "rich crevice," nor sunk a hole upon a "pocket," lest in going home thou shalt leave four dollars a day, and go to work, ashamed, at fifty cents, and serve thee right; for thou knowest by staying here, thou mightest strike a lead and fifty dollars a day, and keep thy manly self-respect, and then go home with enough to make thyself and others happy.

VIII.

Thou shalt not steal a pick, or a shovel, or a pan from thy fellow-miner; nor take away his tools without his leave; nor borrow those he cannot spare; nor return them broken, nor trouble him to fetch them back again, nor talk with him while his water rent is running on, nor remove his stake to enlarge thy claim, nor undermine his bank in following a lead, nor pan out gold from his "riffle box," nor wash the "tailings" from his sluice's mouth. Neither shalt thou pick out specimens from the company's pan to put them in thy mouth or pocket; nor cheat thy partner of his share; nor steal from thy cabin-mate his gold dust, to add to thine, for he will be sure to discover what thou hast done, and will straightway call his fellow-miners together, and if the law hinder them not, will hang thee, or give thee fifty lashes, or shave thy head and brand thee, like a horse thief, with "R" upon thy cheek, to be known and read of all men, Californians in particular.

IX.

Thou shalt not tell any false tales about "good diggings in the mountains," to thy neighbor, that thou mayst benefit a friend who hath mules, and provisions, and tools and blankets he cannot sell—lest in deceiving thy neighbor, when he returneth through the snow, with naught save his rifle, he present thee with the contents thereof, and like a dog, thou shalt fall down and die.

X.

Thou shalt not commit unsuitable matrimony, nor covet "single blessedness"; nor forget absent maidens; nor neglect thy "first love";—but thou shalt consider how faithfully and patiently she awaiteth thy return; yea, and covereth each epistle that thou sendest with kisses of kindly welcome—until she hath thyself. Neither shalt thou covet thy neighbor's wife, nor trifle with the affections of his daughter; yet if thy heart be free, and thou dost love and covet each other, thou shalt "pop the question" like a man.

A new commandment give I unto thee—if thou hast a wife and little ones, that thou lovest dearer than thy life,—that thou keep them continually before thee, to cheer and urge thee onward, until thou canst say, "I have enough—God bless them—I will return." Then from thy much-loved home, with open arms shall they come forth to welcome thee, with weeping tears of unutterable joy that thou are come; then in the fullness of thy heart's gratitude, thou shalt kneel together before thy Heavenly Father, to thank him for thy safe return. AMEN.

—So mote it be. FORTY-NINER.

Fred G. Stevenot presided most happily as toastmaster and introduced, as the first speaker, F. J. Martin, the well known manager of the Utica mine. He spoke briefly of the days when Mr. Loring was foreman in the Utica mill and of his

later successes in various parts of the world, including that just consummated at Plymouth. He closed by expressing the hope that Mr. Loring might turn his attention to Calaveras county, not only that its latent resources should be developed, but in order that he might again make his home among them. H. Foster Bain followed with an expression of appreciation of Mr. Loring's work and of the coming together of so many mining men. He expressed the hope that the Mother Lode operators would form the habit of meeting and dining together. G. McM. Ross called attention to the fact that the disturbed conditions in Europe were likely to prevent for some time the influx of foreign capital and that Mother Lode operators would have to depend upon their own initiative and resources for further development. He called attention to the work being done at the Melones in cyaniding sulphides, and suggested that by proper selection of properties and of ore it would be possible to go on with local development despite the stringency of the money market. Allen Chalmers of the Lightner mine recalled Mr. Loring as a young mill-man and expressed the wish that there were more like him. C. H. Edwards, of Fresno, spoke of the plans for a mineral exhibit at the Panama-Pacific Exposition and the wish of the authorities for the hearty coöperation of the mining men. C. H. Segestrom, of the Dutch mine, expressed the pleasure of the Tuolumne operators in joining in the home-coming celebration. J. F. Davis, in an eloquent and witty address, called attention to the famous men other than Mr. Loring, including Bret Harte and Mark Twain, who had helped to make Calaveras county famous. Dr. G. W. Pache, on behalf of the Chamber of Commerce, expressed the good wishes of those not directly connected with mining.

In his reply, Mr. Loring, in well chosen words, expressed his gratitude for the welcome extended him and his pleasure at meeting old friends. He stated that upon visiting California three years ago, Albert Burch had brought to him the project of reopening the mine. After examining a collection of Mother Lode maps and data placed at his service by F. W. Bradley, and having the whole lode examined in general by Malcolm Maclaren, his firm had decided to undertake the venture. Before building the mill just opened, $180,000 was spent upon equipment and development and at present there was $530,000 invested in the project aside from purchase price. Fortunately, development had justified the expenditure since, whereas at the beginning the workings on the 1600-ft. level showed a vein 16-ft. wide and of no value, two ore-shoots were now known from 1500 to 2000-ft. of ore averaging $7 to $10 per ton and all of workable width. On the 2000-ft. level one shoot 160 ft. long showed 22 ft. of $15 ore. In all, 120,000 tons was blocked out when building began. All this is in new ground. The new mill started August 1, dropping 20 stamps, and in 15 days the return was $11,240 in gold and $2800 in concentrate. Mr. Loring expressed his confidence in the development of the Mother Lode in depth provided work followed lines indicated by the old ore-shoots. He made a strong plea for publicity in mining, stating that in Western Australia, coincident with the adoption of the policy of publishing regular returns and free exchange of information among managers, there was a marked drop in mining costs. He also insisted upon the value of careful scientific work both in exploration and in operation of mines and urged his hearers not to live in a fool's paradise of ignorance. He announced that the Plymouth Consolidated would make frank and full statements of such results as the management obtained, and if mistakes were made would accept the responsibility.

At a late hour the gathering adjourned with many expressions of pleasure at the success of the assemblage.

[Later advices indicate that the duty per stamp at the Plymouth mill is now 17½ tons per 24 hours. The stamps weigh 1250 lb. and crush to ¼-in. size. There is no by-pass. For description of the mill, see page 329.—EDITOR.]

TORONTO, ONTARIO

OIL COMPANIES AND OPERATIONS IN CALGARY.—COAL ON HUDSON BAY.—COBALT SILVER SITUATION.—PORCUPINE DISTRICT.

The number of oil companies incorporated in Alberta up to the close of July was about 450, representing an aggregate authorized capitalization of $400,000,000. Only a comparatively small percentage of these have been able to obtain sufficient subscriptions to enable them to proceed with active development work. Fifteen companies are actually drilling, and have reached depths ranging from 400 to 2700 ft. Twenty more are making preparations to sink wells, and about a score of others have secured sufficient working capital, and expect to put down wells this fall. The standard drills, which have been used hitherto, the process of which is very slow, are being superseded by the diamond rotary drills, a number of which are already in operation and more on the way. They have the reputation of being able to bore a 3000-ft. well in 30 days. The cost is on average $15 per foot, and as 3000 ft. is the depth at which petroleum is expected to be found, the expense of putting down a well is placed at $45,000. A large field is covered by the undertakings now in hand, and it is felt that if there is a big oil deposit located in the foothills of southern Alberta, one of the companies now drilling or arranging to do so will certainly find it.

Mackenzie & Mann, of the Canadian Northern railway, are sending out an expedition from St. John, Newfoundland, by the schooner *Laddie* to prospect for coal along the shores of Hudson Bay. It is of vital importance to the traffic which it is expected will be created by the construction of the Hudson Bay railway, that coal supplies should be obtainable near its northern terminus at Port Nelson. The Canadian Northern railway has a junction at Le Pas, from which point the railway is being constructed northward to Port Nelson. It is proposed to provide at that point extensive storage facilities for coal. At present, coal required for the steamship traffic to Hudson Bay has to be freighted from Sydney, Nova Scotia, and the coal needed in connection with the construction of the railway has to be brought from Winnipeg. The discovery of coal deposits at any point accessible for ships plying on the Hudson Bay route would be of immense advantage.

The sudden decline in the price of silver, owing to the European war, is beginning to affect the output of the Cobalt camp. There is a disposition on the part of mine managers to curtail production, especially in cases where there is only a narrow margin between operating expenses and the returns from smelters, which may at any time be entirely wiped out. The financial stringency prevailing will render it a matter of difficulty to find funds for the development of mines which have not reached the productive stage. The most important feature of the situation is the new departure taken by La Rose Consolidated and the Nipissing companies, which have followed the example of other Cobalt concerns by entering the goldfields. La Rose has secured a working option on the Kensy claim in Boston township, just south of Swastika. As the cash surplus is $1,435,000, it will have ample funds for the thorough development of the property. The Nipissing has taken over on option the Teck-Hughes property at Kirkland Lake, and will expend a large amount in development. On the 75-ft. level, an ore-shoot 120 ft. long and 3 ft. wide, assaying $42 to the ton has been cut.

The work of centralizing operations on the group of Porcupine properties controlled by the Canadian Mining & Finance Co., including the Hollinger and the Acme, is progressing. The 20-stamp addition to the Hollinger has been completed, and foundations will shortly be laid for the 20 stamps to be reserved for ore from the Acme, which has enough ore blocked out to keep them in operation for some time. The combined plant will have a capacity of about 1000 tons per day. The main vein of the Hollinger has been cut at the 675-ft. level.

VICTORIA, BRITISH COLUMBIA

MINERAL OUTPUT IN 1913.—DIVIDENDS FOR 1914.—WORK IN THE CARIBOO, CASSIAR, EAST AND WEST KOOTENAY, SLOCAN, NELSON, ROSSLAND, AND BOUNDARY DISTRICTS.

The annual report of the minister of mines of this province for 1913 shows that the total value of the mineral production for that year was $30,296,398, the revised figures giving a total $137,605 higher than that of the estimate published about the middle of January. As compared with 1912, there was a decrease of $2,144,402, due to two main causes, namely, labor troubles at Vancouver Island coal mines, which prevented production of coal on the customary scale, and the generally lower grade of the great bulk of copper ore mined and smelted.

Dividends declared during the seven expired months of 1914, by metalliferous mining companies operating in British Columbia make a total as follows:

Consolidated Mining & Smelting Co.	$232,176
Granby Consolidated M. S. & P. Co.	449,955
Hedley Gold Mining Co.	120,000
Standard Silver-Lead Mining Co.	400,000
Total	$1,202,131

The Consolidated company's profit distribution is at the rate of 8% per annum; the Granby company's at 6%, the Hedley company's at 20%, and the Standard company's totals 20c. per share for the seven months on 2,000,000 shares, having a par value of $1 each. The Hedley company has in past years distributed 5% at the close of each of three quarters, and 15% for the fourth quarter, which course, it is expected, will also be followed this year.

Of the three divisions of the Cariboo district, Cariboo yields most placer gold. This season the John Hopp hydraulic mines are again in the lead in respect of quantity of gravel being washed and gold recovered. Quesnel division is not likely to yield as much as one fourth of the Cariboo division total, while in Omineca the season's work will again be chiefly preparatory, with little actual gravel washing.

Placer-gold mining on eight or ten streams in Atlin camp constitutes the most important phase of mining in the Cassiar district this year, as for all other years since 1897. Men in varying numbers are busy on McKee, Pine, Spruce, Birch, Boulder, Ruby, Otter, and others creeks, while on O'Donnell river and several tributary creeks there is considerable activity, in some measure recalling the early days of the Atlin diggings, when much more gold was taken out than in later years. As the construction of the Telegraph creek to Dease lake wagon road becomes further advanced, transportation difficulties are lessened, so placer mining on Dease and Thibert creeks in Liard division is less costly. Some lode-gold mining is being done in the neighborhood of Taku arm of Tagish lake, Atlin division.

Coal mining is not keeping the miners occupied full time in Crows Nest district, the demand for coal not being sufficient to give them constant employment. The Hosmer mines have been abandoned, and plant and machinery is being removed, disturbed country and consequent broken coal having caused increasing loss to the Canadian Pacific Railway Co. owning the mines. Reports of new placer gold finds on several streams have led to claim-staking, but little gold has yet been obtained. Some placer mining is again being done this year on Wildhorse, Perry, and other creeks. During seven months, to the end of July, approximately 13,000 tons of lead ore has been shipped to Trail from the Sullivan Group mines, and 750 tons from the St. Eugene. Construction of the Kootenay Central railway is well advanced; this will lead to more metalliferous mining being done in the district it passes through.

The Highland No. 1, and Bluebell mines, in West Kootenay, are steadily maintaining production and shipping silver-lead ore and concentrate to Trail. A small power-plant has been put in at the Silver Hoard, at which, and at the Florence company's property preparations for ore production are being made. Now that the Kaslo & Slocan railway has been reopened, the Cork, Utica, Retallack, and other mines will take advantage of the restored transportation facilities.

Among Slocan mines, the Rambler-Cariboo is keeping its concentrating plant going without intermission; exploration work is being continued at the Payne, but not much ore has yet been found in the deep of the mine; the Slocan Star concentrator is producing silver-lead and silver-zinc concentrate, and shipment of these products as well as of sorted crude silver-lead ore is being made; the Ruth-Hope, Richmond-Eureka, and Wonderful mines, all near Sandon, are being worked; concentrating plant is being put in for the Surprise, and at its neighbor the Noble Five, deep-level development is being continued; another strike of ore in the Reco is reported; the Standard is keeping up its profitable production and paying dividends regularly; the Hewitt-Lorna Doone group has been supplied with concentrating facilities for treating 150 tons of ore per day, while a dozen other Slocan mines are being worked.

MAP SHOWING MINING DISTRICTS OF BRITISH COLUMBIA NEAR THE UNITED STATES BOUNDARY.

In Nelson division, the Silver King's output of copper-silver ore during the expired seven months of the year has reached a total of more than 12,000 tons; the Molly Gibson is again active after the winter suspension, the deep snow having melted; the outlook for Ymir camp is brighter, ore having been proved to occur in considerable quantity in the Wilcox, Dundee, and Yankee Girl mines; the Motherlode and Queen gold mines on Sheep creek are busy; in the latter a big shoot of ore is being mined on the 600-ft. level; the Emerald and H. B. lead mines are shipping regularly to Trail; and work is in progress at the Second Relief at Erie.

Rossland mines are maintaining their output, shipments to Trail during seven months to August 1 having been, approximately: Centre Star group, 92,000 tons; Le Roi, 40,000 tons; and Le Roi No. 2 company's Josie group, 12,000 tons. All three properties are looking well, each having much good ore in its lowest workings. More additions and improvements are

being made at the Consolidated company's smelting works at Trail, including a second large copper blast-furnace and a third lead stack, in place of old furnaces removed, starting of two Wedge roasting furnaces, experimenting with the Cottrell fume condensation system, construction of a 250-ft. high reinforced concrete smokestack, and other betterments.

The largest copper mines of Boundary district continue to make a big production, the lower gold mine and mill are being worked steadily. ore is hauled in wagons from the Union mine, Franklin camp, to Lynch creek, and thence by railway, a total distance to Grand Forks of about 50 miles. In Similkameen district, the Hedley Gold Mining Co. is mining and milling 6000 tons or more of gold ore every month and is making good progress with construction work in connection with its new hydro-electric power system; the New York Syndicate No. 2 is again diamond-drilling on claims near the Nickel Plate group; the B. C. Copper Co.'s exploration work on Copper mountain has shown that much ore occurs there, estimated at 5,000,000 tons at least; and placer-gold mining, coal mining, and cement making are all having attention in the district. Coal mining in Nicola valley is being continued. In the neighborhood of Kamloops, the Iron Mask group is sending out an occasional shipment of copper-gold ore.

In the Coast district, the most important metal mining enterprises are those of the Britannia and Granby companies, respectively, but notice of these and other mining operations in this district must be deferred until later. There is, however, more activity in metalliferous mining now than for several years. Coal mining is not generally flourishing, last year's lack of production having caused the loss of markets to the mining companies. Strike pay having been stopped by the U. M. W. of A., the strikers now realize that they have lost in their struggle with the operators.

[Since the above notes were written, numbers of copper and other metal mines have been shut down, but with a better metal market some are certain to resume.—EDITOR.]

NEW YORK

PRESENT SITUATION IN COPPER, TIN, QUICKSILVER, CYANIDE, ZINC DUST, PEBBLES, AND SPELTER.

The war continues to engross the attention of everyone. There is no market in securities, no one is attempting to float any new companies, of course, and everyone is endeavoring to adjust themselves to the new conditions brought about by the European war. Shipments of copper to Europe are being gradually resumed, and 9472 tons of the metal was exported during the first 20 days of August. Freight and handling rates have come back to about 2¼c. per pound, and insurance rates have been reduced from 15% to 5%, so that it has become easier to get copper across the water to fulfill contracts. It must be remembered, though, that nearly half the United States exports go to Germany, so that with output here cut to one-half normal, it still seems probable that copper stocks will continue to grow for some time to come.

It must not be forgotten that, although the production was cut almost immediately upon the stoppage of exports, there was at that time three months of full-scale smelter production in the course of its routine from the smelters through the refineries, so that even were domestic consumers buying at their normal rate (which they are not), there would still be 150,000,000 lb. of copper for the producers to carry as stocks until exports can be resumed. To meet this critical situation, the selling agencies have declared what practically amounts to a 'moratorium,' by making no quotations for the time being. In this way the utter collapse of the copper market, which would do nobody any good, and would do some a great deal of harm, has so far been effectually prevented. The move has been effective and small lots of copper are being sold at 12½c. as compared with London quotations of 14½c. It is reported that the Calumet & Hecla will continue to work full time and will carry its accumulated stocks until they can be disposed of. As the Calumet & Hecla is an exceedingly powerful organization financially, it may be in a position to do so, but many of the other companies could not follow such a course of action, even if they would. If everybody tried to keep going now, the inevitable result would be that the market would finally break so badly that nearly everybody would have to call a halt. The Mohawk and Wolverine are reported to have made a wage decrease of 10%, with the intention of continuing work with a full force. Most of the copper-mining companies throughout the country have cut their output to one-half of normal. It is interesting to note that the suggestion now comes from London that the heavy copper consumption in Europe for the past year was caused by the manufacture of ammunition in Germany, the government of that far-seeing country having perceived that settlement of the Balkan troubles was not likely to be permanent, and accordingly prepared for war in times of peace.

Tin has begun to decline in price, having gone down again to 45c. per pound on August 20. This reflects confidence in British shipping being resumed on more nearly normal basis soon, though the Suez canal is said to be jammed with ships which are afraid to venture out into the waters on either side where hostile cruisers may be lurking. Now that the Panama canal is open, the 30,000 to 40,000 tons of tin concentrate which is shipped each year from Bolivia for smelting may be diverted here. There is actually a tin smelter already in existence near New York, for it was proposed to smelt tin at Bayonne, New York, some years ago. There is also a small plant at Long Island City. Tin smelting is a rather simple matter, and does not require very elaborate plant, so that if any of the smelting companies want to take advantage of the present situation, it would not be difficult to do so.

Quicksilver has gone up with a jump. The Austrian production is cut off as a result of the war, while the demand for the metal for making fulminate for caps has caused it to score a sharp advance. The production of Europe is completely controlled by the Rothschilds, who will make nice profits for the time being, in which the American independents will have some share, at least. It is an odd thing that the increase in the 'cost of living' is felt most seriously by the gold producers, who cannot increase the selling price of their product. The mercury they use for amalgamation has almost tripled in price, pebbles for grinding the ore previous to cyaniding will be more expensive, if they can be obtained at all, and the same is true of cyanide, both of these necessaries coming from Europe. Those who have protected themselves with advance contracts are therefore wondering if they can get supplied. Zinc dust is another necessity of many cyanide plants that will certainly advance in price, as it has so far nearly all been imported. The smelters in this country have promptly begun to produce it, and ample supplies will soon be available, though doubtless at a somewhat advanced price.

The Butte & Superior management is gleeful over the advance in the price of spelter, as the 1c. advance in the price recently made practically doubles the net earnings. The situation illustrates the truth of the old adage about not having all the eggs in one basket, since the war has made a tremendous decrease in the profits of the copper mines held by the same group, but partly makes it up in the form of increased profits on spelter. The same group is developing a large gold mine in the Juneau district, Alaska, and when that is producing can be practically sure of some profits under any stress of fortune.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

Chisana

According to J. Horsfield, who recently returned to Cordova, the Chisana district should show a good deal of pay-gravel in time. The latest scheme is to operate a hydraulic plant on Johnson creek and the flats. By consolidating certain properties it is expected that next summer considerable work will be done in this way. Men who are interested in this project, he says, are Hamshaw, Wiley, James, Nelson, Baldwin, Noyes, Irving, and others. A drill is now being taken in from White Horse and will be used this winter for prospecting.

Fairbanks

Rain has swollen rivers in the Tanana valley, the highest since 1905, and considerable damage was done last week at Fairbanks.——Two U. S. Government commissioners, Frederick Mears and Thomas Riggs, Jr., in charge of railway routes from Fairbanks to the coast, left here on August 22 for Ship creek. They state that surveys are nearly finished and preliminary estimates will be ready in a few weeks. They favor a route from Portage bay to Fairbanks by way of the Matanuska coalfields, Susitna and Neana rivers. The cost will be about $20,000,000.

Juneau

The Alaska Mexican, Treadwell, and United companies, on August 28, paid dividends of 20c., $1, and 20c. per share, respectively.

Wrangell

Barite, or barytes, or heavy spar, a barium sulphate, occurs on one of the Castle islands in Duncan canal, 40 miles northwest of Wrangell, according to Ernest F. Burchard in *Bulletin* 592-D of the U. S. Geological Survey. The deposit is possibly 75 by 200 ft. in area and 140 ft. thick, it standing up 35 ft. above high-tide level, and contains about 50,000 tons above high water. The mineral occurs mainly in schist, and where fresh is mostly a finely crystalline grayish white rock, with thin grayish blue veins and clouded areas, and a few thin black streaks. Pyrite is present nearly everywhere, and assays show low percentages of gold, silver, copper, lead, and zinc. Barite is used principally as a pigment in mixed paints, and for many other manufactures. The deposit is not of the highest grade, but is valuable, and could be shipped to Puget Sound or San Francisco. The output of the United States in 1913 was 45,298 tons, worth $156,275, while imports of crude barite were 35,840 tons, worth $61,409.

ARIZONA

Cochise County

On August 13 the new test plant at the Copper Queen mines was started, and a capacity of 120 tons per day is expected in a few days. The ore to be treated consists of chalcocite and chalcopyrite, containing from 1 to 3% copper, the gangue being a granite-porphyry. The ore will come from the Holbrook mine under Sacramento hill through the Neptune tunnel and Holbrook 200-ft. level. The mill flow-sheet is as follows: 50-ton storage bins, a Tekpith conical crusher reducing the ore to 1½ in., bucket elevator, 50-ton bin, belt conveyor over automatic scale, sampling system, a two-stage revolving trommel with ¾ and ⅜-in. mesh screens, oversize through rolls and back to smaller screen, Hartz jig, National table, tailing and middling from jig and table to classifier, fine pulp to three conical settling-tanks, coarse material to a Hardinge mill, and further classification and concentration. A flotation process to recover more concentrate is being considered. The rolls, screens, jig, etc., are driven by a 112-hp. General Electric motor, and 10-hp. motor drives the tables and vanners. Churn-drilling on Sacramento hill has been suspended temporarily, after 36 holes were drilled averaging 400 ft. in depth, and totaling about 15,000 ft. The installation consists of two Armstrong electric churn-drills, and one steam drill, in charge of a runner, helper, and sampler on each 8-hour shift. Each machine drilled from 25 to 30 ft. per shift. Two more Armstrong machines have arrived on the ground. Capping over the orebody is about 100 feet.

Greenlee County

Owing to the war the Arizona Copper Co. has suspended operations in mining oxidized ore at Metcalf, the Clifton concentrating plant, leaching plant, and acid plant. About 400 men have been discharged from all departments.——At Morenci, the Detroit Copper Co. has stopped work at the Santa Rosa, Summit, Wattles, and Fairbanks properties, all in the development stage. Production at the concentrator and smelter has been cut about 30%. Wages have been reduced 10%. ——A reduced force is working at the Shannon Copper Co.'s works.——The store departments of the above companies will supply the people of the district with goods at the lowest possible price.

Santa Cruz County

Lightning is supposed to have set afire and destroyed the concentrating plant at the old Mowry mine, damage being about $100,000. The mill formerly treated silver-lead ore, but has not worked for over six years.

CALIFORNIA

The value of the recoverable gold, silver, copper, lead, and zinc produced at mines in California in 1913, according to Charles G. Yale, of the U. S. Geological Survey, was $26,812,489, compared with $26,383,946 in 1912, and $25,174,677 in 1911. Except in zinc, there was an increase in the output

NORTH STAR MILL, GRASS VALLEY, CALIFORNIA.

of all these metals, although the tonnage from deep mines showed a decline and there were fewer mines reporting production than in 1912. The mine production of gold in 1913 was $20,406,958, $693,480 more than in 1912, an increase of 3.52%. The deep mines of the state produced $11,570,781, or

56.70% of the total. The increase in gold from deep mines for the year was $502,966, or 4.54%. The placer mines produced $8,836,177 in gold, an increase of $190,514, or 2.20 per cent.

This output of gold in California was the largest in 31 years, the yield in 1883 having been $24,313,873. Only three times in 49 years has the gold output exceeded $20,000,000, and if the year 1883 is excluded, the gold output in 1913 was higher than it has been since 1864. The gold is now derived from extensive operations, rather than from efforts of individuals or numerous small enterprises. Some of the deeper quartz mines are working as good ore at vertical depths of 3000 to nearly 4000 ft. as was found near the surface. The dredges are now producing 91.56% of the placer gold from ground which was formerly considered worthless for mining, as being too poor in gold, having no 'fall' or no drainage, and on which water could not be used advantageously on any scale under the old systems of gravel mining. There are now 63 dredges in operation in California, and since the beginning of operations with these machines in the state, 15 years ago, the dredge gold output has reached a total of $63,505,485. From a production of $206,302 in 1899, the annual output from gold dredges reached in 1913 the sum of $8,090,294, which is 39.64% of the total gold yield of the state, and 91.56% of the total output of placer gold. The hydraulic mines produced $329,300, or 3.73% of the total production of gold in the state in 1913, the drift mines produced $192,538, or 2.18%; and the surface or sluicing mines produced $224,045, or 2.53 per cent.

There were 410 deep mines reporting production in 1913, a decrease of 122 compared with 1912. A total of 2,495,958 tons of ore, was treated in 1913, a decrease of 145,539. The silicious ore treated at gold and silver mills, amounted to 1,905,258 tons, yielding $8,469,245 in gold, or $4.44 per ton in bullion. From this ore was derived 32,652 tons of concentrate, which contained $2,063,656 in gold, or $63.20 per ton. The average value in gold and silver in the ore milled was $5.57 per ton, of which $5.52 was in gold and 5c. in silver. The 531,189 tons of ore sent to smelters produced $840,030 in gold, or $1.58 per ton; and the treatment of 59,511 tons of old tailing yielded $197,850 in gold, or $3.32 per ton. Of the total recovery of gold in bullion from ore treated at gold and silver mills, $1,025,279 was won by direct cyanidation, and $7,443,966 by amalgamation. The total recovery of gold by the cyanide

Mine Production of Gold, Silver, Copper, Lead, and Zinc in California in 1913, by Counties

County.	No. of producers.	Ore treated. (Short tons.)	†Gold. (Value.)	†Silver. (Fine oz.)	Copper. (Pounds.)	Lead. (Pounds.)	Total value.
Alpine	1	9	$ 537	6	.....	.....	$ 541
Amador	29	640,593	2,901,898	29,962	19,015	.....	2,922,942
Butte	61	13,559	2,269,849	8,548	30	362	2,275,033
Calaveras	46	414,006	1,175,208	101,120	5,823,226	.....	2,138,884
Del Norte	5	.....	2,498	27	.....	.....	2,514
Eldorado	26	16,798	62,688	414	703	.....	63,047
Fresno	3	485	2,846	25	.....	.....	2,861
Humboldt	16	23	25,611	218	7,852	.....	26,960
Imperial	2	10,479	31,700	156	.....	.....	31,794
Inyo	44	38,064	237,310	226,579	114,213	3,246,432	588,670
Kern	39	147,131	649,712	19,621	3,432	159	662,102
Lassen	1	21	.....	3	2,258	.....	352
Los Angeles	2	185	2,322	45	.....	.....	2,349
Madera	8	3,545	14,489	2,677	531,819	.....	98,538
Mariposa	20	20,671	171,034	12,301	439,168	.....	246,535
*Merced	3	111	2,255	152	1,568	.....	2,590
Modoc	3	441	6,061	156	.....	.....	6,155
Mono	7	21,953	147,271	38,515	79,323	.....	182,829
Monterey	3	179	6,491	45	.....	.....	6,518
Nevada	35	276,306	2,918,733	43,944	.....	.....	2,945,275
Placer	39	17,683	220,785	4,921	374	682	223,845
Plumas	39	35,354	138,368	1,167	22,677	5,432	142,827
Riverside	4	780	12,501	172	.....	.....	12,605
Sacramento	15	.....	2,503,633	5,639	.....	.....	2,507,039
San Bernardino	54	40,513	356,524	73,531	484,568	237,480	486,494
San Luis Obispo	1	.....	124	2	.....	.....	125
Shasta	41	477,746	1,208,870	741,773	27,044,297	19,295	5,854,875
Sierra	41	74,656	1,006,573	7,127	484	4,159	1,011,136
*Siskiyou	74	3,508	180,125	2,034	.....	.....	181,353
*Stanislaus	2	.....	200	1	.....	.....	201
Trinity	72	3,497	431,862	3,508	.....	341	433,996
Tuolumne	32	236,062	974,409	40,366	.....	.....	998,790
Yuba	28	1,600	2,491,505	12,535	.....	.....	2,499,076
*Merced, Siskiyou, and Stanislaus	..	.....	252,966	1,109	.....	.....	253,636
Total 1913	796	2,495,958	$20,406,958	1,378,399	34,575,007	3,514,342	$26,812,487
Total 1912	1041	2,641,497	$19,713,478	1,300,136	33,451,672	1,144,731	$26,382,946

*Dredge production combined to conceal output of single dredges.

†Includes placer production.

The recoverable zinc production amounted to 1,057,485 lb. in 1913 (compared with 4,345,591 lb. in 1912), of which Inyo county yielded 963,571 and Shasta county 93,914 pounds.

process, including that recovered by the treatment of old tailing, was $1,289,353.

The two largest deep-mine gold districts are Grass Valley (including Nevada City) in Nevada county, and Jackson (including Sutter Creek) in Amador county, and it is due to these two that the counties of Nevada and Amador ranked first and second, respectively, in 1913 in gold production. In the Jackson district 448,269 tons of ore was treated, yielding $2,117,962 in gold, or $4.72 per ton, and $13,402 in silver, or $0.03 per ton, making a total production of $2,131,364 in gold and silver, or $4.75 per ton. In the Grass Valley district, 252,607 tons of ore was treated, yielding $2,830,661 in gold, or $11.21 per ton, and $26,082 in silver, or $0.10 per ton, a total production of $2,856,743 in gold and silver, or $11.31 per ton. Three other counties had a production of more than $2,000,000 in gold, namely: Sacramento, $2,503,633; Yuba, $2,491,505; and Butte, $2,269,849. These three counties owe their large production of gold to the dredging industry, from which the bulk of their gold is derived. The most productive metal district in the state in 1913 was Kennett, in Shasta county, where the largest smelter in California is situated. The total output at Kennett was 280,657 tons of ore containing recoverable values in gold, silver, and copper amounting to $3,716,430, or $13.24 per ton.

AMADOR COUNTY

Arrangements are being made by A. A. Krogdahl, of the U. S. Bureau of Mines, for a first-aid field meet at Jackson on Labor Day, Monday, September 7. It is expected that about 15 first-aid teams from the Mother Lode district will enter the contests and that prizes will be awarded the winning teams by the American Mine Safety Association and the operators and miners of the district. As a result of Mr. Krogdahl's work in coöperation with the Industrial Accident Commission, a great deal of interest has been aroused in first-aid-to-the-injured practices in the mining districts. Meets like the one mentioned above will stimulate interest and result in much permanent good.

COLORADO

LAKE COUNTY (LEADVILLE)

All of the important mines of the district are working as usual, and no changes are expected at present at the Ibex, Wolftone, Henriette, Colonel Sellers, Iron Silver, New Monarch, and Yak properties.——On August 13 a mysterious fire, in which dynamite exploded, destroyed the engine-room and plant at the Evening Star No. 5 mine on Carbonate hill. This ground is leased from the Star Consolidated Mines Co., in charge of E. D. Dickerman, by George E. Cramer. A new electric hoist and compressor had only recently been installed. The motor bore every sign of having been purposely dynamited.——From 102 pounds of ore, Connor's lease at the Little Jonny mine returned $8192. The full shipment of 2 tons assayed 171 oz. gold per ton.

OURAY COUNTY

The Wanakah Mining Co.'s smelter matte silver content, which is sold to the Garfield plant in Utah, is being settled at 52c. per ounce, and the local plant will settle for silver on that basis.——At a meeting of the Mountain Top Mining Co. on August 17, the old directors were reëlected, namely, J. H. Chambert, George H. Beebe, E. C. L. Bartow, William Story, Jr., Fred Carroll, E. A. Krisher, and G. H. Barnhart.——The Torpedo-Eclipse property in the Sneffels district was sold last week at a sheriff's sale to J. G. Tracy, on an order of the District Court, for $26,000.

TELLER COUNTY (CRIPPLE CREEK)

According to George A. Taylor, mill superintendent of the Portland company, a six months supply of cyanide is on hand for its mill here and at Colorado City. The Golden Cycle also has several months supply.——The Elkton company paid a quarterly dividend of 2%, or $50,000, on August 24.——The Golden Cycle company has paid its monthly dividend of 3%, or $45,000.

IDAHO

MINERAL COUNTY

Near the town of Saltese a new adit is being driven in the Monitor mine. This work will cut the vein at a great depth, and afford cheaper mining and transport than in the past.

SHOSHONE COUNTY

Officials of the various mining companies in the Coeur d'Alene met in Wallace last week, and discussed the lead, silver, zinc, and copper markets, to determine a possible plan regarding the operation of the mines and mills. No final decision was arrived at, although work has been curtailed at several properties, including the Morning, Missoula, National, Bunker Hill & Sullivan, Hecla, Last Chance, and others.

In cutting a station above the old shaft of the Castle Rock, near Wallace, high-grade copper ore, with some gold and silver, has been opened. A shipment of 45 tons is ready for the Tacoma smelter.——A winze is being sunk below the lower adit of the Great Western, north of Burke. Ore in this mine contains lead, copper, silver, and gold.——A flotation process has been tried by the Hunter company at Mullan, on an ore composed of heavy spar with rich sulphides of lead and silver, which has always been troublesome to concentrate by ordinary methods. A product assaying 43% lead and 500 oz. silver was saved, the tests being highly satisfactory.——The Stewart Mining Co.'s report for the past half-year shows a profit of $537,230; dividends paid, $247,672; and surplus, $1,105,366, of which $815,808 was on hand at the end of 1913. The annual meeting of the Company was to be held at Kellogg, August 29.

Ore and concentrate shipped to smelters from the Coeur d'Alene district in July was as follows:

Mines.	Tons.	Mines.	Tons.
Hercules	6,000	Sierra Nevada	1,200
Bunker Hill & Sullivan	5,200	Success	1,400
Morning	4,500	Gold Hunter	1,020
Green Hill-Cleveland	3,300	Ontario	1,000
Stewart	3,500	Snowstorm	1,000
Interstate-Callahan	2,300	Crown Point	100
Hecla	1,700	Caledonia	700
Last Chance	2,000	Yankee Boy	50
Tamarack & Custer	1,300		
		Total	36,270

This was only 3000 tons below the monthly average, in spite of several shut-downs.

In order to produce more zinc ore, the Interstate-Callahan company has engaged 100 extra miners; while the Success and Tamarack have increased their working force.

MICHIGAN

HOUGHTON COUNTY

(Special Correspondence.)—It is said that the Calumet & Hecla company will not cut wages, and if curtailment is a necessary expedient, half-time work will be instituted. Another interesting feature is the fact that the worst possible conditions would not permit shutting down the conglomerate shafts of the old Calumet & Hecla mine. They will be kept working and operating regardless of conditions. Such action practically is necessary, because of the great depth of the shafts, and the cost of maintenance of the pump service. It would be out of the question to permit these shafts to fill with water. It is interesting to know that practically all of the mining being done in these shafts is in the hands of men who have served the Company for long terms of years and are counted as the most efficient miners in the world, and would not be discharged unless exceptional circumstances arose.——Sinking to No. 26 level is under way at the Victoria

mine, and ore is being stoped from below No. 24. ——Tributers in the Michigan mine are taking out mass copper.

Houghton, August 20.

MISSOURI

Jasper County

The market for ores in the Joplin district was strong during the week ended August 15, and showed sharp advances. Zincblende was $6 per ton higher, $45 to $48 being paid for basis of 60 and 62% metallic zinc. Many producers are holding for $50. Prices at St. Louis rose to 5.75c. per pound for the metal. Calamine is bringing $21 to $22 per ton for ores with 40% zinc. A rise is expected in lead, but no strength has been developed yet. The output for the 33 weeks of the year to date was blende, 161,404 tons; calamine, 10,363 tons; and lead 27,804 tons, worth a total of $7,637,118.

A 400-ton electrically-driven plant is being constructed for Frank Wallower and associates on a 20-acre lease of the Connor land, south of Carterville. Sheet ore has been proved at a depth of from 185 to 205 ft.——A U. S. Bureau of Mines rescue-car is to be sent to Joplin for three weeks instruction.

MONTANA

Silverbow County

On the night of August 20, the head-frame, hoisting engine, engine-house, orebins and shaft collar of the Mountain View mine of the Anaconda company were destroyed by fire. The damage is estimated at $100,000. Work was suspended at this mine early in August.——The North Butte mine has been shut down temporarily.

NEVADA

Elko County

The Eastern Star mine in Gold Circle district, in the western part of the county, is to be equipped with a 50-ton amalgamating and cyaniding mill. A. D. Cox has been appointed mine manager, and is now engaged in conducting mill tests in San Francisco. The Company estimates 20,000 tons of ore in the mine and dumps, of an average value of $30 per ton, of which 10,000 tons is developed on three sides. The vein is from 5 to 15 ft. wide, and the ore-shoot is 140 ft. long. There are two quartz veins, on the foot-wall and hanging wall, which carry high gold content. The property is patented and has ample water for mine and mill purposes. R. S. Bolam, vice-president and director, has resigned, and was succeeded by C. F. Spilman, of San Francisco. The office of the Company is at Winnemucca. L. G. Campbell, of Winnemucca, is secretary and treasurer and resident agent.

The Nevada Copper Mining, Milling & Power Co., at Contact, is to erect a 100-ton leaching plant, the crushing department to have a capacity of 500 tons per 8 hours, so allowing for future increases. The process will be similar to the Butte-Duluth at Butte, Montana. Henry Smith is manager.

Humboldt County

The Seven Troughs Coalition gold yield in August will be about $26,000. In a raise above 1200 ft. there is 2 ft. of $624 ore; and in the south drift at this depth is 10 ft. of ore, with a streak assaying $481 per ton. The foot-wall streak of 24 in. is worth $99. Ore in the stope above 1150 ft. assays $243, and a stope north of the Bird winze above 1200 ft. is $198 per ton, according to L. A. Friedman, of the Company.

Lander County

A plant consisting of a rock-crusher, Denver quartz mill, and Isbell vanner is now treating the rich silver-lead ore of the Ruby silver mine, 12 miles from Battle Mountain, and in charge of George Abel. Another Denver mill has been ordered, and the capacity of the plant will be from 60 to 75 tons per day. The mine has been developed by adits. Charles Day is mine superintendent.

Nye County

Seven mines at Tonopah produced 11,026 tons of ore worth $207,800 last week. ——The Belmont in July treated 14,981 tons of ore yielding 3079 oz. gold and 287,593 oz. silver and a profit of $102,316. ——The Extension's yield was 4001 tons for $110,091, with a profit of $51,120. A 150-hp electric Nordberg hoist was ordered last week for the mine. Additions to the mill and surface plant are progressing well. ——Profits of the Jim Butler in July amounted to $9395 from 3950 tons of ore. ——According to Clyde A. Heller, the Belmont company has six months supply of cyanide and zinc-dust on hand, the other mines are well stocked, and all have good cash reserves to help their difficulties, if any, in the silver market.

OREGON

Josephine County

(Special Correspondence.)—The old Granite Hill mine, in the Louse Creek district, are to be reworked by the Oregon Gold Mines Co., in charge of J. M. O'Grady. The first work will be to unwater the mine by baling. Electric pumps were drowned on No. 7 level some time ago. There is said to be a good tonnage of ore developed, containing fair gold content. There is a good equipment consisting of a hoist, compressors, steam and electric power-plant, 30-stamp mill and concentrators, all in good order.——Several mines in Southern Oregon are backed by European capital. The Braden mine has been shut down since the war started, although making good returns. The Bill Nye is owned by French people, but is still working.

Grants Pass, August 12.

UTAH

On account of the improvement in the metal market, lead-zinc-silver mines of the state are resuming production.

Beaver County

Mining has been restarted at the Moscow silver-lead mine in the Star district, and ore shipments are to be made shortly. The new shaft is down 800 ft., and some ore was cut there. There are 63 men employed.

Carbon County

In driving an 8 by 12-ft. tunnel through hard rock in the Utah Fuel Co.'s Clear creek mines, a record was made of 360 ft. in 30 days, working two shifts per day. The tunnel is to be 4000 ft. long. Drills of 3¼ in. size were used to drill 6-ft. holes, and 60% gelatine broke the ground. Between $150,000 and $200,000 will be expended by the Company in the installation of new equipment to consist of an electric power-plant, transmission lines, tracks, electric locomotives, undercutting coal machines and various other forms of equipment necessary.

Juab County

The advance in the price of spelter has resulted in zinc ores being mined again in the Tintic district, especially from the 200, 300, 400, and 500-ft. levels of the May Day, and 1500, 1700, and 1800-ft. levels of the Lower Mammoth.——Eighty-four cars of ore were shipped from the district last week.

Salt Lake County

The Ohio Copper Co.'s coarse-crushing plant at Lark is now working.—Owing to the better outlook for silver, smelters in the district are paying 40c. per ounce for silver, instead of 25c. as heretofore, and silver producing mines are resuming full operation. Copper is paid for at 10c. per pound, and lead at $3.87½ per 100 pounds.

Summit County

Since the Daly-Judge property stopped producing ore, the main shaft is being repaired and retimbered to 200 ft. and the mine and mill equipment thoroughly overhauled. The improved price of silver may induce the Company to resume work, according to the general manager, G. W. Lambourne.

——Driving the Snake Creek tunnel is under full swing, 14 ft. per day being made, the total distance being 8600 feet.

WASHINGTON

The Republic Consolidated Mines Corporation, capitalized at 150,000 shares at $1, recently organized to take over the Lone Pine, Pearl, and Surprise mines at Republic, the properties of the defunct Republic Mines Corporation, has completed the details of its incorporation and taken charge of the mines. A. B. Willard, of Tekoa, is president of the new Company; J. P. Burson, of Tekoa, treasurer; A. J. Laughlin, of Spokane, secretary; and Forrest I. Gill, of Spokane. George S. Bailey, of Republic, who was federal trustee in bankruptcy for the bankrupt concern, is general manager. The new Company has taken a bond for $150,000 on the R. M. C. mines, and the first payment will amount to $54,500, cancellation of the claims of the secured creditors, which consist of a $32,000 mortgage held by A. B. Willard and A. J. Laughlin, a judgment held by F. C. Robertson for $2500, taxes amounting to $12,000, industrial insurance fees of $1000, and accrued interest on all. The remaining $95,500 is to be paid within two years. Royalties on ore shipments of 10% on $12 per ton or less, 15% on that running from $12 to $20 per ton, 20% on that between $20 and $25 per ton, and 30% on all over $25 per ton ore, are to be turned over to the trustees of the Republic Mines Corporation to pay the unsecured claims, approximately $35,000, which now have become secured by the cancellation of the preferred debts.

CANADA

ONTARIO

As the International Nickel Co. has its refinery in Wales, it has closed down all of its mines save the Creighton, and operations there have been considerably curtailed. The Alexo mine shipped 654 tons of ore in July.

MEXICO

CHIHUAHUA

According to Karl Bernson, of the General Engineering Co. of Salt Lake City, which Company is to reconstruct El Rayo mill, the country is devastated and battle-torn. Stocks in stores of various towns are very low. There is a shortage of labor, Mexicans preferring the easy life of Villa's army to working about mines. It is said that Villa used to be head teamster for El Rayo Mining Co. Generally, the outlook for a revival of mining is fairly bright.

KOREA

The Seoul Mining Co., operating the Suan Concession in Whang Hai province, reports the following results for July, 1914:

Stamps working	40
Time, days	28.75
Ore crushed, tons	6140
Total recovery	$68,500
Operating expenses	28,000
Net earnings	42,500

PHILIPPINE ISLANDS

Philippine Dredges, Ltd., boats in June recovered a total of 1027 oz. gold. No. 1 handled 12,600 cu. yd. averaging 34c. per yard; No. 2, 13,300 cu. yd. of 22c.; and No. 3, 27,000 cu. yd. of 46c. per yard. The lower tumbler of No. 1 caused 8 days' delay, the main pump on No. 2 lost 21 days, and on No. 3 the condenser and main engine crankshaft required 9 days to repair. The pontoon of No. 4 dredge was launched on June 27. A typhoon caused further loss of time, resulting in only 52,900 cu. yd. for the three boats, against 127,750 in May.

PERSONAL

PHILIP ARGALL has been in Idaho.

RALPH ARNOLD was in San Francisco.

HENNEN JENNINGS is at Camden, Maine.

J. H. JANEWAY, JR., is in San Francisco.

R. A. PENROSE, Jr., was in San Francisco.

HORACE V. WINCHELL is expected at Butte.

CHARLES JANIN left for New Mexico, Monday.

ERNEST H. SIMONDS is at Melones, California.

WILLIAM BREWER has been at Prince Rupert.

GRANVILLE MOORE is in Alaska on examination work.

WILLIAM S. MANN is testing the ores of La Trinidad Mines, Placer county, California.

HENRY H. ARMSTEAD has returned to New York from Mexico, where he has been on a business trip for six weeks.

C. COLCOCK JONES has returned to Los Angeles after a month's absence in Arizona and southeastern California.

D. L. H. FORBES has accepted the position of chief construction engineer for the Chile Exploration Co., at Chuquicamata, Chile.

J. A. HOLMES has much benefited in health from his stay in New Mexico, but does not expect to return to Washington for several months.

W. M. H. WOODWARD has been appointed mineral examiner of the U. S. Forest Service District No. 6, with headquarters at Portland, Oregon.

A. B. EMERY has been appointed general manager for the Messina (Transvaal) Development Co., Ltd., and has gone to Messina to take charge.

A. J. HOULE has been appointed professor of metallurgy and ore dressing at the Michigan College of Mines to succeed S. S. BRUCE, recently resigned.

H. F. LUNT, of Colorado Springs, made an examination recently of the Scotia mine of the San Juan Queen group, situated in Picayune gulch, in the Animas Forks district.

STANLY A. EASTON, manager for the Bunker Hill & Sullivan Mining & Concentrating Co., spoke on the mining industry of Idaho at the eleventh annual miners' picnic at Kellogg last week.

LLOYD B. SMITH, of the Associated Geological Engineers, sailed on August 12 for Colombia, S. A., where he will be engaged in the examination of oil territory for a couple of months.

D. C. JACKLING has removed his residence from the Hotel Utah at Salt Lake City, to the St. Francis Hotel, San Francisco; he has taken the top floor of the new Hobart building for his head office.

SOLON SPIRO, president and general manager for the Silver King Consolidated Mining Co., of Park City, Utah, is in Germany, and cablegrams have failed to reach him in either Switzerland or Germany.

JAMES BOWE, for several years dredge-master of the Empire dredge, owned by the Oro Electric Corporation, at Oroville, has been appointed superintendent for the La Grange Dredging Co. at La Grange, California.

Among those planning to attend the Lake Superior field meeting of the American Association of State Geologists, August 27 to September 2, were E. A. SMITH, Alabama; H. A. BUEHLER, Missouri; L. W. TRUMBULL, Wyoming; JOSEPH HYDE PRATT, North Carolina; J. A. BOWNOCKER, Ohio; R. R. HISE, Pennsylvania; C. W. SHANNON, Oklahoma; W. O. HOTCHKISS, Wisconsin; I. C. WHITE, West Virginia; W. H. EMMONS, Minnesota; F. W. DEWOLF, Illinois; E. H. SELLARDS, Florida; GEORGE H. PERKINS, Vermont; R. C. ALLEN, Michigan; E. O. ULRICH, United States Geological Survey; W. G. MILLER, provincial geologist, Ontario.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, August 27.

Antimony	No quotes
Electrolytic copper	15¾
Pig lead	3.90
Quicksilver (flask)	$80.00
Tin	No quotes
Spelter	7¾
Zinc dust, 100-kg zinc-lined cases	15

Although the above prices are given, there has been little business done, and in the case of quicksilver and zinc dust stocks are small. According to the U. S. Geological Survey, antimony during the past six years has ranged from 7.45 to 10.31c. per lb., and in July about 7.05c., but since the war it has risen to over 20c. per lb. The United States annual consumption is 12,755 short tons, of which 7410 tons is imported. Deposits of this ore in this country can now be profitably worked.

EASTERN METAL MARKET

(By wire from New York.)

New York, August 27.—Lead is quiet at 3.87c; spelter, 5.77c., with little domestic inquiry, but considerable export demand; while copper is unchanged. The McKinley-Darragh, of Cobalt, declared its regular quarterly dividend of 3%. Exports of gold and silver from New York for the year up to August 15 were $126,962,949 and $25,692,576, respectively, against $68,742,696 and $31,551,899 for the same period of 1913. Platinum is over $50 per ounce. The European market for radium-bearing ores is entirely closed.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.		Average week ending	
Aug. 20	No quotes	July 15	55.60
" 21	" "	" 22	54.14
" 22	" "	" 29	53.42
" 23 Sunday		Aug. 5	No quotes
" 24	" "	" 12	" "
" 25	" "	" 19	" "
" 26	" "	" 26	" "

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The Smoot bill authorizing the Secretary of the Treasury to buy 15,000,000 oz. of silver from American mines within six months passed the Senate on August 23 by 39 to 11 votes. The measure is now before the House. This should make a regular market for about 25% of the annual production of the country. The San Francisco Mint is now a buyer for 200,000 oz. of the metal. On August 27 there were quotes at 58⅝c. per oz. Smelters at Salt Lake City are now advancing 40c. per oz. on ore shipments. The French mint is coining silver night and day. Bar silver in London was 25d. (50c.) on August 26. Advice from London of August 13 states that the average for that week was 26.75d. for cash transactions. Stocks there early in the month were about 5,000,000 oz. On the whole, the silver market is fairly satisfactory.

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per pound more. Prices are in cents per pound.

Date.		Average week ending	
Aug. 20	No quotes	July 15	13.47
" 21	" "	" 22	13.25
" 22	" "	" 29	12.87
" 23 Sunday		Aug. 5	No quotes
" 24	" "	" 12	" "
" 25	" "	" 19	" "
" 26	" "	" 26	" "

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.31	13.26
Feb.	14.93	14.46	Aug.	13.44	
Mch.	14.72	14.11	Sept.	16.27	
Apr.	15.22	14.19	Oct.	16.31	
May	15.42	13.97	Nov.	15.08	
June	14.71	13.60	Dec.	14.27	

Exports during the third week of the month were 3564 tons, an increase of 2927 tons, the month to date showing a decrease of 13,723 tons, and the year to date an increase of 26,221 tons. Smelters in Utah are advancing 10c. per lb. for the metal. Our New York letter of this issue covers the copper situation.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Aug. 20	3.87	July 15	3.90
" 21	3.87	" 22	3.90
" 22	3.87	" 29	3.85
" 23 Sunday		Aug. 5	3.85
" 24	3.87	" 12	3.85
" 25	3.87	" 19	3.88
" 26	3.87	" 26	3.87

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.37	3.80
Feb.	4.33	4.02	Aug.	4.60	....
Mch.	4.32	3.94	Sept.	4.70	.
Apr.	4.36	3.86	Oct.	4.37	.
May	4.31	3.90	Nov.	4.16	. .
June	4.33	3.90	Dec.	4.02	. .

The St. Louis market is firm at 3.75c. per pound.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Aug. 20	5.77	July 15	4.75
" 21	5.77	" 22	4.75
" 22	5.77	" 29	4.75
" 23 Sunday		Aug. 5	4.75
" 24	5.77	" 12	5.25
" 25	5.77	" 19	5.60
" 26	5.77	" 26	5.77

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	....
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	. . .

The St. Louis market is higher at 5.87c. per pound.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
July 23	37.50	Aug. 13	85.00
" 30	37.50	" 20	No quotes
		" 27	80.00

TIN

As soon as vessels are available, tin should be coming to the United States. Bolivian concentrate can be smelted at Bayonne, New York. There is 920 tons of metal afloat for this country, and 2115 tons have arrived since August 1. Prices have receded and are now down to 43c. per lb. A feature of the market is the irregularity and declining tendency of the spot price. Tin-plate works have curtailed their output, and tin plate has advanced in price. A revival of the Welsh tin-plate business is starting.

CYANIDE

Advice from New York states that Roessler & Hasslacher have called in all their salesmen, having the next two years' business in sight. The firm does not consider the shortage serious, and thinks there is enough for all if consumers are careful. Prices are unchanged. The Rand used 10,167,934 lb. in 1913, of which half came from Germany. The present supply in Africa is about three months. A higher price should stimulate production from gas works' by-products.

The Zinc Situation

By C. E. SIEBENTHAL

Supplementing its midyear statistics of spelter production, published in the *Press* of August 22, the U. S. Geological Survey makes the following statement on the general zinc situation, especially as affected by the war in Europe.

By a queer coincidence the great smelting centres of continental Europe are in regions where active fighting is now going on or may be expected in the near future. The zinc smelters of Upper Silesia are in the extreme southeastern portion of Prussia, mostly in the Kattowitz, Beuthen, and Tarnowitz districts, which are adjacent to one another and lie within five or ten miles of the Polish-Russian border and near the corner of Russia, Austria, and Germany. The two smelters in Russian Poland are just across the border from the Silesian smelters. They all seem destined soon to be compelled to suspend, or decrease operations on account of military activities, and in any event their output certainly cannot reach the outside world. The same thing is true of the smelters in Rhenish Prussia and Westphalia, some of which are very near and most of which are within 100 miles of Liége. In Belgium all but three or four of the zinc-smelting plants lie between Verviers and Liége or are strung along the valleys of the Meuse between Liége and Namur, and their industrial prospects can well be imagined. The zinc smelters of France lie outside of the territory where active military operations are likely, and so will probably suffer only from scarcity of labor as the employees are called to the colors, and from derangements of transportation. The same is true of the zinc smelters in England, but those of Austria-Hungary will, of course, be put out of commission. Other small smelters in Europe, Australia, and Japan will possibly not be affected except as transportation is interrupted. From these observations it can be seen that the zinc-smelting industry of Europe will be in a sadly demoralized condition while the war continues and for some time thereafter.

The following table shows the number of smelters in each European country in 1910, the latest year for which information is available, the production for that year, and also, for comparison, the production for 1913, in short tons:

	No. of plants.	Production, 1910.	Production, 1913.
Germany:			
Upper Silesia	24	154,596	187,522
Southwest Germany	10	96,450	102,350
Belgium	13	190,233	217,928
Great Britain	17	69,531	65,197
France	5	57,805	78,289
Spain	2	7,206	
Holland	1	23,121	26,811
Austria-Hungary	4	14,666	23,928
Norway	1	.....	10,237
Russian Poland	2	9,514	8,389
Total	..	.....	720,651

The output of the smelters in Australia and Japan in 1913 was 11,305 short tons.

If the war continues for one year, the output of these countries for that period would, at a conservative estimate, be only about 250,000 tons—a loss of nearly 500,000 tons for the year. The continental spelter market will also be demoralized, however, so it may be that the reduced production will still be ample. Apparently England's industrial activities after the first readjustments are over may not be seriously restricted.

The war but serves to emphasize a condition which already confronted the zinc industry of the United States. The zinc-smelting capacity of this country has been increasing of late years all out of proportion to the consumption, as the following table will show:

	Retorts at close of year.			
Year.	Number.	Est. max. an. capacity, short tons.	Production, short tons.	Appar. consumption, short tons.
1908	93,958	404,960	210,424	214,167
1909	94,328	400,681	255,760	270,730
1910	93,722	398,105	269,184	215,884
1911	85,018	361,327	286,526	280,059
1912	107,948	458,779	338,806	340,341
1913	113,786	483,591	346,676	295,370
1914	130,274	561,165	*175,058	*149,263

*For first six months of year.

The actual gain in capacity is even more than is indicated in the table, for in the earlier years a number of small, antiquated smelters that had been idle for several years were included in estimating the total capacity, whereas in the later years almost all such smelters have been dismantled or abandoned completely, and there have been more new modern additions than ever before in the same time. It is to be borne in mind that a certain portion of the capacity is taken up in the redistillation of zinc drosses, and that some plants do not yield full capacity because they treat lower-grade ores, so that the spelter produced from ore always falls several thousand tons short of the maximum capacity. On the other hand, the new zinc oxide plant at Leadville, Colorado, will take a great deal of the low-grade carbonate ore away from the zinc smelters, so that the capacity per retort will be increased because of the higher grade of the remaining supply; and the introduction of ore flotation in the Western States will probably raise the grade of zinc concentrate from that area, likewise increasing the capacity per retort.

The following table shows that the production of zinc at the mines is increasing. Figures are in short tons:

	1912.	1913.
Joplin district	152,465	146,474
New Jersey	69,755	84,122
Colorado	66,111	59,673
Montana	13,459	44,337
Upper Mississippi Valley	37,115	32,346
Other states	39,911	51,430
Total	378,816	418,382

The largest increase in sight comes as a result of the application of ore flotation concentration in Montana, but an increase due to the same cause is to be looked for in Idaho and possibly in Utah. In Montana the Butte & Superior mill is now producing at the rate of 50,000 tons of zinc per year, and the new Pilot-Butte mill, which has just gone into operation, should raise the state output to 70,000 tons per year, or if, as planned, another unit is added to this mill the state output may rise to 90,000 tons and more by 1915. In Colorado the new zinc oxide plant at Leadville is reported to be purchasing 14% zinc carbonate ore, as against a minimum of about 20% ore purchased by zinc smelters. As the Leadville carbonate ore is not amenable to concentration, this means a large increase in the available zinc ore resources of that region. Another source of zinc which will be made available in the future is zinc-bearing copper ore, the zinc content of which at present either makes the ore unsalable or, when the ore is smelted for the copper, collects as flue and bag-house dusts, for the recovery of the zinc from which there is at present no suitable process. Much ore of this sort is mined in Shasta county, California, and such zinciferous dusts are accumulating in large quantities at the smelters in that region.

With the establishment of peaceful conditions in Mexico, it is to be expected that imports of zinc ore from that country will again reach large proportions, and likewise the imports

from Canada may perhaps become larger even than they were in 1907 before the imposition of the tariff. With the closure of the Belgian and other continental markets to the Australian product from Broken Hill, Australia, this product may be partly diverted to the United States. If a sufficient foreign market becomes available the surplus smelter capacity in the United States might perhaps be employed in smelting foreign zinc ores under bond and a business might grow up similar to that which exists in lead smelting. This work could be done only at the expense of domestic production of zinc ore, for the present domestic production more than equals the apparent domestic consumption as spelter and as zinc oxide and bids fair to exceed it greatly in a year or two unless consumption is increased by development of export trade in manufactured zinc and galvanized-iron products.

The opening of the Panama canal, the necessary establishment of American lines of transportation to South America, Australia, and the Orient, and, in the present crisis, the large dependence of those continents on the United States for their supply of zinc, all make for a quick commercial introduction of the products of the United States zinc industry to those continents—an introduction which under other conditions might have taken years.

It is known that large stocks of spelter exist in Europe. The *Iron Age*, of London, gives the stocks at the end of March as 73,000 long tons and quotes an estimate of 80,000 long tons for the end of April. At that rate the stocks on hand June 30 must have been considerably over 100,000 short tons, compared to 64,039 short tons in the United States. The greater part of the European stocks, however, must have been held in the interior and must now be isolated, so that for the term of the war they may be disregarded. After the war what remains of these stocks will become available again and will possibly operate to depress prices, but in the meantime the United States zinc operators will have had the opportunity to dispose of domestic stocks and to become established in the foreign markets.

There is a foreign market for over 72,000 tons of zinc, of which about 30,000 tons consists of spelter in slabs and the remainder of zinc sheets. The American zinc industry should stand an excellent chance to take over the trade in zinc slabs and such part of the trade in zinc sheets as American zinc-rolling mills can furnish. The trade in galvanized-iron sheets is dominated by Great Britain, which controls 87% of the total export trade in that commodity with the four countries concerned. In addition to over 65,000 tons of spelter smelted in her own plants, Great Britain in 1913 imported 150,000 tons, presumably used chiefly in making her enormous output of galvanized iron. It would seem that any expansion in Great Britain's foreign trade either in spelter and zinc sheets or in galvanized iron would entail the importation of more spelter from the United States. This country has the opportunity, therefore, to furnish the major part of 222,000 tons of spelter a year as long as the war lasts, together with whatever part of the spelter for the galvanized-iron trade of the southern continents and Asia it can acquire. By the time the war closes, American zinc should have obtained a permanent foothold in these markets, sufficient to take care of the surplus smelter capacity of the United States.

These calculations do not take into account the increased exports of zinc pigments that must come about, thus absorbing some of the domestic surplus zinc resources. Moreover, the United States imports each year from Continental Europe about 2500 tons of zinc dust. This supply of zinc dust is now cut off, and the dust has already greatly advanced in price. Zinc dust is produced at two American smelters and could easily be produced at others, so that no doubt the better prices will result in the whole demand being supplied from domestic sources, thus absorbing another portion of the surplus zinc ore.

BOOK REVIEWS

TWENTY-FOURTH ANNUAL REPORT of the Transvaal Chamber of Mines. P. 607. The Argus Printing & Publishing Co., Ltd., Johannesburg, 1914.

The Transvaal Chamber of Mines is an influential body and represents 76 of the most important mining companies in South Africa. A glance at the report for 1913 shows the area and extent of the mines and various other important details. These mines produce about 40% of the world's gold, which was approximately £93,416,000 in 1913, £37,358,000 coming from the Transvaal from 26,267,840 tons of ore. Since 1884 this state of the Union of South Africa has produced gold worth £401,138,233. Dividends paid in 1913 amounted to £8,596,532, and £100,059,305 to date. During the fiscal year ended March 31, 1913, the Union government received £2,359,263 in taxes from all mines, of which £1,011,429 was from gold mines. An average of 24,015 white and 195,614 colored persons were employed in the Transvaal in 1913, who drew a total of £13,476,300 in wages. There were 65 white and 668 colored workers killed, giving a death rate of 3.02 and 3.74 per 1000, respectively. Stores purchased during the year totaled £10,579,712. Such figures indicate the magnitude of the industry. The annual report also gives information on the Chamber's constitution, report of the annual meeting, balance sheet (income of £18,581), president's address, all particulars of native labor, legislation affecting mining, mine sanitation, analysis of gold production and dividends, statements presented to the Economic Commission (a British commission investigating resources, etc., of the colonies) of 182 pages, a list of companies registered in the Transvaal in 1913 with a total capital of £10,253,258, and a list of liquidations of companies with a total capital of £8,404,710.

HANDBOOK OF MILLING DETAILS. Compiled from the *Engineering and Mining Journal* by the Editorial Staff. P. 425. Ill., charts, index. McGraw-Hill Book Co., Inc., New York, 1914. For sale by the *Mining and Scientific Press*. Price, $4.

This may be called a companion work to the 'Handbook of Mining Details,' published by the same firm in 1912, and is in every way as useful for millmen as the other was for miners. The book is a collection of articles which have been published in the New York journal during the last two or three years under the general head of 'Details of Metallurgical Practice,' and were written by a large number of operators working under widely different conditions. As is highly desirable in all such compilations, this one has been arranged with definite departments as follows: sampling; ore dressing—breaking, crushing, and grinding; ore dressing—washing, separating, and concentrating; accessory apparatus for ore dressing; notes on the equipment of metallurgical plants; hydrometallurgical processes; smelting; and refining. Practically all apparatus described is illustrated. Credit must be given to John Tyssowski for the arrangement and revision of a large part of this useful book.

RECOMMENDATION AS TO SANITATION CONCERNING EMPLOYEES OF THE MINES OF THE RAND. By W. C. Gorgas. P. 24. Argus Printing & Publishing Co., Ltd., Johannesburg, 1914.

This is the report made by the well known sanitary expert of the Canal Zone to the Transvaal Chamber of Mines, and was reviewed in the *Press* of August 1.

GENESIS OF THE MACKAY COPPER DEPOSITS, IDAHO. By Joseph B. Umpleby. Reprint from *Economic Geology*. P. 52. Illustrated. An abstract of this paper was published in the *Press* of July 11.

RECENT PUBLICATIONS

U. S. Geological Survey publications, Washington, 1914:

Abstracts from 'Mineral Resources of the United States, 1913:'

Recovery of Secondary Metals. By J. P. Dunlop. P. 6.

Statistics of the Pottery Industry of the United States. By Jefferson Middleton. P. 15.

Production of Fluorspar. With a note on cryolite. By Ernest F. Burchard. P. 9.

Production of Salt, Bromine, and Calcium Chloride. By W. C. Phalen. P. 17.

Gold, Silver, Copper, Lead, and Zinc in the Eastern States. Mines report. By H. D. McCaskey. P. 23.

Production of Abrasive Materials. By Frank J. Katz. P. 20.

Production of Barytes. With a note on strontium ore and its salts. By James M. Hill. P. 10.

Quicksilver in 1913. Production and resources. By H. D. McCaskey. P. 6.

Production of Mineral Waters. With a discussion of their radioactivity. By R. B. Dole. P. 47.

The Gypsum Industry. By Ralph W. Stone. P. 18.

Clay Products of the United States. Chart compiled by Jefferson Middleton.

Production of Peat. By Charles A. Davis. P. 10.

Production of Graphite. By Edson S. Bastin. P. 71.

Production of Manganese and Manganiferous Ores. By D. F. Hewett. P. 18.

Production of Asbestos. By J. S. Diller. P. 16.

Production of Sand and Gravel in 1913. By Ralph W. Stone. Advance chapter from 'Mineral Resources of the United States, 1913.' U. S. Geological Survey. P. 13. Washington, 1914.

Silver, Copper, Lead, and Zinc in the Central States in 1913. Mines report. By B. S. Butler and J. P. Dunlop. Abstract from 'Mineral Resources of the United States, 1913.' P. 171.

The Middle Triassic Marine Invertebrate Faunas of North America. By Jas. Perrin Smith. *Professional Paper* 83. P. 254. Chart, 99 plates, index. In *Paper* 40 was published a synoptical introduction to the whole faunal work, by Alpheus Hyatt and the present author. The remaining specific descriptions and illustrations are to be published in three volumes, on the marine faunas of the lower, middle, and upper Triassic of America. The second named is presented first, as it was nearer completion when this plan was decided on. The large number of halftones are suitably described in the text.

Publications of the U. S. Geological Survey. (Not including topographic maps.) July, 1914. P. 136. Contains complete lists to date of the serial publications of the Survey.

Transportation of Debris by Running Water. By Grove Karl Gilbert. *Professional Paper* 86, based on experiments made with the assistance of Edward Charles Murphy. P. 263. Ill., index. This valuable paper states that the finer débris transported by a stream is borne in suspension, while the coarser is swept along the channel bed. There is also discussed the slope factor, discharge factor, fineness factor, form factor, velocity, mixtures of débris, modes of transportation and movement of particles, collective movement, application of formulas, load *v.* energy, flume transportation, vertical velocity curve, and the Pitot tube.

Water-Supply Papers:

A Method of Determining the Daily Discharge of Rivers of Variable Slope. By M. R. Hall, W. E. Hall, and C. H. Pierce. No. 345-E. P. 13.

Lower Mississippi River Basin. By Robert Follansbee. 'Surface Water-Supply of the United States, 1912.' No. 327. P. 84. Ill., index.

The Discharge of Yukon River at Eagle, Alaska. By E. A. Porter and R. W. Davenport. No. 345-F. P. 11. Illustrated.

Quality of the Surface Waters of Washington. By Walton Van Winkle. No. 339. P. 105. Maps, index.

Electric Activity of Ore Deposits. By Roger C. Wells. *Bulletin* 548. P. 78. Ill., index.

The Ore Deposits of Northeastern Washington. By Howland Bancroft. Including a section on The Republic Mining District. By Waldemar Lindgren and Howland Bancroft. *Bulletin* 550. P. 215. Ill., maps, plans, index. Notes from this will be published in 'The Mining Summary' of another date.

Mining Districts of the Dillon Quadrangle, Montana, and Adjacent Areas. By Alexander N. Winchell. *Bulletin* 574. P. 191. Ill., index. Notes on this were published in the *Press* of July 18.

Reconnaissance of Oil and Gas Fields in Wayne and McCreary Counties. By M. J. Munn. Prepared in cooperation with the Kentucky Geological Survey. *Bulletin* 579. P. 105. Ill., maps, index.

Oil and Gas in the Western Part of the Olympic Peninsula, Washington. By Charles T. Lupton. Contributions to *Economic Geology*, 1913. *Bulletin* 581-B. P. 81. Maps.

U. S. Bureau of Mines publications, Washington, 1914:

Coal-Mine Fatalities in the United States, May, 1914. Compiled by Albert H. Fay. P. 16. There were 160 during the month, against 206 in May, 1913.

Problems of the Petroleum Industry. Results of conferences at Pittsburgh, August 1 and September 10, 1913. By Irving C. Allen. P. 19.

University of California publications, Berkeley, 1914:

Preliminary Report on the Recent Volcanic Activity of Lassen Peak. By Ruliff S. Holway. P. 24, 5 plates.

Description of New Species of Fossil Mollusca from the Later Marine Neocene of California. By Bruce Martin. P. 22, 4 plates.

On a Tabulation of Reduced Binary Quadratic Forms of a Negative Determinant. By Harry N. Wright. P. 18.

The Abelian Equations of the Tenth Degree Irreducible in a Given Domain of Rationality. By Charles G. P. Kuschke. P. 48.

Illinois Coal-Mining Investigations. By State Geological Survey, University of Illinois and U. S. Bureau of Mines. Urbana, 1914.

Coal-Mining Practice in District VII. By S. O. Andros. Field work by S. O. Andros, C. M. Young, and J. J. Rutledge. *Bulletin* 4. P. 53. Illustrated.

Coal-Mining Practice in District I (Longwall). By S. O. Andros. Field work by S. O. Andros and J. J. Rutledge. *Bulletin* 5. P. 42. Illustrated.

Coal-Mining Practice in District V. By S. O. Andros. *Bulletin* 6. P. 34. Illustrated.

Mining Operations in the Province of Quebec in 1913. Compiled under the superintendent of mines, Theo C. Denis. P. 165. Ill., index. Department of Colonization, Mines, and Fisheries. Quebec, 1914. The total value of all metals and structural materials was $13,119,811, compared with $11,187,110 in 1912. There are 9925 men employed, receiving $5,401,702 in wages. Asbestos is the principal mineral, being worth $3,830,504. Brick, cement, and limestone were valued at $6,363,091.

Map of Kanawha County, West Virginia. Showing outcrops of coal beds and location of mines. West Virginia Geological Survey, Morgantown, 1914.

New Machines and Devices

The New Porous Mineral Medium

A few years ago metallurgists and especially those interested in cyanidation, were offered an agitation and filtration medium in the form of a porous tile which was placed on the market by the Just Process Co. While results with this medium were successful in a number of instances, its continued use resulted in mechanical difficulties, non-uniformity, and weakness in structure, which greatly depreciated its original value. This so-called 'silica sponge' tile was produced by mixing the clay with an organic material which was burned out in the manufacture of this product, and instead of the much sought after uniformity in texture and porosity, a tile having considerable dead or closed cellular space resulted; also, it being of clay material with high per cent of alumina, did not resist acids and many chemical solutions. J. E. Porter, of Syracuse, New York, who was one of the inventors of the Just tile, upon its weakness becoming apparent, set about to eliminate these objectionable characteristics, and after a great amount of patient research has developed the new porous mineral medium 'Filtros.' Broad claims have been allowed on the Porter inventions which have been assigned to the General Filtration Co., Inc., which Company has also acquired patents covering the use of a porous mineral septum in a number of industrial arts.

'FILTROS' TILE, SHOWING POSSIBILITIES IN FILTRATION AND AGITATION.

The principle of this new material is similar in theory to the Just tile, but the new product possesses a number of features which are completely lacking in the Just tile. 'Filtros' is of particular interest on account of its resistance to acids, chemical solutions, and high temperatures, and its physical strength and uniformity of porosity. This new development makes possible the production of a truly porous silica septum; no clay nor organic matter being used in its manufacture, it is resistant to chemicals and is free from dead cell space, giving it properties not possessed by other porous mineral materials. 'Filtros' is a white porous ware composed almost entirely of silica. Its excellent physical strength and hardness enable it to resist the mechanical stress and abrasion accompanying many of the metallurgical processes. The uniformity in porosity of 'Filtros,' claimed by the manufacturers, may well be advanced for its adaptability to problems involving aeration and agitation, and the refractory property of the product suggests its application to smelter practice. Its indestructibility indicates the economies possible in its substitution for canvas and muslin in various metallurgical problems.

The following figures are the results of air-rating tests and serve to illustrate the degree of porosity and uniformity of 'Filtros' tile. These show the number of cubic feet of air passed per square foot area of the standard tile 1½ inches in thickness per minute at the given pressure.

Specimen.	Cu. ft. of air at 2-inch water pressure.	Cu. ft. of air at 4-inch water pressure.
1	13.0	25.0
2	12.5	24.5
3	12.0	23.5
4	12.0	24.1
5	12.5	24.0

From a large number of immersion tests the following results bear evidence of the resistance of 'Filtros' to various chemicals:

Solution.	Strength.	Time immersed.	Temperature.	Loss, per cent.	Condition.
Sulphuric acid....	96%	24 hrs.	209°F.	0.020	unchanged
Sulphuric acid....	96%	8 days	"	0.023	"
Hydrochloric, ⅔ of	70%				
Nitric, ⅓ of	37%	24 hrs.	"	0.017	"
Nitric	35%	8 days	"	0.016	"
Water, distilled...		35 "	"	0.000	"
Sulphuric acid....	20%	35 "	"	0.110	"
Hydrochloric	20%	35 "	"	0.140	"
Nitric	20%	35 "	"	0.080	"
Zinc sulphate.....	sat. sol.	20 "	"	0.040	"
Potassium cyanide	50%	20 "	"	0.090	
Mercury bichloride	sat. sol.	8 "	"	0.021	"

Other tests show 'Filtros' to be resistant to organic chem-

ieals as well. Hot or concentrated strong alkalies affect 'Filtros' as it does other silica wares. In testing the tile for use in filtering, the bicarbonate sludge from the carbonating towers in the ammonia works (Solvay Process) practically no action is shown on the tile. As far as the action of zinc sulphate on the tile in the manufacture of lithophone where barium sulphite is filtered from zinc sulphate is concerned, 'Filtros' is admirably suitable. Potassium cyanide does not affect 'Filtros" which fact indicates its applicability in the cyanidation of ores for aerating, agitating, and filtering. The standard tile are 12 by 12 by 1½ in., and show a porosity of 40% by void. A variety of special shapes may be made for exceptional cases. Tile of various grades of porosity are possible which are capable of retaining from the finest to the coarsest solids with maximum efficiency in filtration. Many uses for a mineral septum having the distinguishing properties of 'Filtros' will suggest themselves to engineers interested in such problems as gas and liquid filtrations, agitations, and aerations, and processes employing a porous diaphragm.

Indication of the remarkably free flow of liquids through the tile is shown in the following table, which gives the amount of water filtered per square foot area of the standard tile 1½ inches in thickness under the given head pressure:

Head pressure.	Gallons per minute per sq. ft. area.	Temperature of water, F.°
5	1.40	50
10	2.15	50
15	2.61	50
20	3.27	57
25	3.42	57

The Company concludes from the results of the tests given here, as well as many others, that the tile may be safely used for filtering acids of all strengths and solutions of salts, but not for the concentrated stronger alkalies. The tile are apparently adapted to copper leaching processes, sulphuric acid filtration, as well as various chemical and metallurgical processes. The accompanying halftones illustrate the porosity of the tile for filtration, agitation, and aeration purposes.

Commercial Paragraphs

THE *Du Dont Magazine* for August contains an interesting discussion of 'The Care and Operation of Blasting Machines.'

WESTERN ELECTRIC CO., New York, has for distribution an attractive publication entitled 'Modern Methods in Train Dispatching' and railway telephone equipment.

NATIONAL TUBE CO., Pittsburgh, Pennsylvania, in National Bulletin No. 10-C, presents an interesting paper by William H. Walker entitled 'The Relative Corrosion of Iron and Steel Pipe as Found in Service,' with discussion of the subject by F. N. Speller.

THE HESS FLUME CO., Denver, Colorado, has recently issued Catalog 214, which is devoted to flume construction and equipment. The catalog is replete with diagrams, halftones, and data regarding the construction and operation of Hess flumes for power, mining, and irrigation purposes.

THE HAYWARD CO., New York City, Pamphlet No. 603 on clam-shell buckets. The electric motor clam-shell bucket is said to dig as much or as little of its rated capacity as desired and the load may be discharged gradually, avoiding injury to cars or hoppers. Pamphlet is fully illustrated.

ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, Wisconsin, has recently issued Bulletin No. 1087, devoted to polyphase induction motors. Features which are claimed for this type of motor in general service are: simplicity, built for severe service, low maintenance cost, sparkless operation, and reliability. Bulletin No. 1722, devoted to carriage feeds, and Bulletin No. 1085, descriptive of kerosene engine-generating sets, are also new Allis-Chalmers publications.

CHICAGO PNEUMATIC TOOL CO., Fisher building, Chicago, Illinois, has issued Bulletin No. 34-W, which discusses class A-O 'Giant' fuel oil engines. These engines have no valves, gears, carburetors, mixers, oil, or air heaters, magnetos, timers, wires, or spark plugs. Details of construction are presented with halftones.

THE DENVER QUARTZ MILL & CRUSHER CO., of Denver, Colorado, reports the sale of a 500-ton Denver steel ore-crusher to the Blair-Athol M. & M. Co. of Colorado Springs, Colorado, and a 50-ton Denver quartz mill to the Ruby Silver Mining & Development Co. of Battle Mountain, Nevada. This is the second Denver quartz mill purchased by this Company.

STEVENS-ADAMSON MFG. CO., Aurora, Illinois, has recently had published section 4 of 'S-A' General Catalog No. 19, which is devoted to elevating and conveying machinery, screw conveyors, flight conveyors, bucket elevators, gravity discharge conveyors, pivoted bucket carriers, and other equipment. The catalog is fully illustrated and contains complete details regarding the construction of these machines.

THE WESTINGHOUSE ELECTRIC & MFG. CO. reports the receipt of the following orders for mine apparatus: Anaconda Copper Mining Co., Butte, Mont., eight 150-hp. motors for driving mine pumps, each complete with an automatic starter, panel, and transformers. The Boston & Montana Reduction Works, Great Falls, Mont., has ordered two 8-ton barsteel locomotives. These locomotives are of particularly heavy construction, as they will be used for 'bunting' charging cars about the smelter. There is also being shipped to the Lochray coal department, Great Falls, Mont., one 75-kw. motor-generator set and switchboard. Daly West Mining Co., Park City, Utah, one 175-hp., 16-pole motor with magnet switch hoist control. This is the first Westinghouse magnet switch hoist control to be installed in Utah. Also one 400-hp., 150 r.p.m., synchronous motor for driving a Laidlaw-Dunn-Gordon air-compressor. Utah Copper Co., four 10-hp. special vertical motors for driving agitators for oil flotation, and six 1-kw. turbo-generator units, which will be used for supplying light to steam-shovels operating in the copper mine. The turbines are bolted direct to the shovel frame and supplied with steam from the shovel boiler. Yukon Gold Co., Iditarod, Alaska, six 125-kva., oil-insulated, self-cooled transformers. Jualin Alaska Mines Co., Jualin, Alaska, one 100-kva. water-wheel generator; three 25-kva. transformers; one 75-hp. motor, and one 2-panel switchboard. Kennecott Mines Co., Kennecott, Alaska, one 75-hp. special motor with magnet brake and automatic control. Alaska Treadwell Gold Mining Co., Treadwell, Alaska, one 4½-ton storage-battery locomotive, one 8-ton barsteel trolley locomotive, and one No. 354 200-hp., 2200-volt motor with magnet switch control for automatic acceleration, which is the largest electric hoist motor in Alaska and the first magnetic switch control ever installed there. Kennecott Mines Co., Kennecott, Alaska, one 500-kva. turbo-generator unit, and one 2-panel switchboard. Beatson Copper Co., Latouche, Alaska, two 625-kva. turbo-generator units, one 6-panel switchboard, and two 16-kw. motor-generator exciter sets. Tonopah Merger Mining Co., Tonopah, Nevada, one 250-hp., 200 r.p.m., synchronous motor with switchboard panel and motor-generator set for driving Sullivan Machinery Co. compressor. Tonopah Belmont Development Co., Tonopah, Nevada, one 125-hp. motor for direct connection to Nordberg mine hoist, and one 75-hp. motor for direct connection to Aldrich pump. Burro Mountain Copper Co., Burro, N. M., four 300-kva. and six 100-kva. and three 37½-kva. oil-insulated, self-cooled transformers, for a new copper property being developed by the Phelps-Dodge company. United Verde Copper Co., Jerome, Ariz., three 300-kva. and three 30-kva. oil-insulated, self-cooled transformers for a new smelter at Clarkdale, Arizona.

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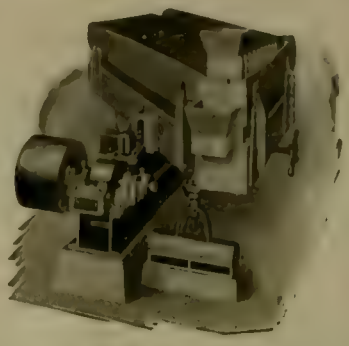

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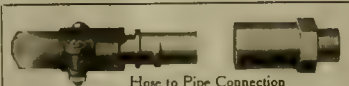

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POWDERED coal is to replace oil in the reverberatory furnaces at Garfield, Utah, the experiments that have been under way there for some months, having proved sufficiently successful to warrant the change.

THE MONEY situation in Mexico presents an interesting problem for the Carranza administration to unravel. In addition to the bales of paper currency bearing the stamp of the Constitutionalists, there are the millions of worthless Federal paper, the I.O.U's of the various rebel leaders, and the private issues of mining companies and other corporations.

POTASH salts are among those likely to be brought into sharp demand as a result of the war in Europe. Germany has now a practical monopoly of the potash business, though the American Trona Corporation hopes to care for a part, at least, of the American demand within a few months. Mulhausen, around which fighting has been raging, is one of the German centres of potash production.

OUR little brown brothers in the Philippine Islands can perceive a useful object lesson in the present situation of Belgium, a country of which the neutrality had been guaranteed by all the most powerful nations of Europe, yet her cities and fields have been laid waste, while the invading army demands a war 'contribution' of $40,000,000. If the neutrality of the Philippine Islands were guaranteed by the United States the first great war in the Pacific would inevitably see Manila made a military and naval base by one or the other of the contending powers.

CHANGES in the smelting situation in Japan are presaged by the action of the Sumitoma company in purchasing a gold mine producing silicious ores, near Sendai, north of Tokyo. This ore is to be mixed with the basic Besshi ore, and the Shisaka smelter is to undertake general custom work. Previously smelters in Japan have been connected with individual mines or the mines of particular companies and there has been no general business in the purchasing and mixing of ores such as is conducted by the American Smelting & Refining and other great companies in North America. This change, by making a freer market and making easy the development of smaller mines, will undoubtedly stimulate mining in Japan.

MINE operators facing a shortage of cyanide might well try flotation. There are many ores with which the choice between the two methods of treatment is wholly a matter of cost, and under present conditions it may be profitable to change to flotation where ordinarily cyanide would be more economical.

RECEIVERS have been appointed for the International Steam Pump Company, though it is stated that the business of the concern this year has been within 15 per cent of its highest record. The difficulty is due to the necessity for raising cash to meet interest and sinking fund payments aggregating $485,000, September 1. There will be no interference with the business of the constituent companies.

A CURIOUS feature of the investments of many prominent financiers, disclosed on their deaths, is that their holdings of mining stocks nearly always prove to be securities of unsuccessful corporations. It might be supposed that such well informed investors would buy only the best securities, but as far as mining is concerned, this seems not to be the case. This was shown in the appraisal of the estates of E. H. Harriman and J. P. Morgan, for example, and a more recent case is the estate of Anson Phelps Stokes, who left to his heirs only $250,000, instead of the millions he was popularly credited with. Mining is a highly specialized business, in which the chances of success by the amateur are less than is generally believed.

THE valor of ignorance is a factor to be constantly regarded and nowhere does it show more frequently than in the brave recommendations of amateur mining experts. We were shown recently a report upon a Calaveras county gold property in which the 'expert' after gravely announcing that "one of the most notable conditions is in the leaves and lenses of primary and secondary enrichment, branching out in natural laws, proving conclusively the origin of the orebodies together with their chemical and physical conditions as we find them today," recommended "that the supervision of the development and all other operations on the ground be retained only by a man of known ability, integrity, and industry—one who is thoroughly familiar with all the requirements and details of business." The advice is most excellent, but why stop at this? It would be better to begin by having the examination made by "one thor-

oughly familiar with all the requirements and details." We were told this week of a placer examination recently made by an 'expert' at Grass Valley where his samples were salted by jokers with metallic copper and brass. He accounted for them by an absurd story of "volcanic spats." The best way to make money in mining is not to go into a venture relying upon an ignorant guide.

POSSIBILITY of transfer of the work of the United States Bureau of Mines as regards safety, to a new Bureau of Labor Safety has aroused wide protest and has been already discussed. We are glad to announce that the proponent of the bill, Mr. Shiveley, has agreed to an amendment substantially along the lines we suggested, leaving the work in the hands of the Bureau of Mines. Another and even more unsatisfactory proposal has since been made in the House where Mr. John J. Casey of Wilkes Barre, Pennsylvania, has introduced a bill to transfer the whole Bureau of Mines to the Department of Labor. The objections we urged to the transfer of part of the work apply equally to the transfer of the whole Bureau of Mines.

COERCIVE tactics of the Butte Mine Workers Union has resulted in most deplorable conditions in the Butte district and grave results are anticipated unless sane leadership supersedes the present dictatorial attitude of the new union. Shortly after the Western Federation of Miners sent out a statement to all unions of the Federation that men leaving Butte and not bearing a paid-up card in the Butte Miners' Union No. 1 were enemies to organized labor, the Butte Mine Workers issued a proclamation that all miners in the Butte district must have cards and wear the buttons of the new organization. Following this proclamation measures were taken to enforce it by large 'committees' calling at the mines as the workmen went underground and not permitting men without the insignia of the new organization to go to work. To avoid trouble several properties, which have been working regardless of the present state of the copper market, have suspended operations and the work of mining has been further curtailed. The dynamiting of the employment office of the Anaconda Mining Company and other atrocities has made necessary a call for troops and 600 state troops are now in Butte for the purpose of restoring order, with a battalion of federal soldiers at Fort William Henry Harrison near Helena for use at Butte if their services are needed. While it has been repeatedly reported that the new union would resist to the utmost any armed intervention on the part of the government, it is gratifying to note that the presence of soldiers has not been the signal for general rioting. The new organization seems to be no better than the old, and the present state of the copper market would not seem to be propitious to the carrying through of its coercive tactics. Copper companies have been taking great risks to keep their mines open in part and to give employment at least to the married men, but in view of the situation at Butte it would not be surprising if the Anaconda should simply close entirely and stay closed until free from union dictation. That policy will win and the Company is strong enough to put it in operation if it be thought desirable. Anaconda officials, many of whom came up from the ranks, have been wonderfully patient with the unions. We wonder when they will stop.

SUCCESSFUL operation of a mine under difficult conditions, and most mining is done under difficult conditions, calls for the fullest exercise of all the powers of a broad-gage man. The following quotation from the report of the manager of a well known mine in Mexico, for last year, indicates some of the incidental difficulties which frequently absorb much of the energies of the management of any remote mine. A superintendent who has to devote his energies to the local manufacture of ordinary necessities can scarcely be expected to make records in low costs and operating profit. It is underestimation of difficulties such as these that so commonly leads to the cost of development of remote properties exceeding the estimates. His comment follows: "It did not seem possible that conditions in northern Mexico could grow much worse than they were in 1912. During that year the procuring and transporting of supplies from the outside, while attended with much delay and trouble, was, nevertheless, always accomplished, but for the past ten months all transportation into the mountains has been abandoned. Owing to the threatening situation a year ago, I purchased supplies for the mine sufficient for six months' operations. Even at that time there was a great scarcity of mules and nearly two months was required for the delivery of the goods at the mine. Since the exhaustion of these supplies the scanty resources of that immediate region have been drawn upon for the bare necessities; such articles as soap and candles have been manufactured on the ground by the superintendent, and powder, fuse, and caps have been secured from a neighboring mine which, fortunately for us, closed down last spring with a considerable quantity of explosives on hand. Of all the mines in the western part of this state, ours is the only one which has not been forced to close down entirely during the past twelve months. Labor conditions here have always been unsatisfactory. During the construction of the plant I brought in at one time one hundred men with their families; we managed to retain ten or fifteen of them, the others all drifted back after the first payday. Later on I had an American take twenty-five men with their families from the city of Chihuahua, where, at that time, there was absolutely no work at any price. Notwithstanding the fact that I had the trails around the mine guarded to prevent their escape, they all left within a month, and most of them deserted us after the first full meal. Again I sent an American about one hundred miles north and he gathered between twenty and thirty men with their families; he reached the mine with about fifteen, and they did not remain long."

THE CALUMET & HECLA LEACHING PROCESS

In our issue of November 22, 1913, we published an account of the dredge which is to be employed by the Calumet & Hecla Mining Co. to reclaim its tailing from the bed of Lake Linden. This old tailing, after passing through the usual pipe-line supported on pontoons, will discharge at a point on the shore of the lake near the regrinding plant, where a second set of suction pumps will pick it up and raise it to a set of classifying and dewatering tanks. The sand will discharge through the bottom spigots and pass over a set of dewatering screens, discharging on a belt-conveyor which elevates it to the storage bins of the regrinding plant. The slime will flow directly to a set of Wilfley tables.

The principal purpose of the arrangement described is to allow flexibility, so that irregularities in the operation of the dredge will not affect the operation of the mill. When the main dredge is stopped the second set of pumps can continue to draw from the pond in front of them, and this, together with the mill-bins, will permit the mill to continue operating for a whole day. Another important feature is the possibility of operating in the winter time, when the surface of the lake is covered with thick ice. During this period the main dredge will be brought in near the dewatering plant, where the tailing has filled in the lake considerably above the water-level. Here the dredge will dig in a small pond, much as a gold dredge does. The amount of water involved will thus be limited, and as it will be warmed somewhat by the mechanical work done on it in pumping, it is hoped to be able to continue operations even in the middle of winter. The main dredge has a capacity much greater than the rest of the plant, and during the summer, when it works under the most favorable conditions, a portion of the sand pumped will be diverted to fill the excavation made during the winter.

The sand will be ground in 64 Hardinge mills, the grinding practice differing considerably from that in other mills. The pulp fed to the mill will consist of three parts of water to one of solids. No classifier is used on the discharge, only 35 tons per day being put through a 20-inch by 8-foot Hardinge mill, driven by a 40-horsepower motor. The reason for this is that coarse particles of copper liberated in regrinding would be returned to the mill by a classifier, and it is this grinding away of the free copper which it is desired to avoid. The ground pulp will pass over a series of Wilfley tables to take out the free copper.

The tailing from the Wilfley tables will still contain about one-half the copper present in the sand, and it is proposed to recover this by leaching, using a process devised by Mr. C. H. Benedict, the mill metallurgist, who has also worked out the plans for the whole scheme. Since no official statement in regard to this has been given out, there has been much speculation regarding the supposed secret process. There is, however, no secret regarding the matter, except certain details which are now undergoing patent, as the general chemistry of the process is well known. Acids cannot be employed on the pulp, as it contains too much calcium carbonate, so the well known reaction between ammonia and copper oxide will be utilized as the basis for the process. Finely divided copper has at all times on its surface a microscopic film of oxide of copper. If this is subjected to the action of ammonia in the presence of an ammonium salt, such as ammonium carbonate, the film of oxide is dissolved, going into solution as a double cuprammonium salt. If oxygen is present in the solution, the film of oxide is at once renewed and the process is a continuous one until all the copper has gone into solution. This reaction was first employed by Schnabel, many years ago, and was later used in gas analysis by Hempel for the determination of oxygen. Mr. Charles Van Brunt has recently described the use of this reaction for absorbing oxygen from the air in order to generate nitrogen. In his 'Handbook of Metallurgy,' Schnabel discusses its application to the hydrometallurgy of copper in these words: "Experiments hitherto tried along these lines have failed because ammonia-tight vessels were not employed, and because the precipitation of the copper, for which iron cannot be employed, was performed by means of H_2S, CaS, or BaS. By the use of iron vessels, however, the loss of ammonia may be avoided; the copper can be recovered as oxide by distilling off the ammonia, which can thus be recovered." The experiments made in Germany were on natural oxides and roasted ore, Mr. Benedict being the first to apply the method to the treatment of native copper.

In carrying out the process at the Calumet & Hecla, sixteen 1000-ton vats, 54 feet in diameter and 12 feet deep, will be employed in a 91 to 96-hour cycle for the treatment of the ore. In treating a sand containing 12 to 13 pounds of copper per ton, 5½ to 6 pounds will be recovered by the regrinding and table treatment, and 4½ to 5 pounds will be recovered by leaching. It is estimated that the cost of the leaching will not exceed 35 cents per ton, and the recovery will exceed 70 per cent.

The contract for the construction of the plant has been let to the Riter Conley Manufacturing Company, and one-half of the 4000-ton plant was in process of erection till recently stopped. Its success depends upon whether the recovery of the ammonia, which has a strong vapor pressure at ordinary temperatures and consequently constantly tends to escape into the surrounding atmosphere and be lost, will be as complete in the full-sized plant as was indicated by the laboratory experiments. In the use of this reaction for the absorption of oxygen, the working solution is made by mixing equal volumes of NH_4OH, 0.93 specific gravity, and a saturated solution of commercial $(NH_4)_2CO_3$. Doubtless the solution used in this case will be more dilute. At a later date we hope to be able to present a detailed account of the process by Mr. Benedict himself, to whom the greatest credit for skillful metallurgical work is due. If the process proves successful on native copper, it may prove feasible to apply it to roasted ores.

As It Looks in London*

By T. A. RICKARD

Your Sherman said that "war is hell." Another has said that "the essence of war is violence and moderation in war is imbecility." This appears to have been learned by our Admiralty and War Office, for they are going ahead at full steam and with intense vigor. The Government is accepting the offers of troops from the overseas Dominions; even if these arrive late and are used for defence only, their coming will be a fact of unexampled eloquence.

The lowering of the Bank rate to 5% within six days of the sudden rise to 10% is a symptom of sound financial conditions. The closing of our Stock Exchange was due entirely to the use made of it as a dump for all the panic-stricken sellings from the Continent. The city is quiet. People go about their business without hysterics. We don't use motor-cars and we restrict ourselves to one course at luncheon. We smoke pipes instead of cigars. We are prepared to go on rations. The suffragettes have ceased to be a worry and the name of Ulster suggests an island in the South seas. We are one. When the Prime Minister asked for $500,000,000, he got it in five minutes; and when the Earl Kitchener of Khartoum (K. K., as he is known, for short) asked for a half million more soldiers, he was promised them forthwith. The first issue (to speak in terms of a prospectus) of 100,000 has been over-subscribed.

As you know, I have no experience in military affairs, but as a detached onlooker (which is the true pose of a journalist), I venture to predict that this war will establish one supremely important fact, namely, an enormous enhancement of the power of the defence. In the wars of other days it was possible to capture defended positions by a rush of men and a hand-to-hand fight on a breach or in the trenches. Effective shooting began at a hundred yards, so that the enemy were near before they could be stopped. Now, with modern arms of precision, the enemy are under rifle-fire at half a mile, not to mention the correspondingly longer and more accurate range of artillery. Whereas a defensive position could be attacked in the ratio of 2 to 1, it will be necessary nowadays to increase the ratio to 10 to 1. The story of Liége is an illustration. That, of course, is the outstanding episode of the first week of this Armageddon. Some people talk of the Belgians as a non-military people. As a matter of fact their Ecole Militaire is one of the best soldier-schools in Europe and Liége itself is considered by experts as one of the strongest of the ring-fortresses within the area of conflict. You will remember that it is the seat of an important zinc-smelting industry, and it is also the place where an Englishman, John Cockerill, founded a steel industry of international fame. The closing of the Belgian smelters has already affected some of the Broken Hill mines, which have been sending their zinc concentrate to Antwerp for treatment near Liége by the Vieille Montagne company. In the same way, the lead concentrate that went from Broken Hill to Rhenish Prussia is now without a market. The closing of these smelters, as well as those at Essen and Hamburg, will be felt in localities far from Europe and may have the effect of shifting smelting industries permanently. However, these and other far-reaching changes inevitably imminent, must depend upon the outcome of the struggle.

August 9.

The South African mining companies are postponing the distribution of their half-yearly dividends. As these in the aggregate amount to $20,000,000, this is an important matter. It looked at first like 'hoarding' of the most objectionable character, for the companies don't need the money, they have the whole of the July gold output already as a reserve at Johannesburg, and gold bullion in times like these is the most liquid of all assets. The ostensible reason given for withholding the dividends is that the war renders it impracticable to send the money to shareholders on the Continent. I enquired this morning, and find that the Postoffice will take mail for France and Russia; indeed, everywhere except to Germany and Austria. On further investigation, the true reason for not distributing the dividends was made clear. The money, of course, does not lie idle at the banks, it is lent at interest subject to recall, which, however, is not now possible owing to the moratorium. A moratorium, in simple terms, is a suspension of the payment of debts.

Systematic efforts are being made to assist Americans stranded in London. Some of your friends and mine have organized a committee of American residents for the relief of those in trouble. H. C. Hoover is chairman, and has worked like a Trojan. On the committee are Edgar Rickard, J. P. Hutchins, Jack Hoffmann, H. A. Titcomb, A. F. Kuehn, and A. C. Beatty. Mrs. Hoover is at the head of the ladies committee, which includes Mrs. R. Gilman Brown (Brown himself just now is at Tanalyk, in Western Siberia), Mrs. Edgar Rickard, Mrs. Charles Janin, Mrs. Hutchins (only recently known as Miss Bessie McNear), and Miss Daisy Polk—the last the sister of your well-known architect. Edgar was telling me this morning that one of the lady refugees, expelled suddenly out of a German hospital after a capital operation and subsequently exposed to severe hardship, has committed suicide. Half-a-dozen German residents from your side that had only declared their intention of becoming Americans asked for help. This makes serious legal difficulties.

August 11.

*In this series of war letters, the *Press* will print extracts from Mr. Rickard's personal letters from London, believing that an account of the war as seen by a mining man in that great centre will be of interest to mining men everywhere. Mr. Rickard is an Englishman who was born in Italy, passed his early boyhood in Russia, managed mines in France and Australia, and lived in the United States more than twenty years. His sympathies are naturally with the Allies, but he will endeavor to be as impartial as he may.

The Labor Crisis in Chile*

By BANCROFT GORE

The digging of the Panama canal has had the effect of arousing in this country a widespread interest in conditions along the west coast of South America. As three out of five of the republics that are soon to be brought into direct communication with us are essentially mineral producing, it is not surprising that we, as mining engineers, should be most interested in the developments in our line of work that are taking place in these countries. A discussion of conditions in Colombia and Ecuador does not fall within the scope of this paper, but the labor situation may be summarized by remarking that although they are undoubtedly rich in placer and dredging ground, these attractive deposits are generally in places where the white man cannot live and the black man or Indian will not work.

In Peru, mining operations are not under such a handicap, but the mines are unfortunately at extreme altitudes, where the efficiency of the miner is low; moreover he is small in stature, slow in action, and not over muscular; furthermore, he will only work in the mine or smelter during such seasons as he is not busy on his own little farm, distant many hundreds of miles.

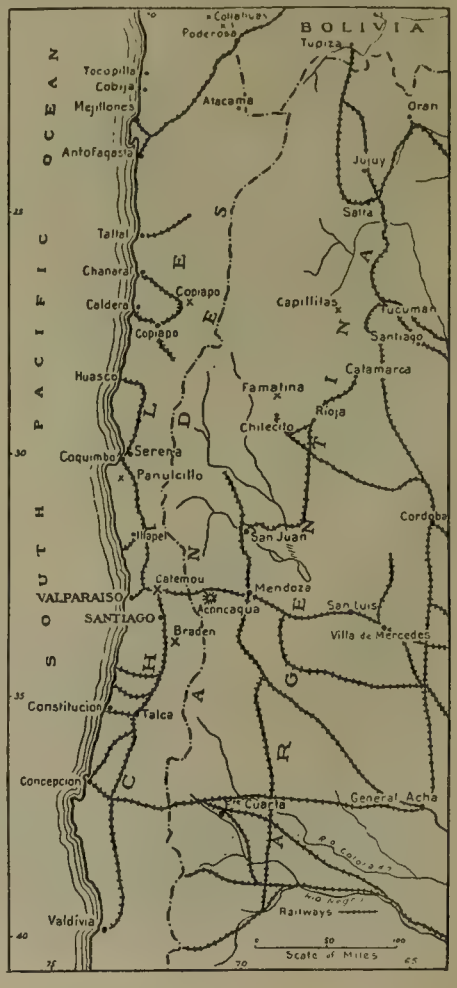
Passing southward one leaves the enervating tropics and reaches a country far more favorable for mining operations. One then passes along that thin slice of seacoast known as Chile, which if placed across the United States would reach from New York to San Francisco, but with an average width corresponding to the distance between Chicago and Milwaukee, just 87 miles. Here is a great mineral country, favored by a healthful, temperate climate, where work, especially in the northern provinces can go on every day, peopled by a vigorous active race, under a strong centralized government, offering every protection and encouragement to foreign capital, especially freedom from the endless varieties of taxation found in other Latin-American countries. Nowhere is it very distant from tidewater, where competing steamship lines afford direct communication with Europe.

First in order of importance are the only commercial deposits of nitrate of soda in the world. Scientists have sounded many cries of alarm in the past showing the calamities that would arise from the depletion of these Chilean saltpeter beds, little knowing of their extent and depth. European countries, and especially Germany, would suffer an agricultural crisis were the supply of this plant-stimulating salt cut off. Consequently in Europe there is most active research for fixation of nitrogen from the atmosphere and by synthetic methods.

What has happened in Chile has not been any appreciable exhaustion of the nitrate resources of the country, although the shipments between the years 1878 and 1907 exceeded 29,000,000 metric tons, valued at nearly a thousand million dollars. These figures are official returns from the Estadistica Minera de Chile for the year 1909. It is true that the richest spots have been worked up by those who had first selection of the ground, but recent government investigation of the nitrate zone indicates an available tonnage adequate to supply the world for another century without making allowance for the use of artificial products.

What is found instead is a critical situation in regard to labor conditions that has increased the difficulties and incidentally the cost of digging the crude salt, refining it near by, transporting it to the coast, and getting it on board for export, thereby giving the artificial nitrate a firm foothold in the markets of the world.

Last year a tramp steamer from Europe dropped anchor in Iquique harbor, the leading nitrate port of the



*The title of this paper, which was read at Butte before the Montana section of the Amer. Inst. Min. Engineers, was suggested by a pamphlet issued from the Chilean Bureau of Statistics, written by its director, Francisco de Béze, entitled 'La Población de Chile,' Santiago, Chile, 1911. It is a brief but fearless criticism of the economic conditions of the country, especially the neglect by the governing classes of the workman and his family. It had been popularly supposed, previous to the taking of the last official census of 1907, that the total population was between five and six millions, but the final count gave 3,249,279, an increase of only 1.52% per annum since the census of 1895.

country, en route to the Hawaiian islands with a cargo of artificial nitrate, showing how this product, made almost without muscular effort, had won out in competition with the natural salt depending for its production and refining upon arduous labor operations in a desert country where labor is scarce and difficult to manage.

Read what the director of the Chilean bureau of statistics, Francisco de Béze, reviewing the last census taken in 1907, says: "As regards the increase in population (and it has about doubled in the past 50 years), it does not take much philosophy to prove clearly that our nation moves ahead at the speed of a tortoise."[2]

This in a country where American enterprise in the short interval of two years has proved the largest of all known copper deposits and one of the richest mines of bessemer iron.

The Labor Shortage

But the nitrate business, although the most important, is not the only one to feel the effects of the critical shortage of labor. The borax industry, developed to a point where Chile is now the second producer in the world, is having troubles also. Then there is the copper business. Many can remember when copper was synonymous with the name Chile, which, up to the opening of the Anaconda mine, produced more copper than all of North America. This copper, mainly exported in the form of so-called Chile bars, was the product of scores of small establishments, situated generally at favorable harbors along 1500 miles of seacoast and drawing their ore supply from thousands of copper mines, many of them mere gopher holes, yielding, with careful and laborious sorting, a few sacks daily of high-grade ore, which found its way on mule-back to the coast, where there was either a smelter or a receiving station, where ores accumulated until a cargo was on hand for shipment to some reduction works, generally of the reverberatory type, along the coast.

The force employed at mine and smelter was large in comparison to output, but wages were low in those days, and the necessities of the workman limited, compared to what he now thinks he needs. Furthermore, families were large and everyone worked, including father. The domestic bill of fare was a frugal one and meat a luxury. Flour sacks were made into articles of clothing entirely adequate for the mild climate. For shoes each was satisfied with canvas sandals with braided hemp soles. They lasted a month or two and cost little for renewal.

Then came a world-wide demand for the products of advanced civilization. It spread to Chile as elsewhere. Factories for the manufacture of shoes patterned after the latest models from the United States did a flourishing business. Ready made clothing became popular. Reed hats gave way to imported felts, the starched linen collar and the bright satin four-in-hand were omnipresent.

All these cost money, but the laborer soon found out that he could obtain higher wages by demanding them. His employer had no one to take his place and there was work everywhere, and for reasons shown a little later on, there was no immigration into the country; in fact there never had been any. Valparaiso and a part of Santiago de Chile had to be rebuilt after the earthquake, long lines of government railroads were to be constructed, extensive harbor improvements were authorized, a new porphyry copper mine was added to the list of producing properties after an expenditure of more than $15,000,000. These are some of the undertakings that called for labor. Heretofore the nitrate works and copper mines in the northern provinces had been the only big employers. Their agents canvassed incessantly the southern agricultural districts where employment on the large estates was intermittent and at low wages. The inducements offered were steady employment at more than double the wages, with free transportation by rail and steamer to the north, free living quarters, and medical attendance.

There came a time when these agents could find no more recruits, and somebody thought of Argentina as a possible field for obtaining laborers. What was their astonishment to find that Argentina, in spite of the steady influx of immigrants from Europe, was short of harvest hands, and none could be persuaded to cross the Andes and work on the Atacama and Tarapaca deserts of Northern Chile while there was plenty of work at good wages close at hand, with opportunities for the foreigner to become a small land owner, which was virtually impossible in Chile. Moreover, many of the laborers in Argentina held tickets back to Italy and Portugal, having come over between the planting and harvesting of their own crops to save a little capital for improvements later on at home. Chile had no charms for them.

Reference to the nitrate exports for the past three years shows practically no increase.[3] This was foreseen by government officials as far back as 1902, and commissions were appointed to study the situation from every point of view and report on possible remedies.

Governmental Studies of Labor

Now if there is any government in the world that can place an exact valuation on the man with the shovel it is Chile. In 1910 there was collected at various nitrate ports and turned into the treasury the sum of $28,679,550 from the export tax on nitrate. Engaged in the mining, refining, transportation, shipping, and industries sustained directly by the nitrate industries, such as powder works and sulphur mines, was a force of some 70,000 men and boys, each of whom contributed directly to the government expenses the sum of $410, being the export tax on nitrate produced by his labor. As it has been found impossible to substitute European or Asiatic labor for this nitrate work, and there was no longer any hope of increasing this force by recruits from the south, it is not difficult to calculate the value to the Government of these workmen in dollars and cents. The loss of

[2] 'La Población de Chile,' page 50; Francisco de Béze, Santiago, Chile, 1911.

[3] See 'Mineral Industry,' Vol. XXI, page 776.

any one of them meant a loss in income of $410, which is the interest at 4% on about $10,000. When one died it was like the loss to the Government of a $10,000 4% bond. Or, putting it the other way round, an increase of population that would make available for work in the nitrate zone 100 able bodied men was like dropping a million-dollar bond into the laps of those few hundred aristocratic families who own and hold the best agricultural land, two thirds of all the city property, and who are the Government. Yet this same Government, just two years ago, debated for a whole week as to whether an appropriation of $40,000 to stamp out yellow fever in the panic-stricken nitrate port of Tocopilla, where local authorities were helpless and a dozen unfortunates were dying every day, should not be cut down to $20,000.

From what has been said thus far it can readily be imagined that there are no men outside of any big establishment in Chile, be it nitrate, borax, copper or iron, wanting for the opportunity to be given employment or the chance to fill a possible vacancy; no long line of applicants, such as was shown recently by one of our local papers, waiting in hopes of employment underground. And it is this very situation that makes the handling of the Chilean workman a very delicate undertaking, and the character of his work very unsatisfactory, because he knows there is no one to take his place and that his employer will stand all manner of nonsense rather than reduce production by discharging him. He comes to work when he pleases, is arrogant, insolent, and full of complaints for more wages and lower prices at the company store. He has five meals a day, three of which include beefsteak, and he little knows the effort and expense to which each company goes in order that the supply of steaks does not run short. Competition for labor among the big companies has brought the price of this meat to the working man far below its actual cost at the nitrate works.

He has no rental, as he lives on company property; no doctors' bills and small fuel expense, as the climate is such that no heating stoves are needed. Most of his supplies are sold to him at their wholesale cost to the company. This was not the case ten years ago, when one of these stores was a veritable gold mine to those in charge. He takes frequent lay-offs, always without notice, and if offended at his reception on returning to work, will disappear in the night and be welcomed personally like a prodigal son by the manager of some adjoining property.

Increasing the wages only results in the man working fewer days each month. He is paid every day in the hope that his cash capital may never reach the value of

A FOOT-BALL TEAM, SHOVEL GANG, AND BAND MADE UP OF CHILEAN LABORERS.

a case of beer or demijohn of artificial wine, but he gets them in spite of this. He is offered a bonus as high as 20% of his wages if he has worked every day in the month, but without arousing his ambition.

Wherever possible, payments are made on a piece-work basis, generally per ton of material handled. Under these conditions he is a fast worker. Where cargoes have to be loaded or discharged within time limits, he knows only too well that time is money, and holds up his employer for all the tariff will bear. From $2 to $3 United States currency is what these men can earn in eight hours, but it is the very hardest kind of labor.

In our own country 30 years ago there was almost the same situation in the unloading of iron-ore boats on the Great Lakes. The hand shoveling of this ore into tubs and afterward wheeling it up by hand to the stock piles required a class of labor that could stand up under extreme physical exertion. There was always a shortage of men, and those who came to work were unreasonable, strikes were common, and high wages prevailed until mechanical engineers eliminated this heavy labor, with the result that today 13,000 tons can be unloaded from one vessel in 3 hours and 20 minutes by 25 men.[4]

Herein lies the remedy for the labor conditions in Chile. Labor-saving machinery alone can save the situation. It is true much of it must be of special design, particularly for the digging and sorting of the nitrate. In the mines the very latest mechanical appliances are needed.

One step in this direction has already been made by substituting fuel oil for coal at many of the nitrate works. The cost per million British thermal units of each fuel is more or less the same, but a 6000-ton oil steamer can pump its cargo ashore in 48 hours, while to discharge the equivalent fuel in the form of coal would require unloading three sailing vessels of 3000 tons each, and keep a crew of 20 men, six barges, two donkey engines, and a locomotive busy for six weeks.

With reference to the refining of the crude nitrate, it is significant that a banking house heavily interested in nitrate works has recently consulted with well known metallurgists in this country, experienced in the design of successful cyaniding equipment, with the idea of overcoming the wasteful and laborious methods now in use, for here indeed is a hydrometallurgical problem that has never been thoroughly worked out, and one in which the chemist and mechanical engineer have a most excellent field for endeavor, the former to improve without excessive cost a recovery of nitrate that seldom exceeds 75%, and the latter to eliminate labor at every possible point.[5]

[4]'Handling the Raw Materials at the Iron Blast-furnace,' J. E. Johnson, Jr., *Met. and Chem. Eng.*, Jan. 1914.

[5]Large investments have been made from time to time in new processes claiming to be improvements over established methods for the recovery of sodium nitrate from the crude *caliche*. These plants have all been abandoned owing to difficulties not foreseen by the inventors. A new 'ammonia process' is under investigation. The field for improvement still remains, however.

There are two more suggestions which if put in practice by the large operating companies would tend to relieve somewhat the present crisis. Keep down the death rate of your force. Don't appeal to the local authorities, invariably without funds, or the chamber of deputies, 1000 miles away, if typhoid, smallpox, or yellow fever is raging in your midst. At least one-third of all deaths in Chile are preventable, and if it were not for one of the largest birth rates in the world the country would have been depopulated long ago. They die of consumption under the same climatic conditions that are utilized in the United States to cure this disease. Their houses need ventilation, more rooms for the large families, board floors, pure water supply, and rigid sanitary inspection. Doctors are scarce, in spite of the great need for them. One doctor to 3000 workmen is the rule in the nitrate zone. Accidents alone keep him busy, and there is no time for preventive measures, so the death rate remains high.

The workman and his family have been sadly neglected by an opulent government. In no other way can the inertia on its part be explained when it comes to meeting these problems face to face and doing something to keep down the high death rate, especially among the children; of improving the sanitary condition of streets and dwellings of the lower class; of purifying the contaminated water supply of most of its centres of population, and restricting the use of alcohol.

Finally, it was noticeable that the few large operating companies, both in nitrate and copper, that had the least difficulties in keeping up production or new construction work were those that had undertaken in a systematic way to look after the welfare of their employees and families, by building hygienic houses instead of disease-breeding shacks, enforcing sanitary precautions, providing adequate medical attendance, patronizing liberally local athletic organizations, and encouraging every form of innocent entertainment for the diversion and improvement of their force.

IRON ORE MINED in 28 states of the Union in 1913 amounted to 61,980,437 long tons, compared with 55,150,147 tons in 1912, according to the U. S. Geological Survey. Ore shipped from the mines totaled 59,643,098 tons, valued at $130,905,558. The totals in 1912 were 57,017,614 tons and $107,050,153, respectively. The average price for the whole country was $2.19 per ton, against $1.88 in 1912. Some of the states produced ore only for fluxing purposes. The principal states were Minnesota, Michigan, Alabama, New York, and Wisconsin, in the order given. The Mesabi range produced 69.46% of the total.

BULLION RETURNS for July from two of the principal mines of New Zealand were as follows: Waihi, 15,057 tons of ore for £25,889; and Waihi Grand Junction, 9320 tons for £19,072. The respective totals to date are £10,608,786 and £4,631,797 in dividends; and £916,767 and £80,000 in dividends.

Ventilation in the Iron Mines of the Lake Superior District

By EDWIN HIGGINS

Introduction

*I am at present engaged in collaboration with associated mining engineers and chemists, in the investigation of ventilation in the metal mines of the United States for the Bureau of Mines. In the course of the field work visits were made to nearly all the mines in Michigan and Wisconsin, and some of those on the Mesabi and Vermillion ranges in Minnesota. Although many air samples were taken, their analyses will be made use of only in pointing out general conditions.

All the mines visited, with the exception of two, depended on natural ventilation for the supply of air to the working places. Of the two exceptions, one mine had a blower fan installed underground, and in the other the air was kept in motion by means of compressed air jets. In a few cases booster fans were found in use in dead ends, especially in those immediately under the timber mat. The amount of air entering the mines per man employed underground varied greatly, but in the majority of cases was between 50 to 100 cu. ft. per man per minute. The analyses of many air samples showed that seldom in the main airways did the air contain any appreciable amount of noxious gases. Invariably the heavily timbered mines showed a higher percentage of carbon dioxide in the return air than did those mines in which little timber is used.

The temperature of the fresh down-cast air varied according to the season of the year. Summer temperatures may be said to range from 50° (nights) to a maximum of 100°F. (days) in the shade; in the winter temperatures range from about zero to a maximum of 30 to 40°F. below. At all times the humidity is comparatively low. In the deeper mines (1000 ft. or more) the temperature underground showed little variation, no matter what the temperature on the surface. In the shallower mines, however, it is common in winter to see huge icicles, in some cases as deep as 300 ft. from the collar of the down-cast shaft. In the heavily timbered mines, the return air ranged in temperature from 75 to 90°, and humidity usually from 95 to 100%. In mines where little timber is used the return air is from 10 to 15° cooler.

Gases in the Mines and Their Effects

With the exception of the combustible hydro-carbon gases reported from time to time from some of the mines situated in the carbonaceous black slate area of the Menominee range, the only noxious gas that is encountered under ordinary operating conditions is carbon dioxide. No explosive gases occur.

In mines, carbon dioxide (CO_2) is produced by the breathing of men or animals, the combustion of timber and explosives, the burning of lamps, and the decay of timber or other vegetable matter. When the human being breathes air containing about 10% of carbon dioxide life becomes imperiled. Candles in air are usually extinguished when the oxygen content decreases to 16 or 17%. Carbon dioxide that may be present has but slight effect upon the extinguishment. Carbide lamps become extinguished when the oxygen decreases to about 12%. There are produced by the combustion of explosives varying percentages of hydrogen, methane, oxides of nitrogen, carbon monoxide, water vapor, and hydrogen sulphide. Very small percentages of either carbon monoxide, oxides of nitrogen, or hydrogen sulphide have marked effects upon the human system. One-tenth of one per cent of any of these gases have a serious effect upon the miner.

Carbon monoxide (CO) is far more deadly than carbon dioxide in its poisonous effect on the system. It is a product of incomplete combustion of wood or other combustible matter, also of the explosion of various types of blasting powder or dynamite. The amount produced is enormously increased when the explosive burns instead of detonating. Carbon monoxide is more than likely to be encountered during a smouldering fire, such as would result in a damp or wet mine. As little as 0.2% of this gas will cause death if breathed for a sufficient length of time. It acts as a cumulative poison to the human system by combining with the haemoglobin of the blood, thus preventing that agent from combining with sufficient oxygen to support life. It gives little or no warning of its effect on the system. The person breathing it usually becomes suddenly weak in the knees and lapses into unconsciousness. Carbon monoxide may occur in quantities sufficient to cause sudden death, and still its presence will not be indicated by the dimming of the candle flame. Thus it may be seen that the belief of many miners that they can live wherever a candle will burn, is erroneous.

Effect of High Temperatures and Humidity

That high temperatures and extreme humidity have a marked effect in lessening the efficiency of the miner, there can be no doubt. In this connection Haldane[1] says: "The normal body temperature of a man is from 98 to 101°F., and in order to obtain efficiency in work, his temperature should not exceed this upper limit. The body may be cooled by radiation, conduction, and evaporation (sweating). Cooling by evaporation is the most important in deep mine ventilation. Evaporation from

*Condensed from a paper prepared for Marquette Range meeting of the Lake Superior Mining Institute, August 31, September 1, 2, and 3, 1914.

[1]J.S. Haldane, *Jour.* Chem. Met. & Min. Soc. South Africa, Vol. 11, 1910, page 227.

the body can only occur when the dew point of the surrounding air is below body temperature, 98° F. • • • In order to maintain the body temperature in hot mines, where one is working, it is necessary to keep the skin at a lower temperature than the interior of the body. The body temperature may be maintained when 78° F. wet bulb in still air, and 88° F. wet bulb in good moving air, is shown. • • •"

According to G. J. Young:[2] "With a temperature from 95 to 105° F., and relative humidity 50 to 70% in still air, miners can do efficient work. From 110 to 115° F., and with other conditions the same as above, efficient work cannot be done. Increasing the velocity of the air, with other conditions the same as above, makes work more bearable, but miners cannot work very long at a time under such conditions. Saturated air at 95 to 105° F., and velocity, is dangerous; 90 to 98° F., saturated velocity of air current 400 to 500 ft. per minute, and slightly vitiated, will prevent efficient labor. Impurities in the mine air seem to hinder labor efficiency more than high temperatures do. The humidity of the air depends upon the amount of water in the mine and the dryness of the down-cast air."

High temperatures in a comparatively dry air do not have so great an effect on the miner. This fact was forcefully illustrated to me on a recent trip through the Comstock mines in Nevada. In one place the dry bulb thermometer read 110°F., and the wet bulb 100°. This represents a humidity of 70%. While performing no work the place was not unbearably hot. Nearby, where the return air current was encountered, the wet and dry bulbs both read 110° (representing a humidity of 100%) and the effect was distressing.

High Temperature and Efficiency

By frequent observations in many of the Lake Superior iron mines, I have noted repeatedly that miners working in temperatures above 75° wet bulb (relative humidity 100%) showed a marked falling off in energy. At wet bulb temperature of from 80 to 90° (relative humidity 90 to 100%) the average miner works only from one-half to one-third of his time; when he is at work under these conditions his efficiency is not normal, and when he is resting, of course, his time is entirely lost. In one mine four miners produced the same tonnage of ore as was produced by nine miners in a similar place in the same mine where the temperature was 10° warmer. Many cases of this kind could be cited.

Without going into a detailed discussion, it may be stated that in heavily timbered mines (especially where the mine is wet or damp) the timbers consume from three to four times as much oxygen as do all the other factors combined. Recognizing the importance of this phase of the problem, an investigation was instituted at the Pittsburgh laboratories of the Bureau of Mines. While the work done to date has been only preliminary, some interesting facts have been brought out. The investigation is being carried on by G. A. Burrell, chemist of the Bureau, whose results show that timber in metal mines (where large quantities of it are used) may be responsible for part of the vitiation of the air therein, especially in dead ends where the air is stagnant, the wood moist, and much timber is present. The state of division of the wood is undoubtedly very important. Further experimenting is required to determine the action between air and timbers. The rock in some metal mines, especially if iron pyrite is present, is probably responsible for some of the oxygen disappearance. Many of the samples of mine air collected by the Bureau, however, have shown a quantity of carbon dioxide almost proportional to the oxygen disappearance, suggesting that the timber or some reaction that is analogous to that taking place between air and wood is responsible for the vitiation of the air.

Heat and Humidity in the Mines

In general, it may be said that heat is developed in mines through the following agencies: rock temperatures; presence of men and lights; crushing and working of rock and timbers, and possibly the oxidation of timbers; operation of machinery and presence of steam lines connected thereto.

The cause of humidity, of course, is the absorption of moisture in the mine by the comparatively dry air admitted from outside. In practically every case in the Lake Superior district the air issuing from mines was found to range between 95 and 100% in humidity.

It was found that rock temperatures had practically no bearing on the great heat encountered in the sub-levels, especially those levels directly under the timber mat. In several cases rock temperatures, at depths of 1500 to 2000 ft., were as much as 10° lower than air temperatures from 500 to 1000 ft. nearer the surface (under the timber mat). Air currents passing through timbered workings where no men were employed were tested at various intervals, and the temperatures were found to increase gradually, regardless of whether the course of the air was downward or upward. With respect to working places, then, the other causes mentioned may be disposed of as of small importance in causing a rise in temperature, with the exception of the crushing and working of the rock and timbers, and the oxidation of the latter. While the laboratory investigations have not progressed far enough as yet to make a positive statement in this connection, it is my opinion, from observations made in the field, that in these mines the oxidation of the timber is the chief cause of the production of heat. In one mine a new sub-level was opened under the sub directly beneath the timber mat. Before the introduction of timber in this new sub the temperature averaged 75°; when drift sets had been put in the average temperature of the level was 80 degrees.

The Problem

There are two problems presented in the proper ventilation of Lake Superior iron mines.

[2] *Jour.* Chem. & Min. Soc. South Africa, Vol. 11, 1910, page 411.

1. The supply of a sufficient quantity of air, and its proper distribution, so that it will carry off the noxious gases produced, and have the effect of lowering the temperature and humidity existing in working places.

2. The production of less quantities of noxious gases.

It is difficult to state just how much air should be supplied in the heavily timbered mines, for the reason that there is no accurate method of calculating how much oxygen the timbers will consume. The factors affecting this are extremely variable. Damp timbers are much more active in oxygen consumption than are dry timbers. Again, due to the methods of mining, it is impossible to figure with any degree of accuracy the amount of timber in a mine. However, a study of actual conditions leads me to the belief that, in untimbered mines, where no animals are used, 50 cu. ft. per minute per man employed underground, is sufficient air. In mines where a moderate amount of timber is used there should be 100 cu. ft. per minute per man employed underground. In the heavily timbered mines, it may be necessary to increase the amount to 150 or even 200 ft. per minute.

There are several guides in determining whether or not there is a sufficient amount of air entering the mine. In the first place there should be sufficient air to prevent the humidity in working places from rising higher than 90%. With 90% humidity the wet bulb thermometer should not read more than 80° in still air, and 85° in a current of 400 to 500 ft. per minute; with 100% humidity these figures may be set at 75 to 80 per cent.

Amount of Oxygen Necessary

The second consideration is the diminution of the amount of oxygen in the air. As pointed out, this is closely related, in the Lake Superior iron mines, to the amount of carbon dioxide in the air. In England, ventilation requirements deal with the oxygen and the amount of carbon dioxide in the air. The requirements (not less than 19% oxygen, or more than 1.25% carbon dioxide), refer to coal mining, in which the ratio between the oxygen and carbon dioxide contained in the air is not as constant as it is in metal mines.

While a miner may feel no discomfort while not exerting himself, in an atmosphere in which a candle will become extinguished (from 16 to 17% oxygen), the effect may be very different when carbon dioxide is present and he is working hard. Another factor to be considered is the heat usually encountered in places containing vitiated air. I have noted miners, when working, showing ill effects in an atmosphere containing 1% carbon dioxide and 19.7% oxygen, the temperature being 75° and the relative humidity 95%. It is my belief that miners will begin to lose efficiency in air containing more than 1.25% carbon dioxide and less than 19% oxygen, in ordinarily cool temperatures; when the working place is hot the effect is correspondingly worse. Recommendations for the Rand mines by S. Perlerich[3] are: That sufficient air shall be provided so that in one hour after a shot is fired, a sample taken anywhere in the mine will not contain more than 0.2% carbon dioxide, and 0.01% carbon monoxide, and only traces of the oxides of nitrogen.

[3] *Jour.* Chem. Met. & Min. Soc. of South Africa, Vol. 11, 1910, page 59.

Remedial Measures

The principal remedy for the conditions referred to is a sufficient air supply, and its proper distribution throughout the mine. Increased air supply may be effected: (a) by providing a greater number of openings to the mine; (b) providing for down-cast and up-cast openings, with due regard to the elevation of the shaft collars, and the presence or absence of steam pipes in the shaft; (c) by the use of fans either at the shaft collar or within the mine. A blower fan at the collar of the down-cast shaft is preferable. If an air shaft is not available, that is, one that is not used for hoisting, it may be possible to use the manway in an operating shaft as an airway, but in this case the partition between the manway and the hoisting compartments must be absolutely tight. If it is not practicable to place the fan at the shaft collar, it must then be placed within the mine workings, preferably a blower fan somewhere near the down-cast shaft.

Many of the mines have a sufficient amount of air passing into them, but, owing to insufficient airways, most of the air escapes from the mine without reaching the working places. Such conditions can be remedied by the running of additional cross-cuts, drifts, and raises for carrying the air, and by the installation, at proper places, of doors and brattices. An important aid in ventilating dead ends may be found in the intelligent use of electrically operated booster fans.

With regard to measures looking to a reduction in the noxious gas produced in the mine, those worthy of consideration are: (a) The treatment of timber with such preservatives as will prevent or retard oxidation or rotting, and (b) the use of explosives that produce a minimum amount of noxious gases. The treatment of timber has been discussed in various papers and publications, and it is probable that the use of some preservative that will act as a sterilizing agent will be effective in the Lake Superior mines. Probably the preservative most used at this time is creosote. However, this is a subject that requires further investigation before definite recommendations can be made. The cost of treatment is an important factor. It might be added that stripping the bark from timber retards, to some extent, its liability to oxidation.

The antimony supply is cut off on account of the war. In the United States, deposits of stibnite (antimony sulphide) near Gilham, Arkansas; Battle Mountain, Lovelocks, and Austin, Nevada; Burke and Kingston, Idaho; Tonasket, Okanogan county, Washington; Graniteville and San Emigdio cañon, California; Antimony, Utah; Red Bridge, Oregon; and other places, are potentially productive in times of prices as high as those now prevailing, over 20c. per pound.

The Daly West New Mill

Near the end of 1913 the mill on this property was destroyed by fire. Since then the flow-sheet of a mill to make a high recovery of zinc and other metals from the ore was devised, and a new mill is now being erected in charge of F. W. Sherman, who gave the following description to the *Park City Record*. John C. Thompson is in charge of grading, and construction is under John Steffers.

The Flow-Sheet

Ore from the mine will be received at the mill in two ore-bins, 12 by 12 ft. square and 35 ft. deep, and fed to Stevens-Adamson pan feeders and delivered to grizzlies. The undersize passes direct to a trommel screen, the oversize going by gravity to a 10 by 12-in. Blake crusher, which crushes to two inches, and this product passes to a trommel screen. The undersize of the trommel goes by gravity to a conveyor belt and thence to an ore-bin in mill proper, and the oversize is delivered to a 10-ft. long conveyor belt, that in turn delivers it to a 48-in. Symons fine disc crusher, weighing 20 tons. The head pulley of the small conveyor is magnetic and picks out any iron or steel before delivering to the crusher. Feed from the crusher goes to a conveyor belt delivering to mill ore-bin. Near the head of conveyor belt is a set of Blake-Dennison scales which weighs and registers weights of ores while in transit on the belt. This conveyor belt is 175 ft. centres. One man will operate the crushing department.

The bins at the top of the mill will be each 100-ton capacity. The conveyor will deliver ore to the above bins through a trommel screen, where two sizes are made, the undersize of 6 mesh and the oversize of 6 mesh. The oversize is delivered by a plunger feeder to a Franz jig. This jig makes a lead concentrate and a middling. The middling is delivered automatically by a drag conveyor to an ore-bin where a plunger feeder delivers it to rolls for re-crushing. The undersize product of trommel screen at head of mill is delivered by a plunger feeder to an Akins de-slimer where the slime is taken out. This is an entirely new feature in milling. The de-slimed product is delivered automatically to a second Franz jig that makes a lead concentrate, a lead-zinc middling, and a tailing which is in turn delivered to the sizing and classifying system, which consists of a series of three Akins impact screens, three screens in each series, and also a five-spigot Richards-Janey classifier. The impact screen and classifier make eight different classes of material. The first three classes are treated each over two three-compartment Harz jigs. The other five classes are first treated each over two Wilfley tables. On the jigs is made a lead concentrate, a lead-zinc middling, a zinc concentrate, and a tailing rejection. The middling from each jig is treated on an Overstrom table, which in turn makes a lead concentrate, an iron-zinc middling, a zinc concentrating rejection. Each series of the Wilfley tables makes a lead concentrate, an iron-zinc middling, a zinc concentrate, a zinc-silica middling, and a tailing rejection. The middling from each series of two tables goes by gravity to the floor below to a third Wilfley table where the same number of products are made as on the tables on the floor above. The middling from the lower series of tables is returned by a cup elevator to the sizing and classifying system. The lead and zinc concentrates from all the tables and jigs go to separate shaking launders that in turn deliver them to separate cup elevators that deliver each class of concentrates to Akins de-waterers. The de-watered concentrates drop into bins from which they will be loaded into cars for delivery to railroad.

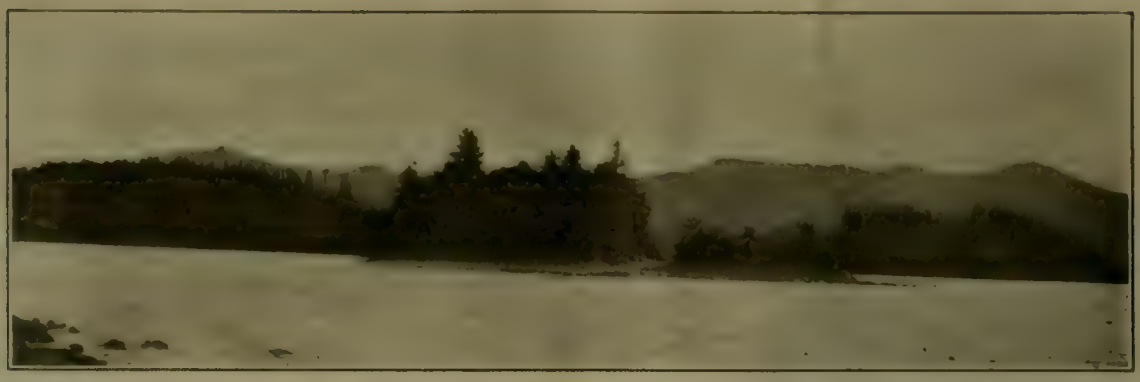
The overflow from the Richards-Janey classifier, which contains all the original slime in the ore, is delivered by gravity to a Sherman classifying tank, 14 ft. diameter and 12 ft. deep, from which the coarser slime is drawn on a series of two slime tables for treatment. The middling from these tables is treated over a third slimer on the floor below. The overflow from the tank is delivered and equally distributed to 32 settling tanks, where the slime is thoroughly settled and thickened, and then delivered by gravity to a flotation machine. This machine gives a thickened slime product 14 separate treatments; from each treatment a froth concentrate is made. The overflow water from the tanks will be so clarified that it will again be used in the mill in place of fresh water.

All tailing rejections from jigs and tables pass over a Harz jig as a last treatment before being finally rejected. On this jig is made a middling and a tailing rejection. The middling is returned to the sizing and classifying system and thence to jigs and tables for re-treatment.

Automatic Handling and Labor Costs

When completed there is no doubt the Daly West will be one of the best mills in the district. The latest milling machinery will be in use, and modern methods adopted in every detail of operation. In the mill proper there will not be a car track, not a shovel used, or a tank of any description. All products will drop direct from machines to shaking launders into tunnels beneath the floor and automatically carried to their respective destinations. This will enable the mill to be kept clean and neat. A 150-ft. tunnel runs from the end of the mill underneath ore-bins to the mine, and all transportation will be done electrically. Below the mill will be a heating plant for both mine and mill. The difference in cost of operation under the new system will be an item of considerable importance. Records show that the last year in the old mill the cost for labor alone was 65c. per ton; in the new mill, the cost will be less than 20c. Mr. Sherman says the new mill will be completed and in operation by the middle of September, and there is every reason to believe that such will be the case, judging from the rapid progress being made at this time.

The Daly West mine is credited with a total production of $9,605,429, from which dividends to the amount of $2,925,000 have been paid.



A Barite Deposit Near Wrangell, Alaska*

By ERNEST F. BURCHARD

An interesting deposit of barite or 'heavy spar' was discovered while I was searching for beds of marble in southeast Alaska in September, 1913. This barite is situated on one of the Castle islands in Duncan canal, a long, narrow, shallow bay that extends northward into Kupreanof island from Sumner strait. The Castle islands, which consist of a group of six or seven islets ranging from 600 ft. to a mile in length, are about seven miles northwest of Beecher pass, one of the entrances to Duncan canal. Duncan canal lies three to ten miles west of the well known Wrangell Narrows, and the barite deposit, measured *via* navigable waterway, is about 40 miles northwest of the town of Wrangell. The nearest port is Petersburg, at the north end of Wrangell Narrows, about 25 miles distant.

There is little in the appearance of the deposit to suggest that it is other than a cliff of weather-beaten, fractured limestone, and it is probable that fishermen have sailed past it or have anchored their boats in its lee for generations, never suspecting that it is composed almost wholly of barium sulphate, a very useful mineral, but one much less common than calcite, quartz, or other minerals that make up the bulk of rock masses.

The deposit of barite forms a rocky outlier on the east side of the second island of the group, beginning at the southeast. It is shown in the picture at the top of the page, as the heavily wooded islet in the centre. The mass stands as block connected with the rest of the island by a low, narrow neck, about 200 ft. long, that is covered by water to a depth of 5 to 10 ft. at high tide. The top of this barite outlier stands about 35 ft. above high-tide level. The mass as exposed is roughly elliptical in shape, with its major axis extending in a direction about N. 30° W., and is possibly 75 ft. wide by 200 ft. long at the maximum. What its extent below low water may be would be difficult of determination, and its thickness measured perpendicular to the lamination is uncertain, but it is probably not less than 140 ft. Near the southeast extremity, which is narrow and more pointed than the northwest end, erosion has cut a notch in the deposit down to within a few feet of high-tide level. Below the base of the cliff, which is washed by extreme high tides, the beach slopes away in all directions and at low tide is 30 to 50 ft. wide with the water level some 15 ft. lower than the base of the cliff. All that is visible of this cliff and the surrounding beach, except the narrow neck which connects the outlier with the island, is of barite, either in place or as a talus deposit. A rough calculation, based on measurements by pacing, indicates that there should be more than 50,000 short tons of barite available above high-tide level.

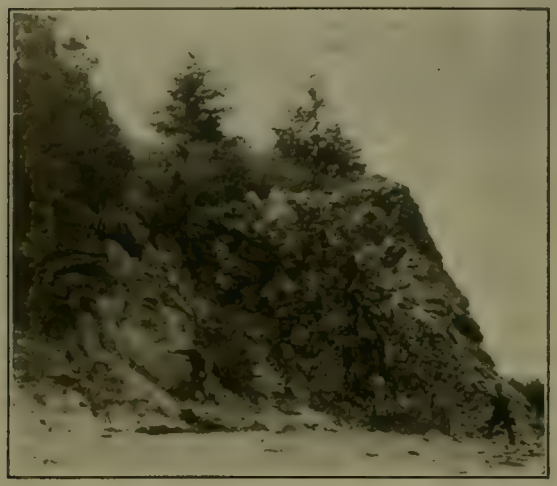
Neither the appearance of the mass nor its geologic relations and structure offer very clear suggestions as to its nature or origin, but it is thought that it may represent the residual portion of a large vein or lens of barite, extending parallel to the schistosity of the adjacent rock, and representing the result of replacement of limestone by barite.

The barite is very much jointed, and is so fractured at the surface, probably by the action of frost, that the material tends to break into fragments not more than three or four inches in thickness. The beds strike N. 30° W. and dip steeply toward the northeast. Only barite is visible around the shore line of the outlier except on the southwest side facing the island where, at low tide, the contact of a granular schistose rock with the barite is just visible. The schistose rock strikes N. 30° W. and dips steeply northeast, just as does the barite. The neck connecting the barite outlier with the rest of the island is of schistose material, which becomes finer grained and more thinly laminated toward the main part of the island. The island itself is composed mainly of schist.

The nearest islet toward the southeast, about 1000 ft.

*Published by permission of the Director of the U. S. Geological Survey. For more extended data, see U. S. Geol. Survey *Bull.* No. 592-D.

distant from the barite deposit and nearly in strike with it, is composed wholly of schist, and the next islet toward the northwest at a less distance is composed mainly of schist with some cherty limestone and veins of calcite. No other deposit of barite was observed, but



CLIFF OF BARITE ON CASTLE ISLAND.

the similar appearance of other cliffs on islands in the Castle group farther north, as observed through a field-glass, suggests the possibility of other deposits.

The schistose rock adjacent to the barite, and apparently dipping below it, is gray in color, granular in texture, crumpled to a slight extent, much jointed, and the grains have been flattened to a lens-shaped section. A thin section of this rock shows under the microscope the following minerals, all of which are regarded as secondary: chert, quartz, barite, a little plagioclase feldspar, a little mica, sulphides, and titanite. When treated with dilute hydrochloric acid it emits an odor of hydrogen sulphide, but does not liberate carbon dioxide.

The barite, where fresh, is mostly finely crystalline, grayish white rock with thin, grayish blue veins and clouded areas, and a few thin black streaks. Occasionally there is some barite that is coarsely crystalline and white in color, and there is some white quartz present in thin seams and small segregations. Pyrite is nearly everywhere present in fine specks disseminated through the mass or arranged in rough parallelism with the grayish blue veins in the rock. The thin black streaks are segregations of fine specks of dark minerals among which are probably galena, sphalerite, magnetite, and graphite. At the surface the material is strongly stained with iron rust resulting from the weathering of the iron pyrite.

Thin sections of the barite appear under the microscope to contain titanite, in part leucoxene derived from ilmenite, iron oxides, and metallic sulphides. The powdered material examined under the microscope showed, in addition to barite quartz, sphalerite (?), magnetite, and metallic sulphides. The thin sections show the barite crystals to have been strained and granulated, and probably the barite was metamorphosed along with the bordering schist. The pyrite crystals appear to be secondary to the barite. The powdered barite is grayish white in color, and under a hand lens shows many particles of metallic sulphides. Laboratory experiments, outlined on another page, suggest that with proper mechanical manipulation it may be possible to bleach the material on a commercial scale.

The presence of metallic sulphides in abundance warranted having assays made for the precious metals, and an average sample weighing about 50 lb. was collected from the surface of the deposit. According to the results of the assays, metals are not present in sufficient quantity to permit the barite to be classed as a metalliferous ore, and its commercial value consequently will depend on the quality and marketable value of the barite itself.

The following results were obtained from two independent assays of the material:

	Assayer	
	Burlingame.*	Ledoux & Co.†
Gold, oz.	0.03	0.010
Silver, oz.	0.79	1.05
Copper, %	0.05	0.07
Lead, %	none	0.29
Zinc, %	1.27	1.14

*Denver, Colorado. †New York City.

The results of a quantitative chemical analysis by W. C. Wheeler, of the U. S. Geological Survey, are as follows:

	Original, %.	Recalculated, %.
Silica (SiO_2)	5.05	5.05
Iron oxide (Fe_2O_3)	0.77	0.77
Titanium oxide (TiO_2)	none	none
Calcium oxide (CaO)	trace	trace
Magnesium oxide (MgO)	trace	trace
Barium oxide (BaO)	58.60	58.60
Strontium oxide (SrO)	0.37	0.37
Sulphur trioxide (SO_3)	34.74	33.69
Carbon dioxide (CO_2)	none	none
Lead oxide (PbO)	0.15	....
Lead sulphide (PbS)	....	0.16
Zinc sulphide (ZnS)	....	1.68
Manganese dioxide (MnO_2)	trace	trace
Total	99.68	100.32

In the original analysis there was shown a surplus of sulphur trioxide and the quantity of zinc sulphide was not determined, but its percentage was calculated as the equivalent of 1.27% of zinc as determined by the first assay. In like manner the percentage of lead suphide was calculated by combining 0.15% of lead oxide, which was found by analysis with a sufficient quantity of sulphur trioxide to form lead sulphide.

According to this analysis the material contains about 89.16% of barium sulphate, or barite, and is therefore a little less than 90% pure. The chief impurity is silica, and for many purposes for which barite is used, a moderate percentage of silica, which grinds white, is not especially deleterious, nor is the strontia, which is in

too small quantity to be separated. The remaining minerals, which are mainly metallic oxides and sulphides, must aggregate less than 4.5%. Only about 2.61% are shown by the analysis. This is not a high percentage of objectionable impurity, and probably is below that carried by shipments of raw barite from many mines.

Mineralogy and Occurrence of Barite

Barite (also termed barytes), or heavy spar, is barium sulphate, the chemical formula of which is $BaSO_4$. The recorded occurrences of barite indicate that it is a mineral of aqueous origin and that it has formed as a direct deposit from waters or as a precipitate when waters of a certain composition mingled.[1] The pure mineral is composed of barium monoxide (baryta, BaO), 65.7%, and sulphur trioxide (SO_3), 34.3%. The specific gravity is 4.3 to 4.6; the hardness of 2.5 to 3.5. Barite is usually a white, opaque to translucent crystalline material, generally a little softer than calcite but harder than gypsum. It differs from both gypsum and calcite in its greater specific gravity, and by the fact that it is practically not affected by acids. A common form of the mineral is an aggregate of straight or slightly curved cleavable plates, but it occurs also in granular, fibrous, and earthy masses, in the form of stalactites and concretions, as well as in single and clustered crystals. Natural deposits of barite are rarely wholly pure, the most common impurities being silica, fluorite, lime, magnesia, and the oxides of iron, manganese, and alumina. The reddish and yellow stains which are characteristic of much of the commercial barite when freshly mined are due in large part to iron oxide. Fine crystals of galena and sphalerite are often found either disseminated in, or segregated through, the barite.

Barite occurs in veins in both sedimentary and igneous rocks as a gangue of metallic ores and also in veins where it is the predominant mineral. It occurs also as a cement between the grains of sandstone, as a replacement of limestone, as concretions in shale, and as a sinter deposited by springs. The deposits in the United States which at present supply the greater part of the output are in southeastern Missouri and in the Appalachian valleys of Georgia, North Carolina, Tennessee, and Virginia, where it is found generally in cherty and gravelly clay, residual from limestone, dolomite, and quartzite. Kentucky has vein deposits which are little developed.

Barite resembling the Castle Islands barite in having a granular crystalline texture, but a whiter color, has been found in the mountains about 12 miles west of Hailey, Idaho, north of Deer creek, according to L. G. Westgate, who reports that the deposit is in the nature of a vein which may be as thick as 200 ft., but which cannot be traced far on the strike. This deposit is associated with calcareous sandstones of Pennsylvanian age.

[1]Clarke, F. W., 'The Data of Geochemistry,' U. S. Geol. Survey *Bull.* 491 (1911), p. 555.

Uses and Preparation of Barite

Barite is used principally as a pigment in mixed paints, and in the manufacture of lithopone, a white pigment, but there are many other uses for minor quantities of barite, such as the manufacture of barium salts, which have a wide chemical application, the manufacture of rubber, wall paper, asbestos cement, artificial ivory, enamels, and for covering packages of ham, cheese, and other foods.

The value of barite as a pigment, if not used in excess in mixed paints, is due to its whiteness, its weight, and its inertness in the presence of chemically active substances, and also to its aptitude to take color stain uniformly, and to make a small quantity of color, such as aniline, cover much surface. In order that the barite may be suitable for the uses above mentioned, it must be free from all associated minerals which do not grind white, or which are affected by acids or atmospheric gases. Thus iron oxide, and the sulphides of metals, such as iron, lead, zinc, and copper must be removed, and there must be little lime or magnesia present. The presence of small percentages of clear or white quartz are not objectionable, for it grinds to a white powder and is not chemically active.

In preparation of barite for the market in the mining regions of Missouri, where the largest quantities are at present produced, the ore is first allowed to stand in the sun and rain so that much of the residual clay with which it is associated drops off, and hand cobbing, picking, and sorting results in such further cleaning of the material that it is ready for shipment to the mills. The product from some workings in the southern Appalachian region is first washed in log washers to free it of associated clay. Next the barite is separated into two or three grades by hand sorting, after which it is ready for the milling process. (Neither of these preliminary processes would be needed for the Alaska barite herein described, as it would be ready for milling directly upon being quarried.) Barite is milled by both the dry and the wet process. The wet process is the later and more effective one, and the one now most generally employed. Several types of mills are in use. The milling processes consist of crushing, grinding, washing, bleaching, and drying, although not necessarily in the order given. The most troublesome impurities seem to be galena and limonite. Where the galena occurs disseminated in fine grains through the barite, the two minerals are not easily separated by jigging or flotation. The limonite cannot be entirely removed by ordinary jigging, and magnetic separation has been attempted but not yet accomplished. Bleaching with sulphuric acid, however, removes the iron if it is not present in quantity so great as to require an excessive amount of acid, but does not so readily affect the lead compound, which, when ground with the barite, imparts a grayish tint to the material, and thereby reduces its value as a pigment. Lime carbonate is also a deleterious impurity when it occurs in sufficient quantity to neutral-

ize a portion of the acid which is used in the bleaching process.

In the manufacture of the white pigment, lithopone, an intimate mixture of precipitated zinc sulphide and barium sulphate, barite is first reduced from the sulphate to the sulphide of barium, which is soluble, and then treated with a solution of zinc sulphate. The reduction of barite is effected by heating to bright redness a mixture of about four parts of crude barite and one part of a very low ash coal in a rotating furnace. The coal acts as a reducing agent, and converts 60 to 70% of the barite to barium sulphide, the remainder being converted to barium carbonate. A similar principle is employed in the initial stages of the production of other barium salts.

Possible Value of the Castle Islands Barite

The grade of the barite described above is not of the highest, particularly for use as a pigment, and it will probably require a milling test to determine whether or not it may be possible commercially to remove the metallic sulphides and to bleach the color to a pure white. Simple laboratory experiments and comparison of the Alaska material with commercial grades of barite suggest that this may be possible. For example, tests by W. C. Wheeler and myself show that washing and flotation tend to whiten the finely ground grayish white powder. Further treatment with hot dilute sulphuric acid containing small quantities of sodium chloride and sodium nitrate bleaches the powder to a shade only slightly less white than that of precipitated barium sulphate or zinc oxide. These experiments are encouraging and seem to indicate that with the aid of proper mechanical manipulation the process might be made commercially successful.

In the process of manufacture of lithopone and the various salts of barium where crude barite is fused with coal a slightly impure raw material would apparently react as well as one having a high degree of purity, providing the impurities present were not in themselves objectionable. It is possible, therefore, that the Alaska barite is suitable for general chemical purposes. Probably it would not be practicable to build and operate a barite mill in the vicinity of the deposit, but the raw material can certainly be quarried and loaded on barges very cheaply, and transported to Puget sound or to San Francisco at low freight rates. The approaches to the Castle islands, while not very deep, show according to the Coast and Geodetic Survey charts from 5 to more than 30 fathoms of water. In the immediate vicinity of the islands the depth of the water is such that wharves could be built, and there is plenty of timber at hand suitable for this purpose. There is level space on the island of which the barite deposit is an outlier sufficient for the necessary buildings of a quarry camp. Quarrying of the deposit would evidently be very simple, as the material could be blasted from the face of the cliff and a large output obtained in a relatively short time. Over the top of the mass there is a brushy growth of spruce and cedar with but little soil, and if this were stripped off at first the deposit would afford an unusually clean quarry.

Production, Imports, and Prices of Barite

The production of crude barite in the United States in 1913 was 45,298 short tons, valued at $156,275. This represents the value of the crude material f.o.b. mines and gives an average price for the whole country of $3.45 per ton of 2000 lb. The average price in the southeast Missouri district was $3.78 per ton. The imports of crude barite entered for consumption during 1913 amounted to 35,840 short tons, valued at $61,409, or $1.71 per ton, and of manufactured barite amounted to 4463 short tons, valued at $38,155, or $6.98 per ton. Of these imports, 82 short tons of crude barite, valued at $144, or $1.76 per ton, and 601 short tons of manufactured barite, valued at $3976, or $6.62 per ton, were entered at San Francisco.

Electric Power at the Homestake

By JESSE SIMMONS

At the Spearfish hydro-electric installation of the Homestake Mining Co., in South Dakota, 40 to 120 cu. ft. of water per minute, depending on the stage of the stream, is carried through 23,862 ft. of tunnel, 1200 ft. of 48-in. redwood stave pipe, and 12,164 ft. of steel-pressure pipe. The wood pipe is laid in two lines, and the steel pipe in three lines. The steel pipe is of 34, 32, and 30-in. diameter; the smallest size being $\frac{7}{16}$ in. thick. Expansion joints and anchors to prevent pipe creeping down hill are spaced about 250 ft. apart. The head is 665 ft., giving a working pressure at the wheels of 288 pounds.

The transmission line of the hydro-electric installation is 11 miles long from the Spearfish generating station to the Lead distributing station. Cedar poles, with an average span of 134 ft., carry on two cross-arms two complete three-wire circuits; one being sufficient to carry the load, the second is kept in reserve. No. 2 hard-drawn copper wire carries the current; on top of the poles is a No. 4 copper-clad ground wire; below the cross-arms are two No. 12 copper-clad wires, forming a telephone circuit. The power is transmitted at 33,000 volts.

Electricity is used for stage pumping of the mine water at the B. & M. shaft. Jeansville double-suction, three-stage pumps, with a capacity of 1000 gal. per minute against a head of 315 ft., are each driven by 125-hp., 2300-volt, A.C. motors. Three auxiliary pumps, of 500-gal. capacity, are driven by 75-hp. motors. Water is lifted in 300-ft. stages, discharging into large concrete-lined sumps, across the top of which are I-beams to which the pumps and motors are bolted.

Electricity is used to drive all of the stamps and rock-crushers, a pumping system at the B. & M. shaft, and numerous other incidental machinery.

Length of Service of Calumet & Hecla Miners

Indicative of the length of service of employees of the Calumet & Hecla, it is interesting to know that this Company employs over 100 men who have been working from 15 to 20 years for this concern, and who have 31 sons working for the Company; 427 began between 20 and 25 years ago and have 62 sons working now; 433 began between 25 and 30 years ago and have 90 sons working now; 174 began working between 30 and 35 years ago and now have 59 sons working; 112 of the present employees began working for the Calumet & Hecla between 35 and 40 years ago and have 44 sons working; 111 began working over 40 years ago and have 57 sons working now. This makes a total of 1660 men who have been working for the Calumet & Hecla company between 15 and 45 years, and they are working at the present time. They have 344 sons working, or a total of 2004.

Improvements at the Ohio Mill, Lark, Utah

The coarse-crushing unit is now in operation and giving excellent results at the concentrating plant of the Ohio Copper Co., according to George F. Waddell, the general manager. The plant consists of one mill proper, in which the ore is crushed and all treatment carried out, except the concentration of the fine slime, which is treated in a separate building known as the slime plant. Both buildings are of steel construction.

The ore is received in cars of five-ton capacity from the mine, approximately 3½ miles distant, by electric haulage through the Mascotte tunnel. One of the steel pan-conveyors, 36 in. wide and about 100 ft. long, delivers the ore from apron feeders under the coarse bins to one grizzly, the oversize of which is reduced to 2-in. pieces in a 24-in. Blake crusher. This product, together with that of the grizzly, passes to one set of 24 by 64-in. Garfield type rolls, where it is reduced to ¾ in., being delivered from there to an elevator, on which it is conveyed to the screens, where a ¼-in. undersize is obtained. The oversize passes to one set of coarse rolls and one set of fine rolls. These rolls discharge to the same elevator as the first rolls, thence to the screens mentioned, thus forming a closed circuit, with the screens as the outlet for the final product. Another steel pan-conveyor will be installed to accommodate the other bin, although the steel pan-conveyor in operation at present is handling the entire tonnage.

The 24-in. belt-conveyor, 70 ft. long, and reversible in its delivery, for the purpose of accommodating three fine-ore bins having each a capacity of 300 tons, and built at the head of each mill unit, has been installed. This conveyor serves two of the bins directly, and when the other 24-in. conveyor, to serve the third bin, is installed the first conveyor mentioned will deliver to it.

From the fine bins at the head of each section the ore is fed by Challenge feeders in a dry state to two 18-in. elevators, each of which discharges to four impact screens, making approximately a 2 mm. undersize. The oversize passes to four sets of 15 by 36-in. rolls. There are two sets for each elevator and they crush to 2 mm., discharging to the two elevators mentioned and thus making a closed circuit of the operation. From this point in the operation no changes have as yet been made in the flow-sheet, although these are under consideration. —*Salt Lake Tribune*.

Atomic Weights for 1915

The Council of the International Association of Chemical Societies, with which the Committee on Atomic Weights is now affiliated, recommended, at its meeting in September 1913, that the annual report of said Committee should be published in August. The present report is submitted in compliance with that recommendation and contains the weights for 1915 as reported in the *Jour.* Amer. Chem. Society.

	Atomic weight.		Atomic weight.
Aluminum (Al)	27.1	Molybdenum (Mo)	96.0
Antimony (Sb)	120.2	Neodymium (Nd)	144.3
Argon (A)	39.88	Neon (Ne)	20.2
Arsenic (As)	74.96	Nickel (Ni)	58.68
Barium (Ba)	137.37	Niton (Nt)	222.4
Bismuth (Bi)	208.0	Nitrogen (N)	14.01
Boron (B)	11.0	Osmium (Os)	190.9
Bromine (Br)	79.92	Oxygen (O)	16.00
Cadmium (Cd)	112.40	Palladium (Pd)	106.7
Caesium (Cs)	132.81	Phosphorus (P)	31.04
Calcium (Ca)	40.07	Platinum (Pt)	195.2
Carbon (C)	12.00	Potassium (K)	39.10
Cerium (Ce)	140.25	Praseodymium (Pr)	140.6
Chlorine (Cl)	35.46	Radium (Ra)	226.4
Chromium (Cr)	52.0	Rhodium (Rh)	102.9
Cobalt (Co)	58.97	Rubidium (Rb)	85.45
Columbium (Cb)	93.5	Ruthenium (Ru)	101.7
Copper (Cu)	63.57	Samarium (Sa)	150.4
Dysprosium (Dy)	162.5	Scandium (Sc)	44.1
Erbium (Er)	167.7	Selenium (Se)	79.2
Europium (Eu)	152.0	Silicon (Si)	28.3
Fluorine (F)	19.0	Silver (Ag)	107.88
Gadolinium (Gd)	157.3	Sodium (Na)	23.00
Gallium (Ga)	69.9	Strontium (Sr)	87.63
Germanium (Ge)	72.5	Sulphur (S)	32.07
Glucinum (Gl)	9.1	Tantalum (Ta)	181.5
Gold (Au)	197.2	Tellurium (Te)	127.5
Helium (He)	3.99	Terbium (Tb)	159.2
Holmium (Ho)	163.5	Thallium (Tl)	204.0
Hydrogen (H)	1.008	Thorium (Th)	232.4
Indium (In)	114.8	Thulium (Tm)	168.5
Iodine (I)	126.92	Tin (Sn)	119.0
Iridium (Ir)	193.1	Titanium (Ti)	48.1
Iron (Fe)	55.84	Tungsten (W)	184.0
Krypton (Kr)	82.92	Uranium (U)	238.5
Lanthanum (La)	139.0	Vanadium (V)	51.0
Lead (Pb)	207.10	Xenon (Xe)	130.2
Lithium (Li)	6.94	Ytterbium (Neoytterbium) (Yb)	172.0
Lutecium (Lu)	174.0	Yttrium (Yt)	89.0
Magnesium (Mg)	24.32	Zinc (Zn)	65.37
Manganese (Mn)	54.93	Zirconium (Zr)	90.6
Mercury (Hg)	200.6		

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Rand Banket

Reply by Mr. Horwood to Mr. Draper's Discussion

In criticizing that portion of my paper which deals with the Witwatersrand syncline, D. Draper commences by misquoting me. I did not state "that the southern and western outcrops (of the syncline) are missing." I said that "the southern and southwestern boundaries are missing." However, had I only pointed out that the southwestern boundary was missing it might have more clearly expressed the meaning that I wished to convey, namely, that the syncline is not a basin but a valley trending northeast and southwest, with its mouth at the southwestern end, and consequently at that end no outcrops of the beds occur.

Mr. Draper suggests that I have ignored the Vredefort granite, and its surrounding sediments. There was no occasion for me to refer to it, as it is beyond the area with which my paper deals. He then makes the definite statement that "the evidence both on the Witwatersrand and in the Vredefort area points distinctly to great earth-movements, resulting in the formation of a synclinal trough *after* the Ventersdorp diabases had solidified." He brings forward no facts in support of this statement, except that the Witwatersrand beds flatten in dip toward the Ventersdorp diabase, whereas he maintains the reverse would have happened if volcanic matter had been removed from below them. It will therefore be sufficient to point out that simultaneously with the removal from below of molten rock, the latter was ascending through openings toward the surface, and consequently there would be a tendency for the dip of the subsiding sediments to be lessened in the immediate neighborhood of the uprising igneous rock. As regards his expression of personal opinion in relation to the Vredefort granite area, I do not agree with him, and in a paper by me entitled 'The Old Granites of the Transvaal and South and Central Africa,' to which A. Wade contributed a petrological description of the Orange Grove granite, I called attention to the fact that Molengraaff in 1903 had showed that this Vredefort granite mass was of much later date than the Witwatersrand beds, and later even than the Pretoria series, but earlier than the Karroo system.[1] This subject has recently been dealt with again by F. W. Penny.[2] The intrusion of this particular granite mass had nothing to do with the formation of the Witwatersrand syncline and doubtless occurred long after it had been formed.

Neither can I agree with his opinion that it will not be generally conceded that such intense volcanic activity could have produced numerous lateral fractures; as such cases are numerous. As an example, I would mention that Molengraaff showed that numerous dikes intersect the strata of the Transvaal system[3] all around the basin of the igneous complex of the Bushveld, as a consequence of the intrusion of the igneous rocks.[4]

Mr. Draper states that the igneous dikes associated with the Witwatersrand beds cannot be in any way connected with the Ventersdorp diabase, but again brings forward no facts to support this opinion, whereas I showed the great similarity in petrographical, physical, and chemical properties of the two rocks; and that the general structure of the district indicated that they are connected in origin in depth.

Mr. Draper suggests that because the Ventersdorp diabase is amygdaloidal, its source was probably many miles distant from the Witwatersrand, since it represents lava flows. He does not seem to realize that there is no chemical or physical reason why even a dike should not be amygdaloidal, provided the aqueous and other vapors which it contained were above the critical temperature at the time of its solidification. I had previously pointed out that an amygdaloidal dike occurs in the Saxon gold mine, and there is also an example in the Heidelberg district of such a dike to which G. S. Corstorphine called my attention.[5] I also pointed out that the axis of the synclinal basin of the Witwatersrand would naturally mark the line along which the main fracturing and resultant vents occur.

Mr. Draper then says that if my contentions were correct, surely there would also be numerous dikes crossing the strike of the beds when such a gigantic volcanic outburst occurred. Had he read my paper a little more carefully he would have realized that I particularly called attention to the presence of such transverse dikes, and showed that although somewhat younger than the longitudinal dikes, since they have in many cases faulted the latter, they also are, or at all events the majority, connected in depth with the same diabase magma.

[1] *Geol. Mag.*, N. S., Decade V, Vol. 6 (Oct.-Dec. 1909), pp. 466 and 467; see also summary, pp. 548 and 549.

[2] Abst. *Proc.* Geol. Soc. of Lond., No. 959 (May 21, 1914).

[3] This consists of the two systems now known as the Potchefstroom and Waterberg systems.

[4] "Geology of the Transvaal," by G. A. F. Molengraaff (Constable & Co., 1904), pp. 50 and 51.

[5] "Notes and Analyses of Typical Transvaal Rocks," by C. B. Horwood, *Trans.* Geol. Soc. So. Af., Vol. 13 (1910), p. 41.

I do not quite follow Mr. Draper when he speaks of the banket beds having been tilted into their present position after their solidification. Does he suggest that these sediments were ever in a molten or liquid state?

In support of his statement, he calls attention to the fact that strain phenomena is a marked feature in microscopic slides of the banket; undoubtedly it is, and this is a natural consequence of the pressure to which these beds have been subjected.

He agrees that I have shown conclusively that sometimes there is a decided rise in the gold content of the banket as a line of faulting is approached; but says I have not shown that a similar phenomenon occurs in the neighborhood of a dike except in the Crown Reef mine, where the dike is accompanied by an upthrow fault, and asks why I consider the dike channels rather than the fault lines as having formed deep seated communications for the up-rising mineral solutions. I consider the main structural lines of faulting as due to the fracturing and disturbance produced during the same period of eruptive activity to which the dikes are due; and consequently they also may have formed deep seated channels for the ascension of the mineralizers. The example I gave of enrichment near one of these main structural faults and which Mr. Draper quotes, should have made it clear to him that I hold this view. If Mr. Draper will read my paper carefully he will find I have given several instances of enrichment near dikes.

Mr. Draper also contends that the intrusion of basic igneous dikes being accompanied by the ascension of other than molten material will not be generally accepted by geologists. The simplest manner of dealing with this portion of his criticism is to refer him to the works of J. H. L. Vogt, S. Arrhenius, and J. F. Kemp, although it seems invidious to pick out particular authors among the numerous well known authorities on the genesis of ore deposits or on world structure.

Mr. Draper says that the fact that these dikes contain traces of gold may be accounted for by their having robbed the gold-bearing beds which they intersected. If he will describe to me the physical and chemical conditions under which such a transfer is likely to have occurred, I shall then have much pleasure in replying to this portion of his criticism.

He says that metamorphosis by basic dikes has rarely been recorded. I have recorded such metamorphism in my paper, which I would again ask him to peruse more carefully.

In the last paragraph of his discussion he states that his conclusions lead him to believe that the gold-bearing solutions were introduced into the Witwatersrand beds while the latter were in a porous condition, either by means of fissures or directly from the aqueous solutions in which the beds were formed. He then relates that a number of nuggets were found at the Rietfontein Mines, one of which weighed over 2 oz. and several over 1 oz. in weight, which were ordinary nuggets such as are found in alluvial gold-bearing deposits. I am really at rather a loss to understand how Mr. Draper reconciles these two statements.

London, June 1. C. B. Horwood.

Milling in Cyanide

The Editor:

Sir: Mr. Noel Cunningham's criticism of figures quoted by me is not unexpected, and I have to thank him for the interesting comparative details he now gives in the July 4 issue as to Dome and Hollinger practice. I may point out that the ones I used last year have been recently re-published, without correction or added comment, in Megraw's 'Details of Cyanide Practice'. It seems regrettable that such information is not revised by those who are chiefly interested and directly responsible.

While accepting Mr. Cunningham's more recent figures I am entirely unwilling to agree with him that they upset the contention I raised in my original article. The extraction at the Hollinger is now given as 96% and that of the Dome as 95%; but this shows no superiority in treatment method when allowance is made for the fact that the ore is three times richer at the Hollinger than at the Dome. Taken in conjunction with the amount of gold left in the residue the result is all in favor of Dome treatment.

Mr. Cunningham's assumption that the precipitation-ratio at the Dome could be reduced to 0.9 to 1 by abolishing amalgamation and adopting milling in cyanide is totally opposed to practice, being based on the faulty contention that such ratio must invariably be relative to the grade of the ore.

"On account of crushing in water" Mr. Cunningham adds, "an excess of solution is made and a corresponding amount must be precipitated and thrown away." I dealt with this aspect in the communication now commented upon, and said: "It is of course imperative that the equipment should be designed to de-water before cyaniding to within a few percentages of moisture contained in the discharged residue. If this is impossible then milling in water is either impracticable or inadvisable." A faulty detail or an omission in Dome practice may be condemned but this is no argument against the principles involved.

Mr. Cunningham states that I make a point in favor of 'waste' solution.. He is entirely in error because I am opposed to such practice. His subsequent remark that: "There is always a loss of solution in the tailing * * * sufficient to offset fouling," is merely a repetition and not a contradiction of what I have already enunciated in the *Press* as the simplest method of avoiding such trouble.

London, July 25. A. W. Allen.

Gold production of British Guiana has averaged 72,878 oz. per year for the past 10 years. The yields during 1912-13 from the several methods of operation were: placer washing, 38,472 oz.; dredging, 12,033 oz.; hydraulicking, 823 oz.; and quartz mining, 437 ounces.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

THE PREMIUM CHARGEABLE on each $480 of insurance, under the Western Australian Workers' Compensation Act, is $2.40.

STAMP-MILLING through coarse screens is generally followed by tube-milling. In this case it has been found a distinct advantage to crushing efficiency to adopt a battery screen of oblong opening. By this means the battery output will be increased with the addition of oblong particles of ore which are more easily pulverized in the tube-mill than cubes of similar volume.

COPPER for the Royal Mint, London, amounting to 200 tons, was required by tender on August 6. Ingots supplied must weigh between 14 and 18 lb. each, and be guaranteed to contain not less than 99.8% of copper, and not more than 0.005% lead, 0.005% tellurium and selenium taken together, 0.001% bismuth, 0.001% tin, 0.001% antimony, 0.01% iron, and 0.02% arsenic.

THE MATTE may be removed from the top of cyanide bullion by putting the bar into a large crucible in a hot fire, and when the matte melts, which will occur before the bullion reaches its melting point, the bar may be withdrawn from the crucible. It is often advisable to then remelt the bar, which may be quickly done in the same crucible after the matte has been poured into a suitable mold.

PNEUMATIC AUGERS are used in the Central mine, Broken Hill, according to James Hebbard in the *Compressed Air Magazine*, their principal work being in the repair of crushed timbered drifts and cross-cuts. In this operation, large quantities of old 10 by 10-in. Oregon pine legs and caps have to be removed, together with the decking, in restricted spaces where the use of axe or saw would be tedious at best, or almost impossible. The drills are also useful in various other minor jobs, such as for boring holes for hanging bolts in shaft sets, or for bolts for handrails at shafts and winzes. The tool used is the No. 11 Imperial piston drill, and the auger bit found most suitable is 1½ in. diameter. This is for Oregon pine; a smaller bit would doubtless be preferable for hard wood. The advantages of the pneumatic auger over axe or saw for cutting through heavy timbers in the confined limits of a narrow drive will be readily appreciated.

CYANIDE MILLMEN should make an effort at all times to turn out bullion with a low base-metal content. United States mint charges are computed at stated prices per ounce of bullion deposited; to give the mint a bar containing much base is only to pay a tariff on some valueless material. With zinc-shaving precipitation, there are two important features tending to yield clean bars. First, do not take any coarse zinc in cleaning-up. Take only the gold precipitate and the shortest zinc, preferably that which will, by working, drop through the screen in the bottom of the precipitating compartment. The next important factor is a painstaking wash, or several of them, if at all convenient, with hot water, after the acid treatment. Hot water means water as hot as live steam will make it. Use plenty, all the wash tank will hold. This is the only practicable means of eliminating the sulphates formed in acid treatment. A careful observance of these two hints will enable the operator to turn out clean bullion, saving mint charges and, furthermore, it will be bullion which will give uniform assays on samples taken from various parts of the bar.

COMPARISON of the Huntington-Heberlein and Dwight-Lloyd processes of sintering ores is discussed in the August *Bulletin* of the A. I. M. E. by W. W. Norton, of Murray, Utah, who summarizes his experience there as follows:

	Advantage in favor of
Cost of installation	D.-L.
Cost of roasting	H.-H.
Adaptability of charge	D.-L.
Metal losses	Doubtful
Physical condition of product	H.-H.

The D.-L. is a good modern machine now brought to a state of efficiency where it is splendidly adapted to lead-smelter work. The H.-H. process is still operated with a good measure of success. A good-sized compact H.-H. plant at Murray, well designed and operated in a painstaking manner, permits of possibly an unusually good expression being recorded in favor of the H.-H. The low first cost of D.-L. units, and the ease and flexibility with which successive units may be added to any given lead smelter, are perhaps the reasons why a greater number of 400-ton H.-H. plants have not received thorough trial. Actual experience with D.-L. machines at Murray has caused them to gradually grow in favor from year to year. The operators are highly pleased with the flexibility of charge and other important items. The well sintered product is so good as to make it unfortunate that exaggerated claims for its virtues should have been published. Mr. Norton was unable to point out any overwhelming advantage of the D.-L. over the H.-H. system, although continued progress may upset the balance at any time. If history repeats itself, some new roasting system will take rank over both within a few years.

REVIEW OF MINING

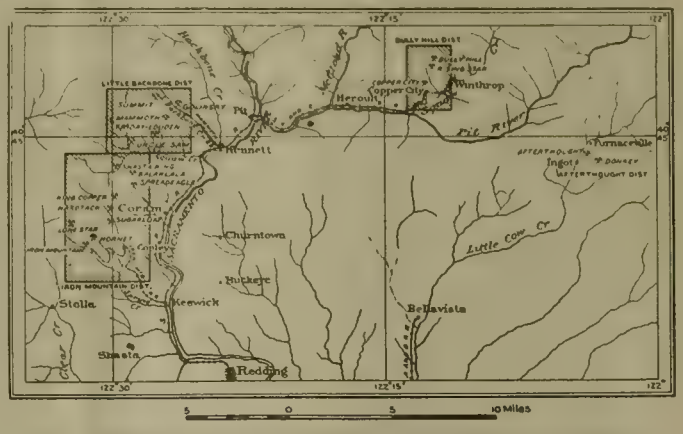
As seen at the world's great mining centres by our own correspondents.

HEROULT, CALIFORNIA

FERRO-MANGANESE TO BE MADE AT HEROULT.—EUROPEAN WAR AFFORDS OPPORTUNITY TO ESTABLISH NEW INDUSTRY.—FURNACES BEING PREPARED.

Although the European war has temporarily disturbed California's mining industry in general, it has also been the cause of establishing an entirely new branch of mining and metallurgical operations in this state. The trouble in Europe has greatly disturbed Shasta county mining through the temporary shutting down of several of its copper mines, the largest of which are the Iron Mountain property at Keswick and the Balaklala property at Kimberly. The electric furnaces of the Noble Electric Steel Co., however, are about to start the commercial production of ferro-manganese at Heroult. The electric steel industry at Heroult was stopped several months ago, due to the fact that the type of furnace which had been adopted for this purpose was not able to produce steel in competition with the Eastern market. Since the shut-down, J. C. Crawford, Jr., manager, has been carrying on a set of experiments along the lines of the production of ferro-alloys with the aid of a small three-phase arc furnace which was constructed for experimental purposes. Ferro-alloys have been successfully produced by this furnace for some time, but it is due to the sudden change in the ferro-manganese market that the large furnaces at Heroult will be rebuilt with the intention of producing this metal on a commercial basis. Mr. Crawford says that "the price of ferro-manganese since the outbreak of war in Europe has jumped from $38 per ton for an iron-manganese alloy containing 80% manganese to as high as $150 per ton, and while the receipts of certain consignments which are en route from England have steadied the price somewhat, the steel trade papers under date of August 20 quote it at from $100 to $125 per ton, Atlantic seaboard. In anticipation of such a condition arising, the Company has recently made arrangements to manufacture ferro-manganese. It has secured control of what is considered one of the highest grade and largest deposits of manganese ore in the state, and will immediately take the necessary steps toward getting ore out to a railroad point, four miles distant, for shipment. The Company is considering offers from owners of manganese ore for immediate shipments. Ferro-manganese is the one alloy that is universally used for the manufacture of all steel, no matter by what process. Its virtue is twofold. It acts as a deoxidizer and cleanser to remove dissolved oxides and oxygen which are deleterious to steel, and in addition to this it imparts to steel properties of hardness, toughness, and resistance to abrasive wear which is required of all steel products. This country has relied almost entirely on England and Germany for its supply of the high 80% grade which is most in demand. That this country has not manufactured ferro-manganese of high grade to any extent has been due to the fact that the main source of high-grade manganese ore which could be cheaply delivered has been parts of Asiatic Russia and India, though Brazil also contributes a considerable amount, as does Spain.

"In the state of California are a great many manganese deposits, several of which are of considerable extent and of good grade, but inability to meet foreign transportation costs has caused these properties to remain idle. It has long been the desire of the Noble Electric Steel Co. to enter the field of making ferro-alloys of manganese and chromium, and now the opportunity has certainly presented itself. Our furnaces are admirably suited for the purpose, as metallurgical details of making ferro-manganese are similar to those in making pig iron. The cost of making ferro-manganese, however, is considerably greater than of making pig iron, but there will be a very substantial profit in making the former, even at a price very much lower than that at present existing. The Company is cleaning and making ready one furnace to be put in commission as soon as the shipments of manganese ore start to arrive, and it seems very likely that conditions will justify the placing of the second furnace in commission shortly afterward. In addition to the eastern market afforded by steel works and iron foundries, Japan is a large consumer, and an appreciable amount is also used by the steel works and foundries of the Pacific Coast.



MAP SHOWING SITUATION OF HEROULT, SHASTA COUNTY, CALIFORNIA.

"Though it is reported that English manufacturers will endeavor to resume shipments of ferro-manganese inside of 60 days they are now asking $102.50 c.i.f. Atlantic seaboard, for future shipments, which were not contracted for previous to the war, and they are only agreeing to fill contracts already made, on consideration of good advances over contract prices to cover the extra insurance risk. It is generally understood that there is at the present time only sufficient ferro-manganese and manganese ore in England to supply the demand for four or five months and as future supplies of ore from Russia, India, and Spain are very uncertain it is conceded that the price of ferro-manganese will remain high for a considerable time to come and those who have supplies of ferro-manganese are finding no difficulty in securing contracts at very favorable prices and for the coming year.

"In making ferro-manganese the Company will use a mixture of half charcoal and half coke. Arrangements have been made for an immediate supply of charcoal and to secure the necessary oak wood to make the charcoal later. The date of starting up depends on arrivals of manganese ore and getting together a furnace crew, but it is believed that the plant can get started in about two weeks."

HOUGHTON, MICHIGAN

Summary of the Copper Mining Industry of the Lake Superior District.—Efficiency Systems Started.

There is a general impression throughout the country that the Lake Superior copper country is now passing through the last days of its history. The reasons for this belief appear to be that (1) the mines have reached such great depths; (2) with the decrease in copper content of the 'rock' at lower depths, mining is possible only at a small profit; and (3) the district has not recovered, and probably will not fully recover, from the strike recently carried on by the Western Federation of Miners. A clearer comprehension of the true conditions may be had from a somewhat brief and general review of the history of the district from the time immediately preceding the strike to the present. Whether the copper content of the rock decreases with depth has not been definitely proved, but that is a point which will have to be seriously considered when the state tax commission arrives here. When the first general strike in this district was called on July 23, 1913, by the Western Federation of Miners, the number of men employed on surface and underground at the various mines totaled 14,250. Within a day practically every mine in the district was closed, and every man employed was deprived of his work. It has been estimated that at that time the various mines were operating with about 1500 men short of normal force. As soon as it was safe and possible under the then existing conditions, the companies renewed operations with small forces. From that time the number of men employed increased as fast as they were needed until on October 8, 1913, there were 5445 men working, and of these 2079 were underground. By the first of the year most of the big producers were back to normal production. April 12, 1914, marked the official end of the strike, when a general vote taken throughout the district expressed the desire of the majority of men to return to work. Following the vote, there was a rush of the men to the mines seeking their old positions. Idle properties were reopened, forces increased as soon as possible, and the old spirit of satisfaction and good times again prevailed among the men. On July 23, 1914, one year after the Western Federation strike was called, the same mines had in their employ 16,505 men, an increase of 2255. The number of men employed in smaller exploration properties and those in the mines not included in the above brought the total up to 17,205. This was the largest number of men ever employed in the copper country. Not only was the total payroll higher than at any time previously in the history of the district, but the average individual pay check was larger than ever before. The payroll of the mining companies in July amounted to about $1,341,990. It has been said that the Lake Superior copper district is the richest in the world. However, the study of the dividends and assessments of about 70 mining companies which have operated in the district from 1849 to 1910, show that of the entire number, only 14 have paid back the money invested. If the Calumet & Hecla be omitted, the industry has just about paid back the money invested in it. Indeed it is remarkable that it should be a profitable one. The ore mined in Michigan is of lower grade than that of any other district, the average copper content per ton of rock mined is about 20 lb. This ore is mined, hoisted, crushed, transported to mills, stamped and concentrated, and the concentrate transported to smelters, there to be smelted and refined. The final product, after being transported to eastern markets, is sold for about 14c. per pound. The low margin of profit, the increasing depth of the mines, and the lower grade of the ore have made it necessary for the operators to study closely cheaper methods of mining, handling and treating the ore. It is the steady improvement along these lines that explains the fact that the Michigan copper district was in July 1914 approaching the greatest production in the history of the district.

Technical graduates are now employed in the larger mines as 'efficiency' engineers. It is the duty of these men to improve underground practice by instructing the miners in the use and care of drilling machines, and by studying and comparing the costs of different methods of mining and handling the ore. One important result of this efficiency work has been the almost general adoption of the one-man drill. The type of machine first used was the Leyner-Ingersoll, which weighs about 150 lb. Recently the Quincy Mining Co. supplanted its old drills with the new 'Baby Leyner,' a 90-lb. one-man drill. This new drill is not only lighter, but is dustless and easily handled and operated. The output of the mines is thus increased, and the miners are receiving higher wages.

All credit is due to the Calumet & Hecla for its initiative in the introduction of efficiency methods. About five years ago its No. 1 regrinding plant at Lake Linden went into operation. This plant was built to regrind and recover more copper from the tailing of the Calumet mill. That this mill shows an average profit of over $150,000 per year certainly proves the success of this venture. A second regrinding plant is nearly completed, a portion being already in operation and handling the tailing of the Hecla mill, which has been going into the lake as waste. The remaining part of this No. 2 plant when completed will treat the enormous tonnage of C. & H. stamp sand along the shore of Torch lake. This product has been accumulating for nearly 50 years and there is now over 40,000,000 tons that can be reground. While the erection of these regrinding plants were steps far beyond the hopes of the people of the copper country, a third large concentrating plant is now in the process of construction. This new plant will re-treat all the sand and slime of the two regrinding mills by a leaching process. It is estimated that a recovery of 70% will be made of the copper contained in the product of the regrinding mills. There is over 40,000,000 tons of sand to be reground and treated, which will average about 15 lb. of copper per ton. The regrinding mills should recover from 5 to 6 lb., and the leaching process 70% of the remainder. The president of the Company states that the new leaching process indicates that the extractable value of the conglomerate sand will be $20,000,000. The large electric dredge, which will recover the sand from the lake and clean it on its way to the regrinding mill, is almost ready for operation.

MELBOURNE, AUSTRALIA

Manufacture of Cement.—Importation of Pyrite.—Broken Hill Proprietary Finance.

A company has been formed in Queensland for the working of large limestone deposits near Gore, in the Stanthorpe district. The works will be established at Darra, about ten miles out of Brisbane, where there are suitable clays and shales in a ridge from 27 to 50 ft. high along the railway, entailing only 'face' working. These shales have been reported on by B. Dunstan, the government geologist of Queensland, as follows: "The shales contain varying percentages of iron, silica, and alumina, and the quantities are practically inexhaustible. They are eminently suited for the manufacture of cement, on account of the varying amounts of the essential ingredients, alumina, and silica, together with the presence of iron in some of the beds of shale. The Gore limestones and the Darra shales would make a perfect combination for the manufacture of portland cement." The Darra property consists of sixty acres.

As regards the Gore deposits, which cover an area of 44 acres, 3½ miles from a railway, Mr. Dunstan said: "The rocks in the locality are slates, limestones, and quartzites, which all appear to be regularly bedded, the slates extending over a large area of country, the limestones and quartzites forming

long narrow parallel belts alternating with the slates. The strike is northeast and southeast, the outcrops occurring at places in both directions for miles. The quality of the stone at Gore is exceptionally good. It is very compact, and is practically free from iron, alumina, and magnesia, and no hesitation need be felt about its suitability in the manufacture of cement of the highest standard."

Coal and water is available close at hand, and the cost of getting the latter is estimated at $16,000.

The cost of production of the estimated 30,000 tons of manufactured cement is as follows:

Limestone delivered at plant	£24,300
Coal	5,625
Clay and shale	1,500
Repairs, lubrication, etc.	1,500
Labor and laboratory expenses	8,250
Bags (not allowing for returns)	9,000
Management, general expenses, and depreciation	6,250
Total	£56,425

Freight is estimated at 60c. per ton additional, bringing the total up to $9.72 at Brisbane. The Company is, however, in possession of a guarantee from a prominent firm of engineers, agents for a European cement-machinery manufacturing firm, to manufacture standard cement from the available material at a maximum cost of $8.50 at the works or $9.10 in Brisbane.

An application has been made to the New South Wales Mines Department for the imposition of a protective duty of $2.43 per ton on pyrite, and $4.85 per ton on sulphur mined in the interests of a company working a deposit in the Mount Stewart mine near Craborn. Much of the ore, which is well fitted for use in the manufacture of sulphuric acid, contains 46 to 51% sulphur and 44% iron. The importation of Spanish pyrite for the making of sulphuric acid amounted last year to 12,835 tons, valued at over $137,000.

An issue of debentures amounting to $3,000,000, as a first instalment of $5,000,000, to help carry out the Broken Hill Proprietary's scheme of iron and steel manufacture, was a success in every way. So far, between $3,000,000 and $3,500,000 has been spent on the new plant at Newcastle, New South Wales.

KALGOORLIE, WESTERN AUSTRALIA

LABOR TROUBLES IN THE STATE; UNIONISTS FIGHT CONTRACT WORK ALTHOUGH HIGHLY PAID.—HORSE-SHOE, EDNA MAY, AND LANCEFIELD MINES.—GOLD RETURNS AND ORE RESERVES.

Labor unrest here, as elsewhere, still continues, and although men on the Trans-Australian railroad at Kalgoorlie, and in the building trade at Perth, have returned to work, they seem far from satisfied, and may strike again any time. The miners at the Golden Ridge, 12 miles east of Boulder, and at Leonora, have appealed to the Arbitration Court for a revision of wages on a higher scale. The Yuanmi mine is shut down, because the majority of the men led by an outside agitator refused to continue to work with 12 men sinking by contract, although H. G. Walton, the manager, proved that the wages earned by the contractors during five months had ranged from $4.06 to $10.26 per 8-hour shift per fortnight, and had averaged $6.10. The men insisted on expelling the 12 delinquents from their union, with the result that the mine is shut down, and, as it is a one-mine town, the hotels, stores, etc., are doing nothing. As the mine is miles from anywhere, work is not likely to be resumed for some time, as the oxidized ore is depleted.

Monthly operations at the Horse-Shoe now show a profit of $12,400 against a loss of $17,000 per month for the preceding four months, while the grade of ore has improved from $5.20 to $5.76 per ton. On December 31 the assay value of the ore reserves was given officially as $7.28, the same as the previous year. At 2900 ft. in the main shaft, No. 4 lode shows considerable improvement, 15 ft. assaying $18.36 per ton. The lode shows telluride and fine gold. This is the Boulder main lode which passed into the Horse-Shoe at 2630 ft. and has produced the bulk of the Boulder's production of 2,509,600 tons returning $45,958,000.

Since it was taken in hand 18 months ago, the Edna May mine at Westonia, 42 miles west of Southern Cross, has produced 19,300 tons of ore for $404,900 and paid $171,400 in dividends. Untreated residue is estimated to contain $100,000 and a profit of $72,500. The lode on this property was found after sinking a shaft to 75 ft. and then cross-cutting. After proving the ore-shoot to be 215 ft. long, and from 8 ft. to 44 ft. wide, a raise was driven which proved that the lode cut off 17 ft. from the surface, above which was an overburden of 'cement' and loam. Two years prior to this discovery the lode in the adjoining lease, worked by the Greenfinch company, had been cut off at a depth of 90 ft. by successive granitic intrusions. At the 150-ft. level in the Edna May mine, a flat granite bar similar to those on the Greenfinch, and 8 in. thick, crosses the lode, but the ore-shoot maintains its length, width, and gold content below the bar. The main shaft is down 232 ft., where the inflow of water has increased from 2000 at 150 ft. to 3500 gal. per hour. The lode is in the shape of a horse-shoe, and is a geological freak, and has puzzled all the geologists who have examined it. A year ago the ore reserves above the 75-ft. level were 20,000 tons worth $20.40 per ton, and are now estimated at 29,500 tons worth $22.80 per ton above the 150-ft. level. A cyanide plant with a monthly capacity of 2400 tons has been installed, and monthly returns and profits should show a marked increase. Owing to the possibility of the lode being cut off by granite the price of the shares keeps at $16.80, although monthly dividends of 72c. per share are being paid.

Since being acquired by the Kalgoorlie & Boulder Firewood Co. the entire surface equipment of the Beria Consols (late Lancefield) has been overhauled. In addition, a new hoisting engine has been installed, as well as two suction-gas engines of 220 hp. each, driven by three 250-hp. (one as a standby) Commonwealth down-draught gas generators to burn 5-ft. firewood, to replace the steam engines and boilers to operate the treatment plant. Two vacuum-filters have also been added, and the all-sliming process has been adopted. The mine is now controlled by I. J. Dunstan, formerly metallurgist of the Associated company, and subsequently government inspector of state batteries. Archie Long, who was previously underground boss, has resigned a similar position on the Great Fingall mine to resume his old position. Mr. Long is confident that the estimate of ore reserves made by the previous management, of 250,000 tons with an assay value of $8.16 per ton is correct and will be confirmed by the mill. The staff of the Firewood company, which supplies the Sons of Gwalia mine with fuel, strongly advised the adoption of the Commonwealth wood-gas generator, after carefully watching the result for several weeks on the Sons of Gwalia mine. By adopting these generators consuming wood at $3.84 per ton, it is estimated that a monthly saving, over charcoal generators consuming charcoal at $14.16 per ton, of $470 will be effected on an output of 6000 tons.

The total mineral output of the state for 1913 was valued at $30,181,300 against $28,842,900, a decline of $1,338,400. There was an all round increase except in the case of tin, which showed a decrease of $14,000, owing to most of the known easily-worked deposits being worked out and no profitable lodes being yet discovered. The detailed output was as follows: gold, $27,908,500; copper, $712,600; lead, $295,000; tin, $360,700, and coal, $904,500. Gold output of the state in May

was $2,265,700, and dividends $69,600. Totals to date are $585,301,700 and $122,634,400 respectively.

The latest estimated ore reserves of the principal mines are as follows:

Name.	Tonnage.	Value per ton.
Great Boulder	688,900	$13.26
Ivanhoe	991,400	9.24
Perseverance	838,200	5.64
Golden Horse-Shoe	800,000	7.28
South Kalgurli	265,500	5.70
Kalgurli	260,000	9.44
Lake View & Star	420,000	6.66
Bullfinch	185,700	8.28
Sons of Gwalia	648,000	7.44
Mararoa	30,000	8.04
Edna May	29,500	22.80
Ingliston Consols	60,000	10.56
Fenian	70,000	14.40
Beria Consols	250,000	8.16
Menzies Consols	76,700	9.24

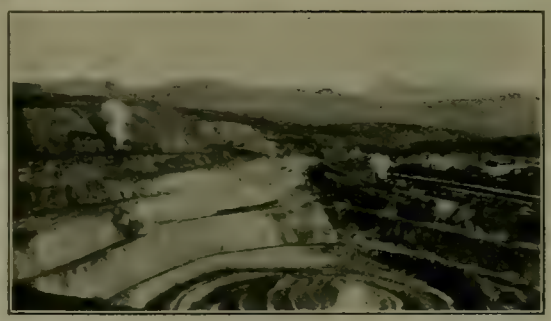
NEW YORK

SITUATION OF ZINC, SILVER, AND COPPER, AND PROBABLE CHANGES IN THE BUSINESS.—DIVIDEND PROPOSALS OF VARIOUS COMPANIES.

The peculiar effect of the war on metal prices is well illustrated in the case of zinc and silver. As has been widely remarked, the zone of fighting in Europe is just at places where most of the zinc production is made. As England draws most of her zinc supply from Europe, this has cut off the supply for the English trade. Orders have already been diverted to the United States, and as a result spelter has risen over 35% in price here, and is still going up. Curiously enough, though, the British companies in the important zinc-producing districts of Australia are in a bad way, and have already postponed the payment of dividends, while the Broken Hill Proprietary has canceled a dividend which it had already declared. The point of this is, of course, that shipments through the Suez canal are tied up, and the companies cannot get their zinc through to England, even though there would be a good market for it there. It would seem possible to divert the shipments from the Suez canal to the Panama canal route, but steamship lines are not well established through the latter yet, and besides, it is difficult for a company to totally change its method of doing business on short notice. In the meantime the Sulphide Corporation is negotiating with one of the large American zinc companies to handle its ore and, with an eye to the future, is investigating the possibilities of building its own works in Wales.

The situation of silver is also a peculiar one. The great demand for gold in the principal centres of Europe would naturally tend to draw gold out of India and China, and there ought to be a good market for silver in these countries. This theoretical consideration is, however, upset by the practical fact that the banking business of England is totally disarranged by the war, and as London has always been the silver market of the world, until this centre resumes dealing in silver there can scarcely be much of a market for it. The supply was very short in London last week, but the demand also seems to be equally short, for on the arrival of considerable shipments from America the price promptly went down again. It is decidedly doubtful whether there will be any considerable market for silver in London until the risk of shipping silver to the Far East becomes very much less. It would seem that the time is now ripe for San Francisco to make a bid for standing as a Far Eastern silver market. San Francisco is the nearest point of shipment for all the Nevada bullion, and if American banks were equipped to handle the business, that city ought to be able to control the silver shipments to China at least. Now that there is such tremendous excitement over the building up of the foreign business of the United States, it is possible that sensible laws will be passed which will permit Americans to have the banking and shipping facilities which are essential for foreign trade. The companies at Cobalt report that they intend to pay their dividends that accrue in the near future. None of the companies have been shipping bullion lately, but traffic between Canadian ports and England seems to be practically free of the possibility of German interference now, and it ought to be possible to resume shipments. It is reported that Holland made inquiries of the United States Government in regard to silver for coinage, and was referred to the American Smelting & Refining Co. Many of the foreign governments are coining silver, but the interference of the war with the manufacture of silver articles seems to be likely to more than overbalance any increased demand for coinage. On the face of it, indeed, it looks as though after this war is over Europe, as a whole, will be too poor to indulge in many luxuries. The diamond mines of South Africa have already foreseen the hard times coming, and are proceeding to close down their mines and send back the natives to their homes. Silver will also suffer in a similar way, and it can hardly be expected that the price of that metal is likely to rise very much in the next year or so.

The copper mining companies are operating steadily but on a reduced schedule. Some of them, which at first made only small reductions in output, have increased them so that practically all the plants in the country except the Lake Superior mines are now running on half time. The Michigan companies at first reported that they would keep their men working full time, but would make a 10% cut in wages. Later reports indicate that some of them will reduce their output. The Calumet & Hecla has stopped its construction work on its regrinding and leaching plant, and most of the other companies throughout the country that were in



EUREKA PIT OF NEVADA CONSOLIDATED, AT ELY, LOOKING NORTH.

process of increasing their output have stopped construction for the time being at least. The fall dividends for many of the companies are in doubt, and very likely will be passed, as it is very much better business for the companies to retain their profits to tide them over, in case operations are held up for a long time, than to pay them out now and perhaps need them later. On the basis of present production and prices, none of the copper companies, with possibly one or two exceptions, could pay the regular dividends without making a deficit. As these companies will need all of their money to carry unsold stocks of copper in case the market does not improve, it is obviously unwise to pay out dividends at this time. The domestic consumption of copper seems to hold up pretty well. Small shipments to Europe continue, and insurance rates have gone down to 1% in Italian vessels, and 2% in English vessels. During the week ended August 27, 1,917,816 lb. of copper was shipped to Europe, more than two-thirds going to Rotterdam.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press

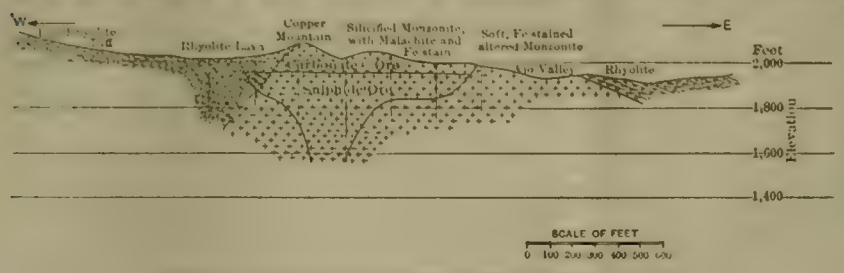
ARIZONA

Cochise County

Work has been resumed in stopes of the Southwest mine containing rich silver-lead ore, the Copper Queen company intending to operate as long as the silver market is regular.

Pima County

The Ajo copper mining district is described in the August *Bulletin* of the A. I. M. E. by Ira B. Joralemon of Warren, Arizona. Gila Bend is the nearest railroad point, 43 miles north, and Sonoita is 30 miles south on the Mexican border. Ajo is the only settlement of note between. The brilliantly stained iron and copper rocks of Copper mountain rise 150 ft. above the village of Ajo. The nearest abundant supply of water is the Gila river, 50 miles north. The district has been worked spasmodically since the '60s. Late in 1911 the Calumet & Arizona Mining Co. secured an option on the available shares of the New Cornelia Copper Co., and began prospecting with Longyear drills. This work, which totaled 23,097 ft., proved a great low-grade copper orebody, covering an area of about 55 acres, and reaching a maximum depth of over 600 ft. below the surface. Other options were taken by other firms, but they are doing little work. Unlike Bingham, Ely, Santa Rita, and other low-grade districts of the country, in which the copper is in the form of chalcocite, the disseminated ore in the Ajo area is a mineralization of the porphyry with chalcopyrite and bornite. Within the orebody, the monzonite is thoroughly shattered by a network of fractures. Reserves are estimated as 11,954,400 tons of 1.54% carbonate ore suitable for a leaching process and 28,303,600 tons of 1.5% sulphide ore suitable for concentration and flotation. About 7,776,800 tons of sulphide is not available for steam-shovels. To make the other available, 3,308,400 tons of 0.63% rock must be moved. The accompanying cut shows the structure of the orebody at Ajo.



VERTICAL SECTION THROUGH NEW CORNELIA OREBODY AT AJO.

CALIFORNIA

The oil production of this state in July was 9,185,176 bbl., or 296,296 bbl. per day, compared with 302,400 bbl. in June. Stocks at the beginning of August were 52,937,438 bbl., an increase of 792,431 bbl. over the end of June. There were 6261 producing wells. The most interesting developments in July were as follows: Midway-Sunset field, No. 10 well of the Consolidated Mutual Oil Co. completed at 3090 ft. depth, 1000 bbl. of 27 gravity oil per day; No. 3 well of the Honolulu Consolidated Oil Co., at 2594 ft., 1500 bbl. of 30 gravity; No. 4 well of Midlands Oilfields Co., at 3390 ft., 6000 bbl. of 25.1 gravity. No. 2 well of the Miocene Oil Co. is now yielding 8000 bbl. per day, and in the Coalinga field No. 9 well of the Turner Oil Co., at 3888 ft., 2400 bbl. of 30.5 gravity. No. 7 well of this Company is yielding 4000 bbl. per day. According to the *Standard Oil Bulletin* for August, the 10 oilfields of the state have a proved area of 78,770 acres, or 123.08 square miles. The yield to the end of 1913 was 658,069,946 bbl., or 8350 bbl. per acre.

It is expected that the U. S. Bureau of Mines rescue-car No. 5 will visit California mining districts from September 9 to October 31, the attendants giving training in mine rescue and first-aid work in some of the mining districts. The itinerary, which will probably be adhered to fairly closely, is as follows: September 9 to 19, Colfax; 20 to 27, Jackson; 28 to October 5, Angel's Camp; October 6 to 13, Melones; 13 to 20, Jamestown; and 22 to 31, Kennett. It is regretted that there is not sufficient time for the car to make a more extended trip through the state, but the Nevada itinerary was prolonged considerably beyond what was originally planned, and it is necessary for the car to return to the coal-mining districts of the Northwest before the winter season, so that an extension of the California itinerary is not possible at this time.

Amador County

Work on plans for the new mill and other equipment at the Argonaut are nearing completion.——At the South Eureka, 60 out of 80 stamps are crushing ore. The main shaft is now ready to handle the full tonnage.

Nevada County

After being shut down and reopened several times, the Union Hill mine has been bonded by E. C. Creller and others to B. Del Ray and W. H. Matson of San Francisco. A. D. Cox is to be in charge of work. The main shaft is down 600 ft. There is a complete mining and milling plant ready for work.——Some specimen ore was opened in the shaft of the Golden Center of Grass Valley mine last week. The shaft is down 600 ft. The new vertical shaft is being 'raised,' and is up 65 ft. out of a total of 244 ft. Twenty-five men are employed.

Placer County

A large deposit of good magnesite has been proved near Towle by J. D. Sullivan and J. H. Johnson. They were offered $150,000 for it, but now want $300,000.——Timber has arrived at Gold Hill for the new dredge for L. Gardella. Machinery for the boat will come from an old dredge at Oroville.

Shasta County

Owing to the scarcity and high price of ferro-manganese, the Noble Electric Steel Co. is preparing to 'blow in' one or two electric furnaces, which will each make five tons of this product per day. A large deposit of manganese lies four miles from the smelter.——Mining men of the Copper City district are to ask for a road to be constructed to connect with the state highway at Redding.

Sierra County

A 300-ft. vertical shaft is to be sunk by W. F. Copeland

and associates at the Bald Mountain gravel mine near Forest. Some machinery has been ordered, but more will be needed later on.——According to the superintendent of the Tightner, Abraham Hall, the mine and mill are being worked at full capacity. A contract has been let for 60,000 board feet of round timber for underground.

TRINITY COUNTY

There is considerable activity about quartz mines in the Helena district. The Enterprise 10-stamp mill is recovering about $20 per ton. Others being developed are the Golden Chest, Yellow Rose, and Oversight.

COLORADO

LAKE COUNTY (LEADVILLE)

Orders are expected at any time to restart the new zinc smelter, according to the manager, Mr. Augustine.——The Dinero Mining Co. is resuming work.——Lessees at the New Monarch property continue to produce a good tonnage of silver-gold ores.——Sub-lessees at the Castle View are shipping a large amount of iron ore containing silver.——The Virginius Tunnel claims are closed until the silver market is regular.——Work in the Half Moon and Lackawanna districts proceeds as usual.——From the Mt. Champion mine a good deal of high-grade gold ore is being extracted.——Officials of the Down Town pumping scheme are not sure when the pumps will arrive from Switzerland, on account of the war.

SAN JUAN COUNTY

At the Hamlet Mining & Milling Co.'s property at Middleton, near Silverton, the mill is to be overhauled and its capacity increased to 100 tons per day. A good tonnage of copper-lead-zinc-silver ore has been developed. Etienne A. Ritter, of Colorado Springs, is manager.——The new Wilfley-Mears 600-ton mill is at work treating old tailing from the Silver Lake mine. There is about 500,000 tons of material to be treated. C. J. Estabrook is manager for A. R. Wilfley, Otto Mears, and others.——A flotation process is being installed at the Gold King mill, according to Louis O. Bastian.

SUMMIT COUNTY

The metal market has not affected the Breckenridge district, and the mines and dredges are producing their regular amount of gold and zinc.

TELLER COUNTY (CRIPPLE CREEK)

Soft ground has hindered good progress in extending the Roosevelt drainage tunnel. The flow of water is now nearly 10,000 gal. per minute, against 7590 gal. at the beginning of the month.——According to the president of the company, John T. Milliken, the Golden Cycle mill's output of metal, about $500,000 per month, will be held in Colorado to assist banks of the state.——The Elkton company has paid a dividend of 2c. per share, amounting to $50,000. The total to date is $3,429,460. Work in the mine is now proceeding on No. 14 level.——Water being under control in the Ajax property, lessees have resumed work on No. 12 level of the main shaft, and are cross-cutting in ground under the rich granite shoot.——A lease has been secured on the C. O. D. mine by Melville B. Rapp, of Cripple Creek, who will start active work on the property, which was idle for some time. He will sub-lease certain areas. The output to date is over $750,000.

IDAHO

BLAINE COUNTY

Twelve miles from Hailey is the Nau Aug mine, leased to Salt Lake people. A new shoot of ore, opened 50 ft. below the 700-ft. adit is 6 ft. wide and assays about 76% lead and 100 oz. silver per ton. A little zinc ore is on the hanging wall. A 30-ton mill has been designed by Kirk & Leavell, Salt Lake City.

SHOSHONE COUNTY

The eleventh annual miners' picnic was held at Kellogg on August 21 and 22, several thousand attending. There were aeroplane flights, motorcycle races, log-rolling and sawing contests, dancing, boxing, auto parade, gun-club shoots, baby shows, and speeches. Among the speakers was Stanly A. Easton, of the Bunker Hill & Sullivan company, who thought that the war would be a boon rather than an injury to the Coeur d'Alene mining industry, if the present trend of prices continues. This Company on September 4 paid dividend No. 204, amounting to $81,750, with a total to date of $15,465,000.

It is stated that the Interstate-Callahan company will probably add to its milling capacity by erecting a zinc concentrator at the junction of the north and south forks of the Coeur d'Alene river, which is an ideal site. Large reserves of zinc ore are open in the mine.

MISSOURI

JASPER COUNTY

On account of the higher prices for spelter, leases which have long been idle in the Missouri-Kansas-Oklahoma district are being re-worked. Other mines have added one or two shifts per day to the working force. During the week ended August 22, sales of zinc ore were numerous, and prices on basis of 60% metal rose to $43, $46, $47, $48, $49, and $49.50 per ton. Calamine was strong at $22 to $23 basis of 40% metal. Lead ore was unchanged at $46, basis of 80% metal. The district's output was 4013 tons of blende, 489 tons of calamine, and 770 tons of lead ores. Water in the Picher land, northwest of Joplin, has been lowered to 130 ft., with another 20 ft. to go. The north pumping plant on the Granby land has the water below the old workings. A number of lessees are working on these lands.

MONTANA

SILVERBOW COUNTY

Labor troubles are again causing uneasiness at Butte, the outbreak being among the men themselves. Last week a fire at the Anaconda company's Mountain View mine destroyed property worth $100,000. On August 30 the employment office at the Parrot mine was dynamited. The governor, Samuel V. Stewart, has ordered the mobilizing of the state militia of about 600 men at Helena, and has sent them to Butte. The miners union numbers about 8200 men, who are said to be armed and in a bad mood. On account of a broken crank shaft of the Moonlight hoisting engine, this mine is shut down, 320 men being out of work.

NEVADA

Great interest is being taken in the mine-rescue and first-aid contests which are to be held on Labor Day, September 7, at the University of Nevada, Reno. J. G. Scrugham, of the engineering department, is organizing the meeting. There will be 17 teams from all parts of the state. The State Electrical Association will meet and discuss papers.

CHURCHILL COUNTY

The Nevada Hills mine produced 5610 tons of ore in July averaging $7.29 per ton. Loss in residue was 72.7c. per ton. Net profit was $6574. Resources of the Company amount to $238,614, including cash, $8376; silver on hand at 52c. per ounce (28,290 oz.), $14,716; concentrate in transit, $6593; and supplies in store, $45,519. There are no liabilities. The Company has enough supplies to last for several months.

ESMERALDA COUNTY

So far for August the Florence mine shipped about 450 tons of ore to the Western ore sampler at Millers. The mine is opening well——At 350 ft. in the Sandstorm-Kendall, 18 in. of $32 ore has been opened for 10 ft.——Encouraging results

are being met with in the Oro mine. An air compressor and machines have been ordered for the Yellow Tiger.——Final figures of the Goldfield Consolidated for July show that 24,548 tons yielded $151,076 profit. Development of 2348 ft. cost $7.85 per foot. Total costs were $6.80 per ton, including filter royalty of 5c. per ton.

Lincoln County

According to H. W. Rand, general manager of the Gold Chief Mining Co., operating near Caliente, the mill is treating 165 tons of $5 gold ore per day. The profit is $5000 per month. A main incline shaft has been sunk 450 ft. At 200 ft. a dike altered the formation, but the lode was found again and is now 10 to 25 ft. wide. Reduction and treatment involve using a crusher, trommels, belt-conveyor, rolls, and six leaching vats, the ore being leached by cyanide for 60 hours. An average of 87% is recovered. H. Dietz is in charge of the mine, and H. Franklin is mill superintendent.

Lyon County

The Mason Valley smelter received 2659 tons of ore during the week ended August 26. The mine is keeping up its shipments. The 20-ton experimental leaching plant at the smelter is ready for work.——A number of men have been laid off at the Nevada-Douglas. Construction of the leaching plant is under way.——From the Empire-Nevada 500 tons of ore is being sent to the smelter's test leaching plant.

Mineral County

(Special Correspondence.)—The Luning Gold Mines Co. expects to start work in the near future.——The Shipper Copper Mining Co. has recently arranged with Carl R. Dwight for taking over the Alamedis property at Lime Point, and funds have been raised for the extensive development of both properties.——The Luning-Idaho Mining Co. recently made an important discovery in driving an adit which has cross-cut a body of high-grade copper ore said to contain 10% copper and about 2 oz. silver. This is at considerable depth in a porphyritic formation, and is considered one of the most important discoveries in that district.——Joseph L. Geroux, operating a property near the above mine, exposed a new body of high-grade copper ore on the 700-ft. level.

Luning, August 27.

After many years the old gold camp of Douglas, seven miles west of Mina, has resumed bullion shipments, the Davenport-Independent Mining & Leasing Co. crushing and cyaniding 100 tons of ore for $2500. Gus Priess is manager.

Nye County

The first 45-ton shipment of ore from the White Caps mine at Manhattan has been sent to the Western Ore Purchasing Co. Some of the ore mined averages $50 per ton. The oxidized ore is to be milled locally.——The Associated mill is treating Manhattan Consolidated ore. A shortage of water has hindered regular work.——The Commercial Mines & Milling Co.'s claims are being sampled for Eastern people. About 80 samples are assayed daily at the War Eagle mill assay office. Two Cyclone drills, made in Orrville, Ohio, are to be used in prospecting. They are straight churn-drills, a bailer being used, after the hole is sunk, to raise the hole contents to the surface. The drills are mounted on tractors, driven by the same power as the drills, an 18-hp. gasoline engine. The outfit weighs 6½ tons complete. These machines are especially good for holes down to 300 ft., but are guaranteed for 800 to 1000 ft. George White is in charge of this drilling work.

Ore production of the Tonopah district in July was 50,011 tons worth $875,630. For the past week it was 10,499 tons, valued at $198,335.——A new shoot of rich ore has been cut at 900 ft. in the Belmont.——The new shoot at 440 ft. in the Silver Top ground of the Tonopah Mining Co. shows 5 to 6 ft. of good ore in the raise.——A good shoot is being opened at 700 ft. in the Jim Butler.——The Extension bullion output is estimated at $110,000 gross for August.——For silver in its concentrate the Montana received 56.625c per ounce.——Final clean up of the MacNamara was worth $14,650.

Storey County

In a report on the plan of exploration now in progress in the Mexican and Union Consolidated mines on the Comstock, Whitman Symmes, the superintendent, makes the following remarks: "The greatest possibilities for discovery of ore in Union ground appear to lie below the 2500-ft. level. The Union-Sierra Nevada joint winze was pumped out, and a cross-cut started at 2650 ft., 100 ft. below the general water-level of the north-end mines. The work was out 20 ft. on August 18. The next two levels of the Mexican and Union will be the 2650 and 2800-ft., and the old 2700 and 2900-ft. levels can be used as reservoirs in case of temporary stoppage of the United Comstock Pumping Association's pumps. Previous inconvenience will not recur. At the north end of the Comstock lode, ore in the hanging wall has been found near a dacite dike, which acts as a convenient indicator. At 2500 ft. this dike, coming northeast from the Mexican orebody crosses the Union west cross-cut at a point 565 ft. from the Union winze. At 2650 ft. it should be met with 100 ft. nearer. So far ore has been found either against the dike or a moderate distance from it. In the cross-cut a second dike is exposed 235 ft. from the joint winze, it being thin and parallel to the other dike, and also dipping toward the winze. The two dikes are 330 ft. apart. The east country diabase contains many lenses of diorite, prominent at 2500 ft. If a new lens of this rock is found in the new Union 2650 ft. west cross-cut, near the east dike, there should be some ore there. The Mexican company is to start a new level at 2650 ft. in the inclined winze, and a north drift driven along the main shearage to the Union line. The Union company can then continue exploration into Union ground, which at 2650 ft. appears promising. The Mexican company can also continue prospecting deemed worth while. At the 2500-ft. level of the Mexican, in the joint cross-cut there is a large area of mineralized formation containing quartz stringers over 90 ft. wide. While low-grade, it is probable that at 2650 ft. it will be of better grade. Generally the work to be done is promising.

UNION SHAFT THROUGH WHICH THE MEXICAN AND UNION MINES ARE BEING EXPLORED.

UTAH

Juab County

The Grand Central Mining Co. has declared its third dividend of 5c. per share, or $25,000, this year. Total to date is $1,602,750. The mine is in good condition.——The Gold Chain will resume work shortly.——It is proposed to concentrate the 18 to 20% zinc ore of the May Day, of which there is a good tonnage. Ore assaying 30 to 40% lead and 22 to 24 oz. silver was shipped last week.——Water amounting to 75 gal. per minute has been encountered in the Dragon Consolidated. Ore being mined is more than paying expenses.——Sinking to 1700 ft. has been started at the Eagle & Blue Bell.——Rich

gold ore is reported to have been found by the Centennial Eureka company.——Ore shipments from the Tintic district last week, from 13 mines, totaled 91 cars.

PIUTE COUNTY

Owing to the potash supply from Germany being cut off, attention is being given the alunite deposits at Marysvale.

SALT LAKE COUNTY

There will be no decrease in stripping work at the Utah Copper mine; the management planning to remove as much ground as last year, when the total was 4,835,479 cubic yards.

SUMMIT COUNTY

A Christensen roasting furnace, constructed at Provo for the Park City Mills Co., is now being installed at the plant. Ore from the American Flag mine will be the first to be treated in the mill. Results are awaited with interest.

STEVENS COUNTY

Forest fires interfered with work at the United Copper mine last week. The Company has a few men in the mine and one shift at the concentrator.——No. 3 vein is being opened at the Copper King.——At the Chewelah Consolidated a contract has been let to cross-cut on the 150-ft. level to prove the orebody.

CANADA

ALBERTA

(Special Correspondence.)—The war in Europe has had at least one beneficial effect on Alberta, it having stopped the oil boom, and given the oil (?) men an excuse for the drop in price of stocks, which were well on the downward slide long before war was heard of in Alberta. Many shares have no market value at the present time, and those which were thought to be good are well within the reach of the newsboys, and few are being sold. Three months ago every office was an oil company's office, but now 80% of them are closed. One interesting feature found is that the Judith River beds, as well as the Bear Paw shales of Edmonton and Paskapoo in eastern Alberta and western Saskatchewan, show the marked effect of the great thrust from the west. This region is 250 to 300 miles east of the Rocky Mountains thrust fault, but notwithstanding this distance the beds are intensely faulted, overturned, and in places faulted by the same forces which formed the mountain range. There have been found small areas where the beds lie almost horizontal, but most of the outcrops of any extent show either folds or faults. There have been no new oil discoveries, only a little gas in some wells being drilled. All unnecessary development in the province by railroad and government has been suspended on account of the war. Crops around Edmonton are good, but light in the south part of Alberta.

Edmonton, August 18.

ONTARIO

The silver situation at Cobalt is much better, and full operations are being resumed. All the Nipissing mines and works are in complete operation. The banks are to supply sufficient cash to enable the mines to produce bullion at the properties. Ore and concentrate shipped outside are not in so good a position, but some are receiving their bullion from the smelters instead of cash. A shipment of 55,000 oz. has been sent to London by the Crown Reserve company. This Company is paying a 2% dividend, or $35,376, on September 15. The McKinley-Darragh distribution on October 1 will amount to $134,862. The Porcupine Crown pays 3%, or $60,000, on October 1.——The Buffalo mill treated 6985 tons of 13.85-oz. ore in July, yielding a total of 97,136 oz. Silver sold up to August 20 was 342,417 oz. That on hand in London when war was declared netted 59c. per oz. The concentrating mill is now shut down, but some mercury is being recovered from residue at the high-grade mill. Underground development work is under way.

PERSONAL

FRANKLIN GUITERMAN is in Colorado.

J. ALLEN VEATCH is examining mines in Shasta county, California.

J. P. KEENE has returned to Woodland, California, from Montana.

DANIEL and S. R. GUGGENHEIM have arrived in New York from Liverpool.

E. H. BENJAMIN has been placed in charge of the Mariposa Grant mining matters.

ANTON and KARL EILERS and ISAAC GUGGENHEIM have reached London from Rotterdam.

J. W. HUTCHINSON, of the Goldfield Consolidated, is at the Adler Sanatorium, San Francisco.

GEORGE WATKIN EVANS, mining engineer of Seattle, is examining coal properties in Montana.

C. T. GRISWOLD has returned from examining several gold prospects in the Sudbury mining district.

LEON J. PEPPERBERG is in Los Angeles from Calgary, Alberta, and will be in San Francisco in a week or so.

FERDINAND MCCANN has left Manila for the Argentine Republic, traveling by way of the Mediterranean.

WILLIAM H. GRANT has gone to Mogollon, New Mexico, to make a geological survey for New York clients.

C. B. LAKENAN was operated on successfully on August 25, and a complete recovery is expected.

P. R. BRADLEY has been made general superintendent of the Treadwell group of mines in place of ROBERT KINZIE, resigned.

L. G. HUNTLEY, formerly of the Associated Geological Engineers, has left for Colombia, S. A., for examination of oil properties.

A. L. QUENEAU has gone to join his regiment in France and is doubtless now at the front. He left his family at Jemeppe sur Meuse, and they have probably taken refuge in Antwerp.

F. YAMADA, a mining engineer of Tokio, Japan, was in the Coeur d'Alene district recently. Mr. Yamada has spent the past year in the mining districts of the United States and Canada studying various mining methods.

FRANCIS CHURCH LINCOLN, until recently resident engineer for the Bolivian Development & Exploration Co., at La Paz, has left the employ of that Company to become head of the Mackay School of Mines, at the University of Nevada, Reno.

VICTOR C. LEDNICKY, who has been engaged in mining in Honduras for the past three years, has been appointed to the staff of the division of mines, Bureau of Science, Manila, and will leave San Francisco for the Philippines early in October.

WALLACE E. PRATT has been promoted to the position of chief of the division of mines, Bureau of Science, Manila, to succeed WARREN D. SMITH, who resigned to accept appointment as head of the department of geology, University of Oregon, at Eugene.

A. M. WALSH has resigned as superintendent for the United Comstock Pumping Association and will be succeeded by THOMAS F. MCCORMICK, superintendent for the Consolidated Virginia and Ophir companies. CHARLES LIDDELL has resigned as surveyor for the Association.

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THE AMERICAN CHEMICAL SOCIETY has indefinitely postponed its meeting called for Montreal, Canada, from September 14 to 18, on account of the war in Europe. As far as can be seen, the next meeting of the Society will be held in New Orleans, on April 1 to 3, 1915. There are now over 7100 members.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, September 3

Antimony	.15	15½
Electrolytic copper	.14	14½
Pig lead	4.15	5.10
Quicksilver (flask)	$75	$85
Tin	.41	42½
Spelter		7¾
Zinc dust 100-kg zinc-lined cases		20

The above quotations represent small transactions only, and would not apply for any considerable business. Zinc dust in New York is reported to be much higher, with small stocks.

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, September 3. The copper market is unchanged, lead is quiet at 3.90c., and spelter is weaker at 5.75c. The Calumet & Hecla has passed its dividend, and it is predicted that the Amalgamated and Anaconda will either do likewise or cut the distribution. Braden mine produced 1,840,000 lb. of copper during the first half of August. The metal now goes to New York by way of the Panama canal. The U. S. Steel Corporation is operating at 77% capacity, against 70% the preceding week. Crude drugs, chemicals, and dyes are short, and Germans will try to send them by way of Rotterdam in Dutch steamers. Platinum is easier, from $48 to $50 per ounce. Depreciation of 387 securities on the London Stock Exchange was $910,000,000 during the last 10 days of July.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.		Average week ending	
Aug. 27	No quotes	July 15	55.60
" 28	" "	" 22	54.14
" 29	" "	" 29	53.42
" 30	Sunday	Aug. 5	No quotes
" 31	" "	" 12	" "
Sept. 1	" "	" 19	" "
" 2	" "	" 26	" "

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

In the absence of any regular market, no average price can be given for August. The New York Assay Office has been paying 52c. per ounce for silver contained in gold bullion. Recent quotations in New York were around 51c., while in London the past week has recorded 23.82d., 24.25d., 24d., and 22d. per ounce for bar silver. Through the curtailment of copper output, silver production will be reduced by from 650,000 to 750,000 oz. per month, which should make a better market for direct silver producers. Business in the metal in London has been confined to liquidating outstanding contracts, while purchases for coinage have been negligible. Supplies from the United States and the absence of competition have combined to reduce the price.

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per pound more. Prices are in cents per pound.

Date.		Average week ending	
Aug. 27	No quotes	July 22	13.25
" 28	" "	" 29	12.87
" 29	" "	Aug. 5	No quotes
" 30	Sunday	" 12	" "
" 31	" "	" 19	" "
Sept. 1	" "	" 26	" "
" 2	" "	Sept. 2	" "

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

No average is possible for August. The "American Metal Market" states that there has been small buying, and quotes the following: prime lake, 12.50 to 12.75c.; electrolytic, 12.35 to 12.45c.; and casting, 12.25 to 12.35c. Exports in August totaled 19,656 tons, against 34,722 tons in the same period of 1913. The Metal Exchange in London has reopened to deal on settlement prices only, namely £56 10s per ton, or 12.10c per pound to help liquidate existing contracts.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Aug. 27	3.90	July 22	3.90
" 28	3.90	" 22	3.90
" 29	3.90	Aug. 5	3.85
" 30	Sunday	" 12	3.85
" 31	3.90	" 19	3.88
Sept. 1	3.90	" 26	3.87
" 2	3.90	Sept. 2	3.90

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Aug. 27	5.75	July 22	4.75
" 28	5.75	" 29	4.75
" 29	5.75	Aug. 5	4.75
" 30	Sunday	" 12	5.25
" 31	5.75	" 19	5.60
Sept. 1	5.75	" 26	5.77
" 2	5.75	Sept. 2	5.75

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.11	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
July 30	37.50	Aug. 20	No quotes
" 13	85.00	" 27	80.00
		Sept. 3	75.00-85.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	..
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

This metal sold from $75 to $90 per flask, wholesale, in New York during the last week in August. On account of the erratic market it is not possible to give an average for the past month.

TIN

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	....
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

The high average for August was entirely due to war conditions, and prices ranged from 65 to 39.50c., at which latter they now stand. The market is quiet, and a shipment is expected. The Dutch government will hold the postponed Banca sale of 2500 tons on September 5, for which it has set the limit at 37.50c. The London Metal Exchange is doing business at settlement prices, namely, £133 per ton, or 28.50c. per pound, to help liquidate existing contracts.

New York Metal Review

The breaking out of war in Europe has changed the complexion of nearly all of the metal markets, and developments have been rapid and some price changes radical during the month. Lead has been fairly steady, the only one to hold thus. Tin has been exceedingly erratic; now wild, now quiet, now up and down. Spelter has also advanced decidedly and steadily because of war conditions, while antimony has gone up nearly four times its former price, due to the same causes. Copper has suffered a setback, due to exports being largely curtailed requiring further reduction by the producers. Conservatism has ruled largely in all branches, but more steadiness was apparent toward the end of the month, as well as a better tone.

COPPER

The predominating factor in the copper market has been the extent of curtailment of copper production as a result of the war. As soon as this broke out, it was recognized that exports might entirely cease, or at least be greatly lessened. Since these constitute nearly 60% of our monthly production, the effect on stocks in this country can readily be appreciated. Early in the month, therefore, the market came to a standstill, and quotations were nominal. The situation was further complicated by the announcement that the Copper Producers' Association would issue no more monthly statements for the present. The nominal quotation for Lake was 12.87½c. early in August, and 12.50c. for electrolytic. Since then the price has declined, as based on small sales, to 12.75c. and 12.25c., respectively. Very little business was done during a greater part of the month. Conservatism prevailed and consumers bought only what was necesesary, awaiting developments as to curtailment of production, stocks available, prices, exports, etc. During the last week in the month some demand appeared and prices advanced slightly to 12.50c. for electrolytic. Not much business developed in Lake, and none was to be had at less than 13c. As the month progressed, England gained firmer control of the sea and exports increased on demand from that country. Up to August 25, exports had amounted to 15,404 gross tons, mostly to England, compared with 28,175 tons for the same period in July. This, under the circumstances, is regarded as excellent. These exports, together with the development of some business during the past week, contributed to a better tone. The Waterbury average for July was 14.12½c. per pound.

LEAD

The price in New York has varied but slightly during August, being 3.90c. early in the month, dropping to 3.85c. near the middle, and then advancing to 3.87½c. toward the close. This latter price is lower than that of the large interest. This is really the only metal that the war had not affected decidedly. Whether there will be any marked influence from that quarter later is debatable. Some look for a foreign demand and also a curtailment in domestic production because of the situation in silver, but this now appears decidedly better. During the last week in the month sales were made for export and shipments went forward. The Bureau of Foreign and Domestic Commerce, Department of Commerce, reports the total amount of lead remaining in warehouses June 30, 1914, at 14,473,010 pounds.

SPELTER

Outside of tin this metal has been more decidedly influenced by war conditions than any other. Previous to August the market had been dull and prices ranged close to 5c., New York, with a slight advance the last week in July. By the end of the second week in August the New York price had gone to 5.75c.; this movement continued until the metal was quoted in this market at 6 to 6.15c., New York, during the last week in August, with the prospect of the price going higher or quotations being possibly withdrawn. The cause for this market condition is attributed directly to heavy inquiry from England and Canada, brought about by the usual Continental supplies being cut off. Producers have taken advantage of this unusual situation and bid up the market. Strange to say, the domestic demand has been quiet. Figures compiled by the U. S. Geological Survey on the zinc situation were published in full in the *Press* of August 22 and 29.

TIN

War conditions have caused considerable fluctuation in this metal, and during the greater part of the month it has been decidedly erratic, with prices in most cases nominal. Early in the month, after England declared war on Germany, fear seized consumers and there was a rush to buy. It was expected that the supply from England might be entirely cut off. A report was issued that England had placed an embargo on tin. Prices advanced on small sales to 65 to 68c. by the middle of the second week. The London and New York metal exchanges closed and quotations were impossible. By the middle of the month the tension was relieved, and prices began falling until 39c. was reached about August 17. This was followed by a further rise of 10c., and again a fall to 39 to 40c. during the last week. The embargo report was found to be unfounded, as shipments began to appear, due to England's command of the sea, increasing in volume beyond anything thought possible, until arrivals up to August 25 were reported to be 2330 tons, with 1620 tons afloat. These revelations caused a decidedly easier tone until the market during the last week became dull, with very few transactions and spot tin a drug on the market. July deliveries totaled 3900 tons, and the total for the seven months of 1914 showed a decrease of 600 tons, as compared with the same time last year. The total visible supply July 31, 1914, was 14,167 tons, as against 12,063 tons July 31, 1913. The total tin afloat at the close of July was 5519 tons, as against 7251 tons in June 1914, and 6731 tons in July 1913. Government statistics show that the exports of tin to Pacific ports in June (by districts) were as follows: Oregon, 6727 lb; San Francisco, 227,312 lb.; and Washington, 124,118 pounds.

ANTIMONY

Being dependent on Europe for this metal, the war has caused a decided advance in prices. Consumers are regarded as being pretty well supplied, however. Imports have largely been stopped and quotations are nominal at 18 to 20c. for Cookson's, 16 to 18c. for Hallett's, and 14 to 16c. for other grades. Should Japan, because of her entry into war, place an embargo on the metal, a famine would ensue.

ALUMINUM

The aluminum market does not display any activity. It is reported that holders of spot metal do not find it easy to make sales. The quotation for domestic metal, 98 to 99% pure, on August 26 was 20 to 21c. The average price for July was 17.59c., compared with 23.34c. in July 1913. According to official figures the imports for June were 489 gross tons, making a total of 3435 tons for the first six months, as compared with 6629 tons to July 1, 1913.

GRAPHITE imports into the United States have been interrupted by the war. The output in 1913 was 4775 short tons, worth $293,756. Imports were 28,879 tons, valued at $2,109,791. The U. S. Geological Survey states that cutting off the foreign supply would affect only the crucible industry. This absorbs about 55% of the graphite consumption, and comes mostly from Ceylon, also a little from Madagascar. There is ample graphite in the country for stove polish, foundry facings, paints, etc. Large deposits of amorphous graphite occur in northern Mexico, Canada, New York, New Jersey, Pennsylvania, North Carolina, Alabama, Texas, and other states.

Current Prices for Oils and Candles

(Corrected monthly by Standard Oil Co., California.)

All prices are f.o.b. San Francisco except where otherwise specified, and are subject to change without notice.

Granite Mining Candles	Per set cents	Granite Mining Candles	Per set cents
6s-12 oz.-40s	8¾	6s-14 oz.-20s	9½
6s-12 oz.-20s	9	6s-16 oz.-40s	10
6s-14 oz.-40s	9¼	6s-16 oz.-20s	10¼

Extra hard 1c. per set higher than the above.

The following prices are for oils (Calol) in wood barrels, cases (2-5 gal.) 3c. per gallon higher.

	Per gal., cents.		Per gal., cents
Compressor oil	40	Light gas engine oil	28
Amber gas engine oil	40	Red compressor oil	26
Castor machine oil	20	Red engine oil	17
Dynamo and motor oil	24	Turbine oil	35
Engine oil	24	Turbine oil, heavy	35
Gas engine oil	26	Diesel engine oil	40
Heavy gas engine oil	45	Cylinder oil	37
Heavy red engine oil	19	High-pressure cylinder oil	50
Heavy red journal oil	21	Low-pressure cylinder oil	37
Ice machine oil	28	Valve oil	50

The following prices are for oils in iron barrels, cases (2-5 gal.) 7c. per gallon higher, except on Eocene, which is 8c. per gallon higher.

	Per gal., cents.		Per gal., cents
Pearl oil	9	Red Crown gasoline	14½
Headlight oil	10	Engine distillate	7
Eocene oil	11	Aroturps	23

	Per bbl.
Star fuel oil, f.o.b. Richmond Refinery	$0.90

	Per ton.
Petrolastic cement X	$12.00
Petrolastic cement XX	11.00
Asphaltum	$5.50 to 12.50

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, per ton	*$27.50	$30.00
Arsenic, white, refined, per lb.	0.05	0.06
Arsenic, red, refined, per lb.	0.12	0.15
Asbestos, chrysotile	100.00	350.00
Asbestos, amphibole	5.00	10.00
Asphaltum, refined, per ton	11.50	20.00
Barium chloride, commercial, per ton	50.00	60.00
Barium sulphate (barytes), prepared, per ton.	20.00	30.00
Bismuth ore, 15%, per ton	*250.00	upward
China clay, English, levigated, per ton	15.00	20.00
Chrome ore, according to quality, per ton	10.00	12.50
Cobalt metal, refined, f. o. b. London, per lb.	2.50	....
Coke, foundry, per 2240 lb.	12.00	15.00
Diamonds (according to size and quality):		
Borts, per carat	2.00	15.00
Carbons, per carat	55.00	80.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Silica, per M.	50.00	55.00
Snowball, per M.	40.00	45.00
Flint pebbles for tube-mills, Danish, per 2240 lb.	26.00	30.00
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	40.00
Graphite:		
Amorphous, per lb.	0.01½	0.02½
Crystalline, per lb.	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Iridium	55.00	....
Magnesite, crude, per ton	5.00	7.50
Magnesite, dead calcined, per ton	20.00	25.00
Manganese ore, oxide, crude, per ton	10.00	15.00
Manganese, prepared according to quality, per ton	30.00	70.00
Mica, according to size and quality, per lb.	0.05	1.00
Molybdenite, 85% MoS2 per ton	750.00	1000.00
Monazite sand (0.5% ThO2) per ton	150.00	200.00
Nickel oxide, refined, per lb.	0.45	0.60
Ochre, red, strength levigated, per 100 lb.	1.60	2.00
Osmiridium, per oz.	25.00	....
Platinum, native, crude, per oz.	30.00	45.00
Silex lining for tube mills, per 2240 lb.	35.00	40.00
Sulphur, crude, per ton	25.00	30.00
Talc, prepared according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	425.00	450.00
Tungsten ore, 65%.	400.00	425.00
Uranium ore, 10%, min.	25.00 per unit	
Vanadium ore, 15%, V2O5 per ton.	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are f.o.b. San Francisco and subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, per 100 lb.	$ 0.80	$ 1.10
Acid, sulphuric, com'l, 66°, carboy, per 100 lb.	1.25	2.00
Acid, sulphuric, C. P., 9-lb. bottle, bbl., per lb.	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, per lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, per 100 lb.	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., per lb.	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, per lb.	0.10½	0.15
Acid, nitric, com'l, carboy, per 100 lb.	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., per lb.	0.16	0.22
Acid, nitric, C. P., bulk, carboy, per lb*	0.12½	0.15
Argols, ground, bbl., per lb.	0.10	0.20
Borax, cryst. and conc., bags, per 100 lb.	3.00	4.35
Borax, powdered, bbl., per 100 lb.	3.38	4.50
Borax glass, gd. 30 mesh, cases, tin lined, per 100 lb.	10.50	14.00
Bone ash, 60 to 80 mesh, bbl., per 100 lb.	0.50	6.50
Bromine, 1-lb. bottle, per lb.	0.55	0.65
Clay, domestic fire, sack, per 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, per lb.	No quotes	
Cyanide, 98 to 100%, 200-lb. case, per lb.	"	"
Cyanide, 129%, 100-lb. case, per lb.	"	"
Cyanide, 129%, 200-lb. case, per lb.	"	"
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white broken, casks, per 100 lb.	10.50	10.75
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white, crystals, per 100 lb.	12.50	13.25
Lead, C. P., test., gran., per 100 lb.	13.00	15.00
Lead, C. P., sheet, per 100 lb.	15.00	18.00
Litharge, C. P., silver free, per 100 lb.	11.50	13.50
Litharge, com'l, per 100 lb.	8.00	9.50
Manganese ox., blk., dom. in bags, per ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, per ton (85% MnO_2—3% Fe)	85.00	140.00
Nitre, double ref'd., small cryst., bbl., per 100 lb.	10.75	12.00
Nitre, double ref'd., granular, bbl., per 100 lb.	9.75	11.75
Nitre, double ref'd., powdered, bbl., per 100 lb.	11.00	13.00
Potassium bicarbonate, cryst., per 100 lb.	14.00	16.00
Potassium carbonate, calcined, per 100 lb.	40.00	60.00
Potassium permanganate, drum, per lb.	0.65	0.75
Silica, powdered, bags, per lb.	0.03	0.05
	Min.	Max.
Soda, carbonate (ash), bbl., per 100 lb.	1.45	1.75
Soda, bicarbonate, bbl., per 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., per 100 lb.	2.75	3.25
Soda, caustic, solid, 98%, drums, per 100 lb.	2.50	2.75
Zinc shavings, 850 fine, bbl., per 100 lb.	17.00	20.00
Zinc sheet, No. 9—18 by 84, drum, per 100 lb.	No quotes	

*Extra charge for packing nitric acid for shipment to conform to regulations.

BULLION received at the San Francisco Mint in August was 232,082 oz. gold and 812,875 oz. silver, of a total value of $5,219,616. Coinage executed amounted to $4,358,950. Coin, bullion, etc., on hand at the end of the month was worth $249,880,032.79.

New Machines and Devices

First Motion Electric Hoist

The accompanying illustration shows a modern electric hoisting plant recently installed by the Silver King Coalition Mines Co. at its mines near Park City, Utah. This hoist is erected in a large concrete chamber at the inner end of a 2-mile tunnel from which point a vertical shaft connects with the lower workings of the mine which will eventually have a depth of 1200 or 1300 feet. In order to set the hoist as closely as possible to the collar of the shaft and avoid expensive rock excavation, flat ropes were decided upon as best adapted to the requirements. The hoist consists of a double-reel machine directly connected with a 200 hp., 575-volt direct current motor, which together with the controlling mechanism, was furnished by the General Electric Company.

Each reel has a capacity for 1300 ft. of 4 ft. by ⅜-in. rope.

DOUBLE REEL FIRST MOTION W-S-M ELECTRIC HOIST AT SILVER KING COALITION.

and the load on each reel consists of a double-deck cage with two cars of ore, and, including the rope, approximates 13,000 lb. While the hoisting will ordinarily be done in balance, the hoist is so arranged that either reel can be operated independently of the other, as required. The load is hoisted at an average rope speed of 1200 ft. per minute. The reels are loose on the main shaft, having removable bronze bushings, and are fitted with powerful band friction clutches and heavy post brakes, the clutches being air operated and the brakes of the gravity type, that is applied by weights and relieved by air cylinders.

An automatic slow-down device is connected with each reel so that when the cage reaches a certain distance from the collar of the shaft the hoist is slowed down by the controller lever being gradually thrown to the central position. In addition to this, should the operator fail to stop the cage at the collar of the shaft, the brakes are automatically applied by the safety stop system operated by two hatchway limit switches, one located in each shaft compartment.

All operating levers are conveniently grouped on an elevated operating platform from which the operator has a clear view of the cage as it reaches the landing point at the collar of the shaft. The hoist is placed on a substantial concrete foundation in a concrete arched room, and a heavy steel headframe is erected over the shaft, which may be seen in the accompanying illustration. The plant is most modern, and efficient. The hoist employed was manufactured by the Wellman-Seaver-Morgan Company of Cleveland, Ohio.

Commercial Paragraphs

The Malm-Wolf Company has moved its offices to First National Bank Bdg., Denver, Colorado.

Denver Quartz Mill and Crusher Company is distributing an illustrated folder devoted to the Denver quartz mill and the Denver ore crusher.

A carload of Cushman high-power gasoline engines is due in Sacramento. These little 4 hp. engines are finding many uses and proving much in demand.

General Filtration Co. Inc., Rochester, N. Y. is distributing a brochure entitled 'Filtros' which is devoted to the new porous mineral medium manufactured by this company.

Duriron Castings Co., New York. Bulletin devoted to 'Duriron' as used for plug cocks, check valves, pumps, and all kinds of castings. Duriron is claimed to be an acid, alkali, and rust-proof iron alloy.

Western Electric Co., New York, has for distribution a new publication entitled 'Magneto Telephones and Supplies.' The catalog lists the apparatus and equipment for small lines having up to 200 telephones. 'Telephone Cords' is the title of another publication of this Company.

Chicago Pneumatic Tool Co., Fisher building, Chicago, Illinois, has issued Bulletin No. 153, devoted to the 'Chicago Sinker,' a hammer-drill for which is claimed distinguishing features. The bulletin contains many illustrations showing the construction and operation of this type of drill.

Ingersoll-Rand Co., New York City, has recently issued two new catalogs, No. 3024 and 3030, on Ingersoll-Rogler air-compressors. Catalog 3024 contains a description of the Ingersoll-Rogler valve, and catalog No. 3030 describes the class ER-1 type of compressor. Both catalogs are profusely illustrated, showing the details of the machine.

Electric Weighing Co., New York, presents a bulletin devoted to the Messiter conveyor scales. The bulletin describes in detail the action of the Company's conveyor scales for belt and pan conveyors and the duplex scales for pivoted bucket carriers. The Company also manufactures automatic tonnage regulators and mixing systems.

Sutton, Steele & Steele, Denver, Colorado, is offering a screenless sizer for which many claims are made as to its adaptability to sizing any free, dry, pulverous mass containing 4 mesh or even larger down to 200 mesh, or finer in the same operation. The sizer is installed in the Denver mill of this Company, where it is being demonstrated.

Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, Missouri, has for distribution Bulletin 109, containing a discussion of power economy with the Diesel engine. The bulletin contains charts illustrative of efficiency and fuel consumption, together with other interesting details regarding power-plant economy. A booklet entitled 'Evidence' contains extracts from letters regarding the performance of the Diesel engine.

H. W. Johns-Manville Co. is introducing a machine into this country which makes it practicable for anyone to manufacture ice on either a small or large scale. The machine is a French invention and was designed primarily for ice making for factories, stores, residences, mines, smelters, and the like. The machine is unique in many ways, it occupies comparatively small space, is entirely self contained, and requires no recharging.

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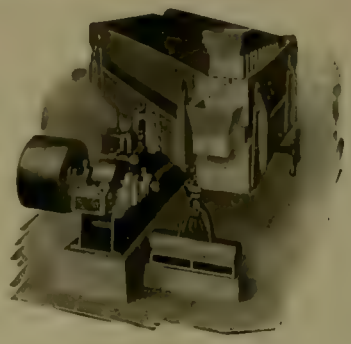

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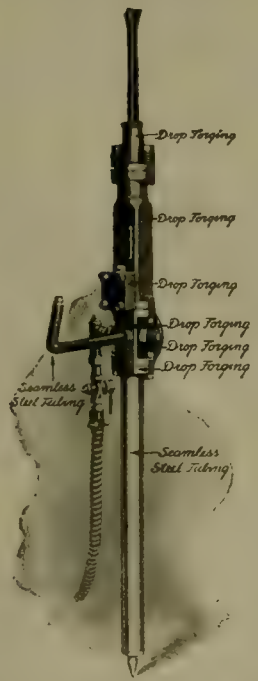

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is just as necessary to a Rock Drill's success as to a man's. Ability to "keep at it" is usually a matter of physical endurance.

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MUCH enterprise has been shown by the United States Geological Survey in the prompt preparation and publication of *Bulletin* 599, which deals with "Our Mineral Reserves—How to Make America Industrially Independent." The war has disturbed many trades and cut off foreign supplies of various sorts, including many products of the mines. It has also opened neutral markets to the United States under most favorable conditions. The bulletin just issued is authoritative as well as timely and should be widely read and studied.

FIRM is the public belief that a long life and a green old age is a lapsed characteristic of our pioneer ancestors; that in the strain, rush, and hurry of modern life men are snuffed out like candles in middle age. And yet among the fifteen persons whose deaths were noted in a New York daily paper of September 2, we note such robust figures as Austin Cronin, aged 106; Almond F. Cooper, 97; Squire Fox, 86; J. S. Sands, 74; E. S. Bradford, 71; E. W. Bradley, 67; and J. S. Brockington, 66. One-third of those whose deaths are noted had passed the Biblical three score and ten. Two thousand years ago the Greeks pictured their present day as one of degeneracy; apparently human nature has not much changed since then.

"SHOULD the American people take advantage of the golden opportunity afforded them by the outbreak of the war, it will mean not diminished, but increased prosperity for the United States." This sentiment from the *Statist* of London has been expressed and repeated by many of our economists and while present trade conditions are disturbed, this feeling of optimism is to be felt in all of the industries. Even though the important German merchant marine has practically suspended operations, many of the English and French boats acting under the protection of the fleets of the allied nations in addition to the vessels flying the flag of the United States and other neutral powers are making regular trips across the Atlantic and the products of American manufacture continue to find an export market. The greatest opportunity for expansion in trade is, of course, with Mexico, Central and South America, Africa, and the colonies and nations of the Orient. In the mining industry, the gold mines of South Africa and Australia afford a large market, the silver mines of Mexico, which are beginning to resume operations, will require large investments in machinery and supplies after two years suspension of operations, and the nitrate, tin, and iron mines of South America will all afford increased markets for American machinery. There has been little if any interruption in the Latin-American steamship service; the Ward, Panama, United Fruit, American-Hawaiian, Pacific Mail, Merchants, Barber, Norton, United States and Brazil, South American, and other lines are all in operation between North and South American ports, and transportation facilities have been practically unaffected. The recent opening of the Panama canal will greatly expedite the coastwise shipping between North and South America, and with an increased demand from Latin America an excellent opportunity is afforded for strengthening the existing bonds of trade and meeting the increased responsibilities and opportunities which the occasion demands. Americans would be foolish not to take full advantage of the situation.

THE CYANIDE SUPPLY

The present war in Europe is of intense interest to gold miners everywhere, because it seriously interferes with the supply of sodium cyanide, which is so absolutely essential to continuous work that the management of a cyanide plant is always nervous unless there is a considerable supply in stock. Such comfortable assurance is now quite impossible, because in the past few years more than half of the world's supply has been made in Germany, and most of the rest in England. The plants in South Africa drew their supply, in large part, from Germany, and with that source of supply cut off the Rand plants have overwhelmed the two English producers with orders. As the Rand consumption of cyanide amounts to nearly a million pounds per month, the English producers are not likely to be able to do much for the rest of the world. Some years ago three or four American firms began the manufacture of sodium cyanide, but apparently the difficulties encountered were greater and the profits smaller than expected, for the plant of Roessler & Hasslacher, at Perth Amboy, New Jersey, was the only one making any important amount of cyanide in this country at the time the Underwood tariff went into effect. With the removal of the import duty this plant also ceased operations, and since that time all the cyanide used in this country has been imported from either Germany or England. The Perth

Amboy plant was at once reopened on the breaking out of the war, but it has not sufficient capacity to supply the American demand. The owners are naturally loath to expend capital in increasing its capacity in view of the fact that by the time the increased equipment is in normal operation the European war may be over and with the resuming of normal imports it would have again to shut down. In addition, although the modern process of making sodium cyanide by passing ammonia over molten sodium in the presence of coke seems simple, it requires much skill to make a satisfactory product. The product of the reaction is not pure sodium cyanide, but a mixture of salts of varying composition, and unless great care is exercised in the operations the cyanide produced will be of varying strength, thereby causing much annoyance to the cyanide operator, who makes up his solution by weight, adding so many pounds of salt per tank of solution. If the salt is of variable purity the resulting solutions will be of varying strength and, unless tested and corrected, will disarrange the routine of the plant. There is therefore little incentive to chemical manufacturers to undertake the making of cyanide in this country unless they can reasonably hope to hold the business when business conditions again become normal. As far as raw materials go, there is an ample supply in this country, as sodium is produced at Niagara Falls, and plenty of ammonia is available at the by-product coke ovens and gas plants. The relative cost per unit of these here and abroad and the higher wages paid labor here make it unlikely that domestic manufacturers can make enough profit to make it worth while to invest their money in plants for its manufacture here.

Although practically all the cyanide now used is made by the process mentioned above, there are many ways in which cyanide salts can be made. Some of the various cyanide salts and their possibilities were discussed by Mr. D. Mosher in our issue of March 25, 1911 (see 'Cyanide Practice, 1910-1913,' page 27). Of these methods the most promising seems to be the manufacture of low-grade sodium cyanide from cyanamid, which is now manufactured on a large scale at Niagara Falls for use as fertilizer. It is made by passing nitrogen over granular calcium carbide which is heated to the proper temperature by the passage of an electric current. This yields a mixture of $CaCN_2$, free carbon, calcium oxide, and some undecomposed CaC_2. If this material is fed into a bath of molten $NaCl$ the carbon reacts with the $CaCN_2$, forming cyanide, and the resulting product consists of a mixture of $NaCN$, $Ca(CN)_2$, $CaCl_2$, and $NaCl$, which is known by the trade name of 'surrogate.' This 'surrogate' contains the cyanide equivalent of 25 to 50 per cent KCN and can be produced at a cost which enables it to be sold at a price which corresponds to 8 cents per pound of KCN equivalent. This material is not now being manufactured in this country, but arrangements to do so are being made, and it is expected that by December it will be regularly produced in quantity at Niagara Falls, providing the expected market for it can be secured. There seems to be no public records of experiments as to whether this low-grade material can be successfully used as a substitute for pure cyanide, though experience in Western Australia with impure cyanide gives every promise that it can. Where freight costs are important, the increased charges for transport of the 'surrogate' would be to its disadvantage, but as it is much cheaper than pure cyanide this will be offset in many places. It can at least be used as a makeshift until supplies of pure cyanide are again available. Quite a little cyanide is used by fruit growers for killing insects, and for this purpose the cheaper material should be more satisfactory. Cyanide is also used by electroplating plants, but for this purpose the pure salt is essential.

GOVERNMENT OWNED MERCHANT SHIPS

Advocates of government ownership of public utilities now have an excellent chance of testing their theories in practice, since Mr. J. A. Alexander, of Missouri, has introduced in the House of Representatives, with the support of the Administration, a bill to create a $10,000,000 corporation, of which the United States shall hold 51 per cent of the stock, to own and operate merchant vessels engaged in domestic and foreign trade. The corporation is to be directed by a shipping board composed of the secretaries of the Treasury and Commerce and the Postmaster General. The same bill has also been introduced in the Senate by Mr. J. P. Clarke, of Arkansas. Meanwhile Mr. John Wanamaker has proposed, in order to meet the difficulty of providing the necessary funds from an already depleted treasury, that the 30 per cent legal reserve of the $45,000,000 now on deposit in the Postal Savings Banks be invested in the corporation. Leaving aside such obvious and superficial criticism as that navigation of the troubled waters of middle Western politics is doubtless the experience on which the gentlemen mentioned have based their plan for venturing in the wider waters of the Atlantic and Pacific oceans, it will be worth while to consider the essential features of the plan proposed, since, if it is carried into effect it may perhaps serve to indicate the lines along which government ownership of other utilities may finally develop.

The American public is now wide awake to the fact that the shipping of our goods in foreign bottoms and the conduct of our international transactions through foreign banks is a serious handicap to the trade of this country, since the standstill to which our imports and export trade has been brought because of it has served to bring the matter sharply home to everyone. One reason why we do not now have the ships is that a modern steel freighter, costing $1,000,000 to build in England, costs $1,400,000 to build in American shipyards, and in addition to this greater first cost the interest on it and the increased depreciation, insurance, and taxes combine to make its overhead charges so high as to prevent the American ship from operating on an equality of rates with foreign ships. The law formerly

only admitted American built ships to American registry, but it has now been amended so that Americans can purchase ships abroad and register them in this country. This only lets down one bar, however. Our ships have been obliged to employ American officers and a large crew. According to figures given out by a well known New York firm an American vessel of 4500 gross tons burden must maintain a crew of 35 men at wages totaling $1700 per month, while a British steamer of 6000 tons only is required to have 25 men, with a wage list of $850 per month. The cost of feeding the 35 Americans is $550 per month, while the cost of feeding the British is $325 per month. Thus the smaller American ship costs $2250 per month, as compared to $1175 per month for the larger British ship, for wages and keep. It is now proposed to permit the employment of foreigners to man American ships, but as a bill before Congress increases the restrictions in regard to crews, this bar has been only partly removed. Another handicap on American shipping is our method of measurement of cargo in assessing port charges, canal tolls, and other dues. The American basis of measurement rates a ship at 30 to 35 per cent greater cargo space than does the foreign basis. Add to this the inequalities of taxation of the ships owned by American corporations and it is at once seen that the development of an American merchant marine is not a mere matter of buying ships. The Standard Oil Corporation, for example, has not heretofore maintained its large fleet under British and German registry out of mere lack of patriotism, but because the decrease of operating costs by so doing is so great that it cannot afford to do otherwise.

In proceeding to build up a merchant marine, one of two courses of action are available. The conditions under which American ships operate can be made so favorable that privately owned ships will be able to compete on an even basis with foreign ships, or conditions can be left much as they now are and government owned ships can be put in operation and maintained at a loss, if need be, in order that trade generally may have the benefit of their service. Some of the most illogical and unnecessary restrictions already have been or bid fair to be soon removed. It is obviously no more reasonable to force American shipowners to buy their ships in the United States and employ only American officers and seamen than it is to compel American cyanide plants to use American pebbles, instead of Danish, in their tube-mills, or to compel American hotels to employ only American waiters. As a matter of fact it is much less reasonable, for all the cyanide plants and hotels would operate under the same restrictions, while American ships are obliged to compete with ships free from restrictions. Regulations such as these merely indicate that the influence of certain interests at Washington have heretofore been too powerful to permit the interests of the country as a whole to be alone considered in framing legislation. A good start has been made in improving conditions, but nevertheless it may well be doubted whether it will ever be possible to put American shipping upon a basis of equal operating cost with foreign ships. In recent years the influence of labor unions at Washington has been so strong that it is hardly probable that the number of men employed on American ships, or the wage paid to them can be reduced to the basis of foreign shipping. American manufacturers, employing men paid high wages for short hours of work, can compete with European plants using cheaper men working longer hours, because the American manufacturers get a higher output per man, but a ship cannot increase its earnings a single dollar by doubling its crew; it merely increases its operating expenses. For this reason alone it seems probable that the present agitation for the building up of a privately owned merchant marine is not likely to produce much of actual results.

For the same reasons it is equally probable that a government owned merchant marine is not likely to be a source of operating profit. On the other hand, with the government system of bookkeeping, in which depreciation is charged up to capital, it would probably not show much loss. Even if it did, it may be argued that a course of action which is of so much benefit to the country as a whole is a proper field of government expenditure, as amply justifiable as the sums spent to fight insect pests, for the direct benefit of fruit growers, or for maintaining a postal service in districts where the receipts do not meet the cost. Only those who are alarmed at any new proposal, or who object to any increase in the functions of government will see any danger in the proposed plan on this score. A more serious question is whether privately owned ships will be able to continue operations in the face of the low freight charges, coupled with presumably high operating costs, that the government ships are likely to establish as a standard. Somewhat similar objections were made by the express companies when the parcel post was proposed, but so far only one express company has gone out of business, and there is at least room for suspicion that it imitated the Chinese custom of committing suicide on the doorstep of a powerful enemy. Certainly there would be no fewer privately owned ships than we now have. As to whether the service under government ownership would be satisfactory and efficient is hard to tell. There are many drawbacks to government operation of utilities; there are also advantages. A government line could carry its own insurance, at a less cost, and the Federal service has so far been able to ignore workmen's compensation laws. Certainly rates on government-owned lines could not be juggled so as to kill off small but threatening competitors of the big interests. Possibly the present marine service could take on many of the tasks connected with operating a merchant marine at a comparatively small increase of cost. The conclusion of the whole matter is, however, that it seems unlikely that a privately owned merchant marine can be called forth simply by a general public demand ignoring operating costs, and as it is generally agreed that we should now have an American merchant marine, government ownership and operation seems the most feasible way to secure it.

As It Looks in London*

By T. A. RICKARD

A distressing feature of this international war is already apparent, and that is, the natural dislike of everything German. In yesterday's *Financial Times* there was a letter by F. J. Dormer, a man of some standing in the City, urging that the German control of the big South African mines should be ended by ousting these gentlemen from the directorates. He argued that as the shares were held predominantly by English and French people, it was time to make this change. This suggestion has already caused ill feeling to rise to the surface. Of course, most of the South African directors with German names and guttural speech have become naturalized. At the same time, their German affiliation will not be denied. Naturalization is a legal, not an intellectual, process. However, my own detestation of the Potsdam warcrowd, and of the so-called 'intellectuals' that have supported it, is not inconsistent with keen sympathy for German nationals that are victimized by this war. They will suffer quite enough without my raising my hand, or my voice, against them. Among the pitiful incidents to be recorded is the haste of some German professional and business men in London to become naturalized. I don't care to look into the heart or the head of a man who disowns his country in the hour of her need. Personally, just now I am particularly glad that "in spite of all temptations to belong to other nations," despite the greatest temptation of all—to be an American—I am still an Englishman.

H. H. Knox, who was on his way from New York to the Altai, to examine the Ridder mine, has shown me a letter he had sent to the New York *Sun* pointing out that American detachment from this European war may be overdone. He argues that if the Austro-German combination should by any chance triumph, it would mean the annexation of the Dutch West Indies, and a menace not only to the Panama Canal, but to the American nation.

As you know, we have several German advertisements in *The Mining Magazine*. Having received no instructions from the firms concerned, we might assume that their contracts with us continued in force, and as they dealt with purely industrial machinery there seemed no immediate reason to discontinue the advertisements. But there is. By proclamation we are forbidden to do business with the King's enemies or to give them credit; it is high treason to do so; hence we telephoned to our printers at Rugby (90 miles from London) to cut out these German 'ads' and to insert some of our own book advertisements in their place. On trying to telephone to the London agencies of these German firms, we found that they were disconnected. By Government orders all Germans have been taken off the telephone circuit. Of course, after the war there will be a boycott of German products throughout the British Dominion, and the prejudice will extend to many regions not under our flag. I say this to you with no satisfaction, for it is one of the unlovely results of a relapse into barbarism. Whether Germany wins or loses—and I hope that as a military bureaucracy she will be smashed to smithers—it is inevitable that her people will suffer in business.

August 11.

Among the humors of the hour I may record the capture of the scientific expedition sent from Germany to the Crimea to observe the solar eclipse. It is reported that "their scientific instruments of great value have been confiscated." We may presume that the Germans would have done the same if Russian scientists had gone to the Aland islands for the same purpose. No matter, it is more evidence of the gross barbarism to which we have been pushed by the military autocrats.

A. L. Queneau, the zinc specialist, who did good work at Broken Hill, is in the French cavalry. You will find that his address is given in your professional directory as Jemeppe-sur-Meuse, in the heart of the Belgian cockpit. He is a Columbia graduate. His wife and four children are at Liége. May his sword-arm have the strength of ten! Another zinc specialist is H. M. Ridge, of London, who happened to be on the continent at the outbreak of war and is now 'detained' at Düsseldorf. We have heard from him that he is well, but under surveillance. It is a pity, for the schemes on foot for starting smelters to treat zinc-lead concentrate would gain from his knowledge in this branch of metallurgy. He speaks German fluently and likes the people, so that he will probably escape harsh treatment.

Gilman Brown has arrived from Russia. He was 8 days on the way from St. Petersburg to London, his itinerary being Raumä, in Finland, thence to Stockholm, then by train to Bergen (through Christiania) and so to Leith in Scotland, and by train to London. He underwent no hardships. The Russians, he says, are enthusiastic. Twelve million uniforms are ready for use. Even the Finns are coöperating loyally. At the big copper mines at Tanalyk, Kyshtim, Spassky, and Atbasar, the mobilization has withdrawn 30 to 40% of the employees, necessitating a cessation of development work. But production of copper continues, stimulated by the domestic demand and the import duty (equivalent to a bounty), so that the effective price for the metal is £103 per ton. The Kirghiz, being nomadic, are not called to the colors, so that they afford a valuable labor-supply. H. H. Knox and E. J. Carlyle are leaving at once, by way of Norway and Finland, to go to the Ridder and the Sissert mines, respectively.

Aug. 25.

*In this series of war letters, the *Press* will print extracts from Mr. Rickard's personal letters from London, believing that an account of the war as seen by a mining man in that great centre will be of interest to mining men everywhere. Mr. Rickard is an Englishman who was born in Italy, passed his early boyhood in Russia, managed mines in France and Australia, and lived in the United States more than twenty years. His sympathies are naturally with the Allies, but he will endeavor to be as impartial as he may.

FIG. 1. DISTILLATION BUILDING, ACID PLANT, STORE-ROOMS, AND POWER-PLANT.

The Rose Lake Smelter of the Granby Company

By E. H. LESLIE

Among those companies which have been conspicuously identified with the development and advancement of lead and zinc smelting, the Granby Mining & Smelting Company holds a most enviable and patriarchal position. Incorporated in 1865 by Henry T. Blow, Peter E. Blow, James B. Eads, the bridge builder, and Charles K. Dickson, the Granby company acquired the business and mining interests of the firm of Kennett & Blow which had been operating lead properties in Newton county, Missouri, for a long period previous to and during the Civil War; having thus laid its foundations in the beginnings of the industry, a superstructure has been raised which is both a credit and monument to the builders. The Granby company has been in active business for a period of 49 years, and application has been made to the Secretary of State of Missouri for a renewal of its charter for a period of 50 years, beginning April 5, 1915. The officers who have directed the affairs of the Company for a number of years past are president Elias S. Gatch; vice-president, Norris B. Gregg; secretary, Kennett Burnes; treasurer, Elias S. Gatch; who together with James H. Grover, and Howard O. Edmonds, comprise the board of directors.

Suitably to commemorate the 50 years of successful mining and smelting activity and meet the expansion of its business, the Company purchased 148 acres of land, just outside of the city limits of East St. Louis, and adjacent to the right-of-way of the Vandalia and Terminal tracks, for the site of a zinc smelter which would fitly characterize the stability and progress of this concern.

The Rose Lake smelter has been laid out and designed with a view of obtaining the most modern equipment and best practice which the industry affords, and toward attaining this end the Company has spared neither time nor expense in the erection of a smelter which embodies the most modern methods and mechanical equipment. Before ground was broken for the smelter, the president of the Company, Elias S. Gatch, and the chief engineer made extensive trips throughout the zinc-smelting districts of the United States and Europe to study the latest and best of the world's zinc smelters, and this, together with the Company's experience and the best engineering talent available, has resulted in the present

FIG. 2. POTTERY, POWER-PLANT, ROASTER BUILDING, AND STORAGE HOUSE.

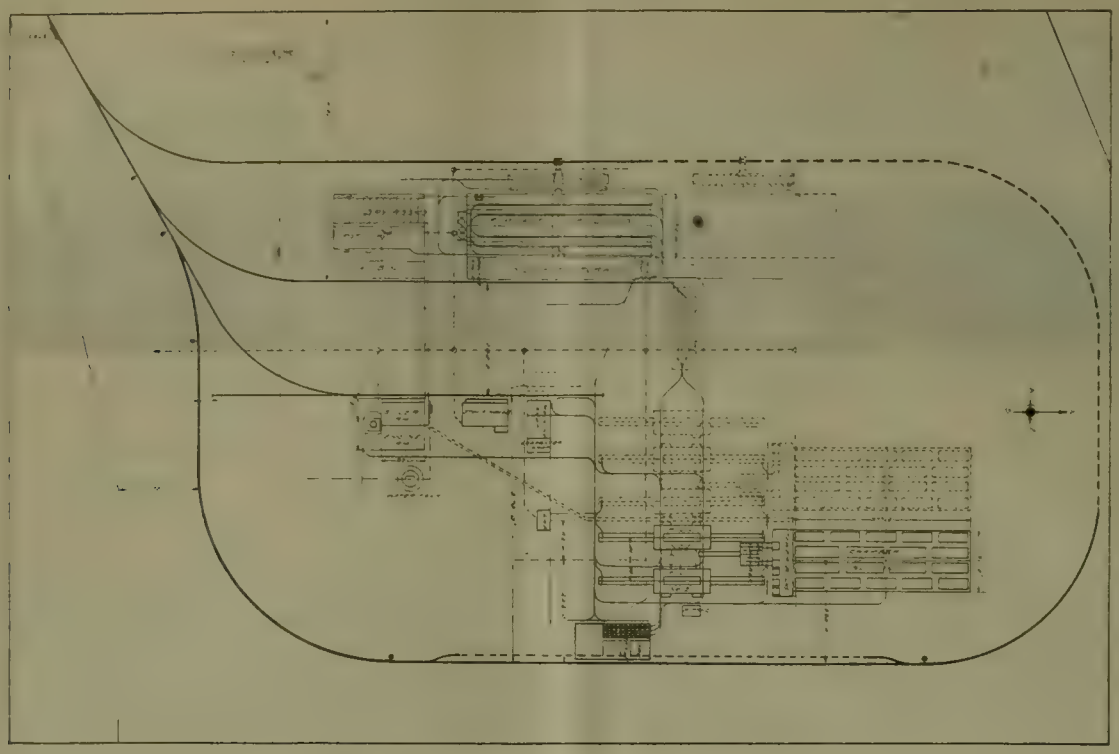


FIG. 3. PLAN OF THE ROSE LAKE SMELTER.

plant. Before deciding on the erection of this smelter, the Company purchased 10,000 acres of coal lands in Bond county, Illinois, about 50 miles distant from the smelter, which guarantees a fuel supply for many years to come. The engineering work was done largely by the firm of Ruebel & Wells in coöperation with the Company's staff. The concrete and brick work was let to the James H. Bright Contracting & Building Co., and the steelwork was supplied and erected by the American Bridge Company. While the metallurgical practice as planned for this plant is the standard practice of producer-gas smelters, there has been a number of departures in the general layout of the plant in construction, and in mechanical equipment which makes it novel in many respects.

PLAN OF THE SMELTER

The topography of the site is almost level, with a few depressions which will later be filled with retort residues as the work progresses. The plan of the buildings and grounds of the smelter is as shown in the accompanying plan, Fig. 3, solid lines indicating buildings which comprise the original plant, while the dotted lines represent buildings which will later be erected as the initial capacity of the plant is increased. Besides the standard-gage track, which is as shown in the plan, there are several miles of industrial track for the handling of furnace materials and supplies. A study of the plan cannot fail to impress one with the orderly arrangement of the various buildings and departments. The halftones, Fig. 1 and Fig. 2, show general views of the smelter and the stability and permanence of the construction, a feature in marked contrast to the natural gas smelters of the Middle West. It will be noted that the construction is entirely of concrete, brick, heavy corrugated iron, and steel. As with the new producer smelters, the excavated type of furnace structure has been abandoned, the furnace floors being elevated permits better ventilation and greater efficiency in the handling of furnaces.

CONCENTRATES TREATED

The concentrates to be treated, when the smelter is placed in operation, will be derived largely from the Company's mines in the Joplin district. These concentrates will be delivered at the plant in the standard-gage cars at the ore-storage building, which is 100 by 150 ft. in dimensions. The cars enter this building over a 5% grade and are mechanically discharged into a Bartlett & Snow rotary dryer. As the cars enter the grounds they pass over a track scale which is situated near the entrance to the smelter grounds, as shown in the plan. Here the concentrates and fuels are weighed and a check kept on all raw materials. The storage shed is equipped with Power & Mining Machinery Co.'s crushing rolls, Bartlett & Snow Co. 40-ft. rotary dryer, and two Newwaygo separator screens. The material after being dried passes to the rolls and screen, the oversize being returned and the final product which passes 2 mm. is elevated and conveyed to the storage bins by

FIG. 4. CHAMBER BUILDING, ACID TOWER, AND ROASTER BUILDING.

Stevens Adamson machinery. The bins are of steel and suspended over industrial tracks, and have a capacity of 5000 tons.

The concentrates are drawn from the bins into industrial cars, which are of $2\frac{1}{2}$ tons capacity, and trammed to the roasting furnaces. Here they are elevated to bins placed above the feed-end of the furnaces from which they are automatically discharged into the top hearths. The initial roasting plant consists of two separately housed modified Hegeler roasting furnaces. The acid plant and one of the roaster buildings is shown in Fig. 4. The plant is laid out for the erection of three additional roasters when needed, which will be situated as shown in the plan. These furnaces are 22 ft. wide, 32 ft. high, and 84 ft. long, with 7 hearths. This type of muffle furnace has come to be recognized

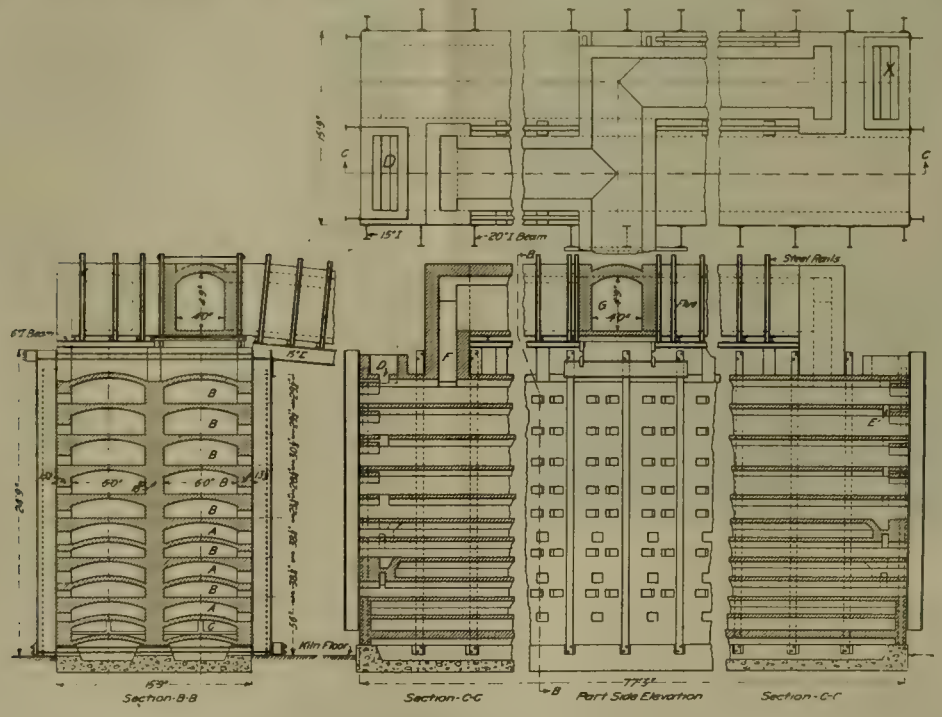


FIG. 5. MULTIPLE HEARTH HEGELER ROASTING FURNACE.

A—Fire muffles.
B—Roasting muffles.
C—Muffle for preheating the air.
D and *X*—Feed hoppers.
E—Discharge into second muffle.
F—Gases leave furnace.
G—Flue to acid plant.

as standard in zinc smelting practice where a sulphuric acid plant is a part of the equipment as an exceptionally pure and clean gas is obtained from this furnace. An idea as to the construction of a Hegeler type furnace may be obtained from the accompanying drawing, Fig. 5. The furnaces consist of seven hearths and only the lower three hearths are heated by producer gas. The hearths are arranged with muffles on each side of the centre wall, the concentrate being fed in at opposite ends of the two top hearths and discharged at the two opposite ends of the bottom hearths. The passage of the blende through the muffles is effected by means of the rabbling mechanism. Rabbling is commenced at the top hearth, the charge being moved from the feed toward the discharge end where it is dropped through a slot in the floor of the hearth upon the hearth below. It is then drawn by another rabble toward the opposite end, where it is again dropped through another slot to the next lower hearth. The ore is thus drawn through the furnace by the rabbles and discharged from the lowest hearth of the furnace. The rabble used is of the ordinary rake type, so designed as to turn over, plow, and move forward the charge as it moves through the furnace. The rabbles are supported on a stand at the end of the furnace which may be revolved from one side to the other for the rabbling of each of the two hearths on each floor level. The rakes are drawn through the furnace by detachable rods with an improved driving mechanism. The gas travels in the opposite direction, being admitted to the lowest fire muffle at one end it passes to the other, being partly burned by the admission of air at intervals. The gas then passes outside of the muffle and is admitted through a by-pass to the next muffle above, where it is further burned, the combustion being finally completed under the third muffle. The hearths are closed at the ends by sheet iron doors which are hinged at the top and automatically opened and closed by the passage of the rabbles through the furnace. These furnaces have a capacity of 50 tons per day.

Fig. 6. Acid towers.

A ten-foot Chapman gas-producer supplies gas for both the roasting furnaces. The Chapman producer is manufactured by the Chapman Engineering Co. of Cleveland, Ohio. It is a mechanically operated producer consisting of two revolving parts. These parts revolve in the same direction at different speeds, resulting in a twisting motion in the fire zone, thus keeping the fuel from clinkering. The residue is broken by the revolving action of producer, grinding it against the corrugated surface of the tuyere frame. The ashes are automatically ejected by the motion of the producer. The coal used in this producer is delivered in industrial cars and elevated to a superimposed steel bin above the producer.

Acid Plant

The sulphuric acid plant is one of the most important parts of the smelter and will be seen immediately at the rear of the roaster building, Fig. 4. The chamber building, also seen in Fig. 4, is of most modern construction, is 130 by 360 ft. in dimension, and is built entirely of structural steel, corrugated iron, and concrete. The working floor is of steel and is 15 ft. above the ground to permit of good ventilation. The truss line from which the chambers are suspended, as the lead chambers will not admit of compression, is 24 ft. above the working floor. The gases from the roasting furnaces pass through the dust chamber and into the tower building which is a part of the acid plant. This department consists of two Glover towers and three Gay-Lussac towers. A view during construction is shown in Fig. 6. From the Glover towers the gas passes through the two systems of lead chambers, and from these chambers it is returned to the three Gay-Lussac towers, through which it passes in series and is finally discharged into the air. The weak acid produced in the chambers together with a small amount of nitric acid, which is required to produce the nitrous oxides which are necessary in sulphuric acid manufacture, enters at the top of the Glover towers and passing through them is returned to the system of Gay-Lussac towers through which it passes in series. It is then returned to the two Glover towers for concentration. Here the weak acid or water which is added is

converted into steam, which when passed into the chambers supplies a part of the steam necessary for the chamber part of the process, and the acid thus concentrated is again ready for reabsorbing nitrous acid gas in the Gay-Lussac towers, while the excess which is the major part is ready for the market or further concentration. The circulation of gas through this system is accomplished by means of two fans between the Glover towers and the chamber systems, and one fan between the first and second Gay-Lussac towers. The flow of the gas and acid through the plant is shown by the accompanying diagrams, Fig. 7 and 8. The matter of ventilation, as previously mentioned, has been given particular attention in the construction of this plant. In addition to floor gratings, there are, at the top of the building, 120 sashes which are automatically controlled by the action of a wind vane and a motor. The two sets of chambers are made up of nine chambers each. These chambers are of different sizes and arranged in series.

The connection between the roasting furnaces and chamber system for the transfer of the gases has been so arranged that by the opening and closing of gates the two furnaces and the two chamber systems may be operated separately or in series. In this manner the gas supply to the acid plant can be carefully regulated. The nitric acid which is used in the manufacture of sulphuric acid at this plant, is manufactured in a separate building on the grounds by the Valentinier process, the feature of which is the distillation under a vacuum. The sulphuric acid to be produced at this plant will be of a strength of 60° Baumé which is the standard grade manufactured by the chamber process.

FIG. 9. DISTILLATION FURNACE BUILDING.

DISTILLATION FURNACES

The four blocks of retort furnaces are housed in one

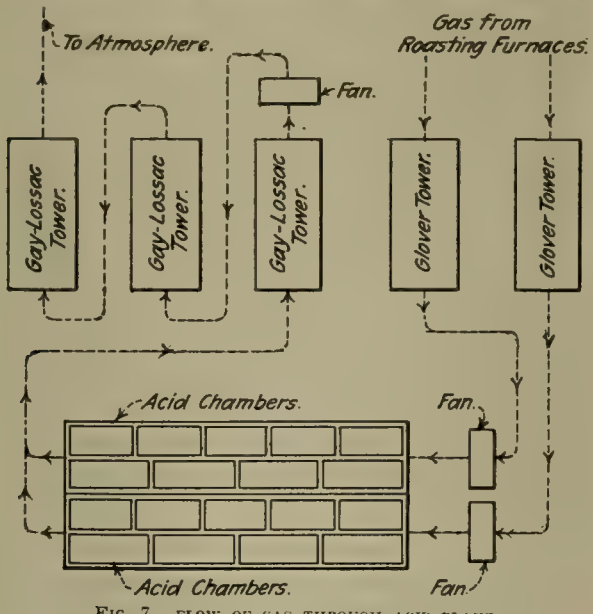


FIG. 7. FLOW OF GAS THROUGH ACID PLANT.

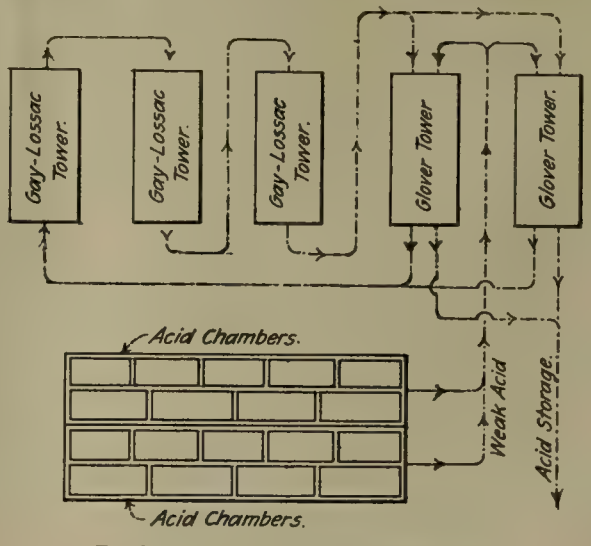


FIG. 8. FLOW OF ACID THROUGH ACID PLANT.

building which is situated to the west of the roasting kilns and acid plant and connected with it by industrial tracks. The construction and arrangement of this building is as shown in Fig. 9 and plan of the smelter. It will be noted that the elevated floor type of structure has been adopted and that every detail of construction has been carefully planned. While the initial plant will consist of four blocks of furnaces, the arrangement is such that a similar number can and will be added at some time in the future. The furnaces are fired by producer gas.

The mixing room is centrally placed at the east side of the furnace building, as shown in the plan. Here the roasted concentrate from the storage bins in the cooling shed is brought and automatically weighed. The fuel, carbonate, and roasted sulphide are mixed in an 80-ft. Milwaukee concrete mixer, from which it is discharged upon an 18-in. belt-conveyor and conducted to the charge storage bins. There are two bins for each of the four smelter blocks. The mixer is driven by a 50-hp. Sprague motor, and the belt-conveyor by a 15-hp. Sprague motor.

The fuel for the furnaces is supplied by 12 Hughes gas-producers arranged in two batteries of six each, as will be seen in Fig. 10. The coal is unloaded by a locomotive crane or dumped directly into the hoppers of an apron conveyor. This discharges into a Jeffry single-roll crusher. The crushed coal is then elevated by a bucket-elevator and discharged upon a conveyor which transfers the coal to the bins over the producers; Stevens-Adamson conveyors are used for this purpose. This reversible conveyor, for the distribution of the coal to the bins, is mounted on a carriage which moves over a track above the bins. The conveyor carriage is operated by the same motor as the 24-in. conveyor-belt, and is moved in this manner into position to discharge into any of the 12 coal bins. These bins are of the suspended steel type and are fitted with concrete divisions to take up the dead space between outlets of the bins. These bins have a capacity of 90 tons each. One man will operate the crusher and coal-distribution system. The power for handling the coal consists of one 10-hp. Sprague motor for the distributing conveyor, one 10-hp. Sprague motor on the elevator, and one 15-hp. Sprague motor to drive the coal crusher and apron conveyor.

FIG. 10. PRODUCER PLANT FOR DISTILLATION FURNACES.

The coal from the bins is discharged directly into the bell sealed hoppers of the Hughes gas-producers, which are connected with one main header. As previously stated, the 12 producers are divided into two batteries of 6 each and each battery is driven by a 30-hp. motor. Each producer gasifies 18 tons of coal per 24 hours.

The four blocks of regenerative distillation furnaces are arranged in rows of two each. The furnaces and the building are laid out so that charging machines may be installed without alterations. The gas and air enter ducts in the bottom of the furnace through large Swindell valves, travel the length of furnace through the ducts, and enter the furnace from these ducts through a system of checkerwork, absorbing heat therefrom, and after burning in the furnace travel to the stack through corresponding checkerwork and ducts, leaving the heat to be taken up by the air and gas on the reversal of valves at stated intervals.

The furnace blocks are 108 by 18 ft. in dimensions. The retorts are placed in five rows with 15 retorts to the section. There are 27 sections to the side of a block, thus making 405 retorts to the furnace or 810 retorts to the block. The original plant will therefore contain 3240 retorts. Each block is fitted with a Wiederholdt chimney 80 ft. high.

The charge is drawn from the storage bins into the charge cars, and moved to the front of the furnace, where it will be charged by hand into the retorts. The drawing is effected in the usual manner by means of a draw car with a ladle suspended in it and operated by a hand winch. During drawing operations the operator is protected from the heat of the furnace by means of a sheet-iron shield. The metal thus drawn is cast in molds and removed to the spelter stock room by a gasoline locomotive. The discharging of the retorts is accomplished by means of scrapers, the usual method in the Illinois field. The retorts are 52 by 9 in. inside dimensions. When in operation the plant will have a capacity of 100 tons sulphide concentrate per 24 hours.

The furnace floor is 20 ft. above ground level, which type of structure has been adopted by the more modern smelters. The hot residue falls by gravity through chutes at the front of the furnaces into hoppers in the sub-structure. The hoppers discharge into industrial cars in which the residue is removed to the dumping ground. The residue, together with cinders from the gas-producers and boiler plant, will be used for the filling of depressions in the grounds around the buildings over the entire tract, as the present surface is from 3 to 7 ft. below the established grade. At such a time as necessity demands, there is an area of several hundred acres adjoining the property on the north which is 20 ft. lower than the level of the smelter grounds and will furnish a dumping ground for many years to come.

POTTERY

The pottery plant, in which the retorts and condensers are manufactured, is complete in every detail and em-

bodies mechanical features which make it noteworthy in many respects. This building, which is seen at the left in Fig. 2, is a pressed brick and reinforced concrete structure. The clay and adobes are delivered on standard gage cars at the plant and unloaded into bins at the side of the pottery. The crushing plant consists of a Williams hammer crusher which is driven by a 50-hp. Sprague motor. The discharge from the crusher falls upon a belt conveyor and is conducted to the foot of a bucket-elevator by which it is elevated to a ¼-in. Newaygo screen. The oversize is returned to the crusher. This screen is actuated by means of a cam-shaft which gives it a vibratory movement and is fitted with a screw feed. The under-sized material from the screen falls into a reinforced concrete storage bin. The clay, adobe, and crushed retorts are stored in separate bins and drawn from them as needed into a large steel bucket which is suspended from overhead rail, and in this manner taken to the wet pan for mixing. The pan used is 9 ft. in diameter, built by the American Clay & Machinery Co. The clay, as it emerges from the wet pan, is allowed to season for several days and is again given another kneading in the pan. After this, it is passed to the W. C. Raymond ball-mill, from which it is subsequently removed to the retort press. A Wettengel hydraulic retort press is used for the moulding of retorts, pressure for which is furnished by a four-cylinder pump and accumulator. The condenser mixture and looming material for the furnaces is mixed and pugged in an American Clay & Machinery Co. combination pugging and ball-mill. This is fed direct from the bins. The condensers are made in a Garrison & Whipple, Cheeryvale, Kansas, condenser machine, which has a capacity of 1000 condensers per day. Power for the entire pottery plant is furnished by a 100-hp. Sprague motor.

Dry-Rooms

The retorts as removed from the press are taken to the 12 dry-rooms for subsequent treatment. The construction of these rooms is of a special interest and forms an important part of the pottery plant. The rooms are opened at both ends by ice-box doors which make the rooms practically air tight. In filling the rooms, the retorts are taken in through the doors on that side adjoining the pottery room. When the retorts are removed they are taken out through the doors at the rear or opposite end of the rooms. In this manner the first retorts to be placed in the drying-rooms are the first to be removed. The air used for drying is heated by exhaust steam from the power plant, it being brought from the power-plant to the pottery through pipes in a concrete conduit. At the pottery this steam circulates through coils of ¾-in. pipe which are in a steel housing, and the air is drawn through this chamber in which the steam coils are placed by means of a Sirocco fan. This fan is driven by a 7½-hp. Sprague motor. The air thus heated passes through sheet-iron conduits to the dry-rooms. It enters at the top of the rooms, passes through the retorts and out at the bottom of the rooms through another conduit. The air from the dry-rooms is conducted to the workroom of the pottery and is used for heating it in the winter time, while in the summer time it is discharged outside of the building. The pressure on the dry-rooms is kept at about 2-in. water gauge. This is regulated by means of valves in the discharge air passages of each room. These valves are opened or closed from the outside of the room by means of a chain near the rear doors. The roof of the dry-room section of the building is made of hollow tile and reinforced concrete, thus affording a dead air space which has been found to be very beneficial in the prevention of condensation, especially in the winter time.

The condensers are made from a half-and-half mixture of clay and old retorts, and are dried and burned in especial kilns for this purpose. The retorts are removed from the dry-rooms on flat trucks and trammed by a gasoline locomotive to the furnace building. The tempering kilns, of which there is one for each block of furnaces, are especially designed circular beehive kilns made for down draft. These kilns are fired with coal.

Power-Plant

The power-plant is one of the features of the smelter and has embodied in its equipment and construction the most modern of machinery and appliances. The boiler plant consists of three 350-hp. Babcock & Wilcox, marine type, steam boilers. These boilers are fitted with Bayonne stoker attachments. In planning the boiler-room, provision has been made and the foundation is in for an additional boiler unit. The boiler-room equipment also includes a Sorge-Cochran water heater and purifier and two Epping & Carpenter boiler feed pumps.

The two power-units are 600-kw. Sprague generators, direct connected to Fulton-Corliss engines. Space and foundations have also been left for an additional unit as occasion requires. The switchboard is of Vermont blue marble made by the Frank Adams Electric Co. A Bowser gravity oil system and filter has also been installed. By this system all the oil is collected in a tank in the basement and pumped by air to the filter and storage tank in the engine-room above. The machine includes a water separator and oil purifier.

The fire pumping plant consists of an Alberger 2-stage 1500-gal. pump, driven by a 150-hp. motor. This pump is controlled from the engine-room. The equipment also includes a 700-ft. Chicago Pneumatic Tool Co. air-compressor. The water-supply for the smelter comes from two 90-ft. wells, and is pumped into a 120,000-gal. steel storage tank which is 140 ft. above the ground, as shown in the general views of the plant. The pumping plant consists of two 350-gal. Alberger, direct-connected, turbine pumps placed at the wells. A gauge-board in the engine-room records the height of water in this tank. Electricity is conducted to the various departments of the smelter by lead-covered cables through concrete underground tunnels. No overhead wires are anywhere in evidence about the smelter grounds. The exhaust steam from the engines and pumps is also conducted through

these tunnels to the various departments for heating purposes.

Machine Shop

The machine and carpenter shop is a pressed brick building on a siding of the standard-gage track, and is amply equipped to meet all the requirements of the smelter. The equipment includes a band-saw, a cross-cut saw, a pipe machine, a metal-breaking machine, a 16-ft. lathe with a 26-in. swing, a 30-in. planer, a shaper, a radial drill-press with 36-in. swing, a small drill-press, a combination punch and shear, a triphammer, small punches and shears, a bolt machine, a pipe-cutting machine, a set of rolls, and emery wheels. All of the machines are driven from a line shaft by a 15-hp. Sprague motor. There are also two forges operated by direct-connected blowers which are driven by small Sprague motors. The tool-room, which is a part of the machine-shop, is stocked with a complete supply of all kinds of tools for use about the smelter.

The laboratory is a small pressed-brick building completely equipped for the analysis of smelter supplies and products. For grinding samples, a small jaw crusher and Braun planetary pulverizer, which are driven by a 3-hp. motor, have been installed. There is also a steam dryer for drying samples. Water for laboratory uses is distilled in a steam still manufactured by the Stokes Machine Co. The routine laboratory is equipped with a hood, electric hot plates, and the most modern of analytical apparatus. There are two well equipped balance-rooms and a store-room for glassware and laboratory supplies. An emergency hospital room is provided in this building, where first-aid work can be administered. There is a research laboratory room in addition to the routine room, fully equipped for research and special work.

The store-room is a two-story, pressed-brick, semi-fireproof building which is 50 by 96 ft. in dimensions and is heated with exhaust steam from the engine-room. About $10,000 worth of smelter supplies are kept on hand in this building. A sewage-disposal system has been installed at the plant at a cost of $10,000. No effort has been spared to provide the most sanitary buildings and care for the comfort and health of the employees.

The plant as it stands today represents an outlay of $1,500,000, and when put into operation will represent one of the most advanced practice and complete mechanically equipped smelters in this country. As a monument to the executive ability and engineering skill of the Granby company, the Rose Lake smelter reflects great credit to this organization, and the shareholders are to be congratulated upon this latest addition to their holdings.

Mining District of Pinos Altos, New Mexico

By W. ROGERS WADE

This district is situated in the northeastern part of Grant county, New Mexico. The postoffice for the camp is Pinos Altos and is reached by an eight-mile stage drive from Silver City, which latter point is on the Atchison, Topeka & Santa Fe railroad. The town lies at the base of the Pinos Altos mountains at an elevation of 7000 ft., while the peaks themselves reach about 8050 feet.

Placer gold was the first discovery in the district, in 1860, by a Mr. Birch, a California pioneer. Lode mining commenced soon after and the first vein to be worked was the Pacific. Within the next two years several hundred men were at work in the camp and over 25 veins were developed. In 1896 the Hearst estate of California became interested, and operated the Hearst and Gillette shafts on the Pacific mine. Later, in 1903, these were sold to the Comanche Mining & Smelting Co. This latter concern built a smelter at Silver City and a narrow-gage railroad to Pinos Altos. It went into the hands of a receiver in 1908, and the property now belongs to the Savanna Copper Co. The district has produced about $5,000,000 in gold, silver, and copper. Some of the ore has been exceedingly rich.

The Pinos Altos mountains appear to be an intrusive mass several miles in diameter. The intrusive has penetrated through beds of quartzite, limestone, and sandstone, and tilted these beds sharply to the west. A part of these beds is to be seen on the western side of the mountains and strike northerly, dipping west.

The tops and eastern sides of the mountains are composed of granodiorite (locally called granite) and diorite. The granodiorite appears to be the older of the two. It shows a porphyritic structure northeast of the town. The diorite is dark greenish in color and forms the central part of the peaks. The granodiorite forms the eastern part along the base. The diorite appears to have come up through the granodiorite. Both rocks are closely related and probably of nearly the same geological age. Judging from similar formations in other parts of the state, they are early Tertiary.

The western part of the district has some extensive zinc orebodies in the limestone. This article will be confined to the gold-silver-copper veins in the igneous rocks.

The oldest vein system which I observed strikes east and west, and is very indistinct, being really a series of crush zones, generally narrow. Next followed a north-south faulting with a dip from 65 to 75° to the west. This faulting opened channels for mineralization, and quartz, chalcopyrite, pyrite, zincblende, galena, gold, and silver ores fill the fissures. The Langston, Pacific No. 2, and Pinos Altos workings are on one of this

series. This system was then faulted by two series of faults one striking N. 60 to 65° E., and the other northwest. The N. 60° E. faults throw the north-south veins from 6 to 20 ft. horizontally. In several cases these N. 60° E. faults have opened fissures which have been mineralized with gold, silver, copper, lead, and zinc ores in a quartz gangue. The Gillette and Hearst workings are on one of these N. 60° E. series.

In other cases, parallel faults of this series are not mineralized. These N. 60° E. faults and veins either are vertical or dip about 80° to the northwest. Lastly, there has occurred the northwest-southeast faulting mentioned before. I have not observed any mineralization along this system and believe the faulting occurred after the mineralizing activity had ceased.

Mineralization

Mineralization in the district was caused by ascending solutions. Most of the veins were apparently open fissures. Quartz was first deposited on each wall with the tips of the crystals well formed and pointing inward. Next the deposition was more rapid, and a mixture of quartz and metallic sulphides filled up the remaining space. The upper portions of the veins are now oxidized, with the result that the zinc is leached out and the gold enriched. This oxidation extends from 50 to 150 ft. below the surface.

There seems to have been considerable enrichment at points on the veins where they are cut by cross-faults. In the case of the Pinos Altos lode in the Pacific No. 2 claim, this north-south vein is cut by a N. 65° E. fault. The displacement of the lode is 17 ft. on the first level and 6 ft. on the second. The fault dips vertically, or practically so. At the point where it crosses the vein there seem to be the remains of an east-west fissure, so that three breaks meet at a common point. The east-west vein has been displaced by the north-south fissure and the latter faulted by the N. 65° E. fault. The result is that the only evidence of the ancient east-west vein is a quartz and copper sulphide filling, the crystallization and banding of which is at right angles to that in the north-south vein. I observed this filling on the 130-ft. level in the Bell and Wright workings at the intersection of the fault and the vein. It was only about a foot wide, both ends being cut off by the foot and hanging walls of the north-south vein.

As a result of the faulting, a notable enrichment has occurred on the intersection, the ore having risen in value from $30 to ore so full of gold that it assays up to $25,000 per ton. The ore was many times above the general mine average for distances of 20 to 25 ft. from the fault on the south side, all the way from near the surface down to the 230-ft. level, at which point the ore at the fault became shot full of free gold. A winze sunk on the vein for a distance of 30 ft. below the 230-ft. level is said to have produced $40,000 in high-grade ore. This winze is 3 by 5 ft. in size. The rich ore was found on the 230-ft. level about two feet above the floor, and was reported to me to be three feet long, eight inches wide, and to extend to the bottom.

The veins in this camp being all practically similar in character, the various mines operate about the same way. I will describe the practice as I observed it in the Pacific No. 2, or Bell and Wright lease.

The main hoisting shaft is an incline sunk on the vein. It is timbered on the hanging wall and the two ends. It is of one compartment only. Hoisting is done in buckets with a friction geared hoist belted to a two-cylinder, two-cycle, Gray gasoline motor. Levels are turned about every 100 ft. as measured down the incline. The vein dips 66° and averages 10 in. wide. The walls are diorite, much shattered next to the vein, considerably altered, and full of gouge. All drifts are generally timbered. Stoping is done overhand, stulls being put along the top of the drift and no pillars left above the level. These stulls are placed close together and covered with lagging. Chutes are carried up through the stopes every 50 ft. and provided with a gate at the bottom to draw the ore.

The hanging wall rock is first shot down and left to fill the stope. After exposing the vein for 10 to 15 ft. along the roof and about 3 ft. high, canvas is laid on the waste and the vein is then mined out. It is then shoveled from the canvas into the ore chutes. By keeping the stope narrow so that, say, two and a half feet of hanging wall waste is broken to ten inches of vein mined, the waste left in the stope can be adjusted (due to the greater volume of the rock when broken) to just fill the space mined and be kept up to the working back without hoisting any waste.

The ore is drawn from the chutes and hoisted to the surface, where it is sorted into different grades, the idea being to get out the zinc if possible.

The cost of mining and sorting is about $4 per ton. The cost of development runs about $1 per ton. The wagon haul to the railroad at Silver City is $2 per ton, and the freight to the El Paso smelter is $1. The treatment charges average $7 per ton. Gold is paid for at $19.50 per ounce; silver, 95% assay at New York price; copper at 2½c. below New York price, to allow for costs. Over 12% zinc is penalized.

Future of the District

Operations of recent years have been small and mostly by lessees. The only available ores have been those high grade enough to ship direct to the smelter. The rich find recently made by Bell and Wright has encouraged much activity, and nearly all the properties are now being worked by small companies or by lessees. The real future of the camp is dependent on concentration. The ore below 200 ft. is all sulphide and contains generally less gold and increased amounts of zinc. The great difficulty is to separate the lead, copper, and iron sulphides from the zinc sulphide. The gold seems to be associated with the iron pyrite. Operators at present believe from test runs that this can be done with the Huff separator with success. If this works out commercially, the district will enjoy a long life.

Prospecting on the Upper Magdalena

By C. S. HALEY

Recent developments on the Cauca river, chiefly due to the operations of Oroville Dredging, Ltd., but also in part to the work of a few smaller companies, have attracted the attention of mining people to Colombia, with the result that in the last year several parties have been sent out, from both sides of the Atlantic, with the object of investigating dredging ground.

Early Conditions

It is, of course, from the latter standpoint that Colombia is interesting to gold miners. While in the early days of Spanish colonization the workable surface placers were numerous and in some places very rich, everything that was at all accessible to water in a country which is noted for the abundance of its rivers and the frequency of its rains, was ground-sluiced on a large working scale as soon as its value was discovered. As labor was fairly abundant and under the Spanish system cost nothing; food for the peons grew in a naturally prepared state on the grounds; and working tools for ditching and mining could be manufactured by hand from the heavier woods, with the use of a little iron, it is rather difficult to see just how the working cost could be calculated. Probably the most important element consisted in expenditure for powder and ball shot to be used against the cheerful English buccaneers.

At any rate, working conditions being so ideal from the operators standpoint, and the demand for gold being so acute in the mother country it is little wonder that all of the placers which could be handled were worked, and that right rapidly. However, there remained the deeper bars of the larger rivers, which were absolutely impossible to work by hand, and which were foreordained to retain their value (when they had it) until the introduction of modern machinery.

While the chief centre for gold during colonial times was probably on the Cauca and its tributaries, as well as the rivers of the west coast, nevertheless the upper portion of the Magdalena, lying directly east of what is known as the Cordillera Central, contributed its share, as well as a larger proportion of silver than its neighbors on the west. It is this area that is shown on the accompanying map, and historically it is perhaps of greater interest than any other portion of Colombia. Here it was that the knighted pirates of the Caribbean penetrated in their search for the Castilian goose that was monthly furnishing the golden egg for the treasure trains of Bogota; sailing their little cockle shells up the wide and muddy bosom of the Magdalena, and flaunting their black and white flag of death and destruction under the very faces of the Spanish slave drivers in the heart of their own country.

The rough and truculent business methods of those times have passed away; the spirit of modernity has so far encompassed this, as most other of the far corners of the earth, that where one boatload of swarthy pirates levied their toll upon the land at monthly intervals, whole squadrons of steamers plying up and down the river every week now exact dividends of 50% and more per annum.

As everybody knows, Barranquilla, near the mouth of the Magdalena, is reached by railroad from Puerto Colombia, some twenty miles west, which is the port of entry for the former town. The Hamburg American, the Royal Mail, and the United Fruit companies all make connections there, as well as several European boats. So far as I know, the service from New York is excellent on all three, and food and comfort are all that could be desired. The trip from New York to Puerto Colombia requires about eleven days.

Arrived at Barranquilla, the first thing to be attended to is the passing of luggage and personal effects through the customs. Accommodations here are much better than down in the west coast ports of Peru and Chile, and, so far from meeting with hostility from the Colombian officials, I have found them to be thoroughly courteous, expediting matters as far as lay in their power. In general throughout the country, in fact, I was agreeably surprised, after what I had heard, to notice that the attitude of the people was decidedly friendly. In talking with several of the younger generation, from 20 to 30 years old, I frequently found them expressing a desire to go to the United States and see for themselves the results of an enterprise for which they express the most sincere admiration. It seems to be the idea of many of the leading business men to send their children here, after learning English in the Colombian schools. The result is that there is a great demand for English teachers.

Transfer to Steamer

After getting everything through the customs, your effects are transported on two wheeled carts over to your steamer on the 'dique.' This latter, named from the dock built upon it, is a small bayou or arm which runs from the Magdalena up to the city, and is deep enough for the passage of all river steamers. It is usually full of flat bottomed river boats of all sizes and conditions, loading and unloading coffee and merchandise of all sorts, hides, live stock, sugar, corn, and a multitude of other things, including the omnipresent banana, the staple food article of the country. Swarms of swarthy *cargadores* are scurrying here and there with their heavy loads upon their backs, and one can with difficulty walk without stepping on their bare feet.

The first question that confronts you is that of which boat you want to take. The express boats, sailing with the mail weekly for La Dorada, Girardot, and Bogota,

leave every Friday. Being ready to leave on a Monday, say, the average man prefers to take an intermediate steamer of that date, not caring to waste his time in waiting. As a result of his haste, especially if the river is low, he will find himself boating leisurely along the lower river, stopping every mile or two to take on a few cattle, or an old woman with a basket of eggs, and may eventually find himself stuck on a mudbank with his heavily cargoed boat, watching the express boat, which, though leaving four days later, comes direct stopping only when necessary to take on wood or deliver mail, flaunt merrily past him. For all upriver destinations, especially above La Dorada, it is much better to wait and take the express boats, as it saves time in the long run, and makes the trip even more comfortable.

River Travel.

The river steamers themselves are rather surprisingly comfortable, even the intermediates. The food, prepared in Colombian style, is appetizing, though of course one should keep away from the kitchen. Beds are simply canvas cots occupying about half of each stateroom. In addition to bedding, the traveller should always provide himself with a mosquito net to place over his cot; otherwise, sleep is wellnigh impossible on certain parts of the river. As the climate is so mild, bedding consists merely of two sheets.

The fuel supply on the lower river service is wood, cut by natives and piled along the banks at convenient intervals. Every boat carries a crew of cargo handlers, who bring the wood down the bank and across the gangplank on their shoulders, piling it up close to the boilers and fire box.

The interest attracted by one's fellow passengers is varied. There may be a bevy of convent bred girls accompanied by two or three sober faced sisters in their demure uniform of white and black; sombre robed priests with their flat crowned hats and well nourished bodies amble about the boat; young Colombian gallants, generously supplied with necktie and gorgeously arrayed of hosiery, twirl their inevitable mustaches with abandon. French, Spanish, and English are spoken on all sides, as well as a good deal of German, and the traveller who has even the rudiments of these languages at his command, can find plenty of opportunities to practice them.

We will suppose that the object of the expedition is to prospect one of the areas of dredgeable ground (of which, omitting discussion of gold content, there appear to be many) lying adjacent to one of the tributaries of the upper Magdalena. The most promising of these tributaries appear to flow east from the Cordillera Central toward the Magdalena. As most of them have small villages at their junction with the Magdalena, the method of procedure is about the same for any of them. The steamer will disembark you at any hour of the day or night that you happen to arrive, and the *cargadores* will unload your personal effects and your equipment, including your drill (in our case an Empire.)

You will then hunt up the principal merchant of the village (if you are wise, you will have a letter to him) and make arrangements to have yourself supplied with canoes and *coqus* (native boat handlers to transport your expedition up the river. Before making the trip with all hands and the cook, however, you will of course want to make a preliminary voyage to inspect the deposit generally and to pick out a camp site. This being done on the first day, or the first two or three days, if you have to go far up the river, you will, if you are wise, make a binding agreement with the aforesaid local dignitary as to just how much he is going to charge you for men, canoes, and whatever supplies he may furnish you with. Then you are prepared to start up river and make your camp.

The native Colombian canoe is a very convenient institution. It is a log dugout, tapering at both ends, and varying in diameter, or rather, width, from eighteen inches to three feet. It is propelled by from one to three natives (and, in the case of the larger canoes, or *champanas*, many more), with the use of long steel-shod poles, by means of which, keeping close to the banks, they propel the boat forward against the current alternately, the steering being done by one man with a paddle seated in the stern. When on account of creepers it becomes impossible to get close enough to the bank to use poles conveniently, or the flow of the current becomes too strong, the bow men drop their poles in the boat, and pick up paddles, crossing to the other side of the river and resume their poling.

All cargo is placed well down in the boat, to prevent capsizing (for these craft are, to say the least, cranky), and a surprising amount, for such frail craft, may be so stowed. A dugout canoe about 25 ft. long and 2½ ft. wide will easily hold a ton of freight as well as passengers, and will require three men to work it. The result is that camp supplies and a hand drill can be carried readily up all but the most torrential streams. After mule back trips through the Andes the Colombian canoe on the rivers is a welcome, if somewhat torrid, method of transportation.

Selecting a Camp Site

Arrived at the locality where you desire to start operations, you are confronted with the problem of where to place your camp. You will naturally desire to be in the shade of trees; yet if you get too far back from the river you will be bothered with vermin, ants, and insects of all kinds. The closer down to the river, the easier to get your water for all camp purposes; and yet, with a heavy rainstorm and a ten-foot raise in the river your whole camp may be flooded out. So it is merely a question of judgment and experience, after all. But it is while clearing a space for your camp, and stirring up a lot of aged leaf mold and rotted tropical wood, as well as cutting a way through the jungle for your drill, that you will begin to realize what a well populated country Colombia is—from the insect standpoint. Ants, small flies with a poisonous bite much larger than them-

selves *cahuns*, and mosquitoes, will hail your coming with joy and hasten to greet you. To all of this you will in time become accustomed, however.

Your camp once established and made livable, and your drill assembled for work, the first question to which you must turn your mind is labor. Being several miles away from the main highway of the Magdalena, it might seem that your difficulties would be increased; and, in a way, they are, as far as getting together a sufficient working force is concerned. On the other hand, this difficulty is more than compensated by the quality of the men that you do get. The cargo handlers that you will get from the little villages along the Magdalena are not accustomed to the steady grind of daily labor, and are mostly too lazy to make good workmen. In the little clearings in the interior, and among the ivory nut gatherers, who are mostly Antioquanians, you will find a hardier stock, much more trustworthy and teachable, and above the average South American laborer in intelligence. Furthermore, although all of them seem to be infected with malaria (a condition in which, if you are not unsparing in dosing yourself with quinine, the mosquitoes will soon put you yourself) it only attacks them intermittently, and is soon over with. A good supply of quinine and of purgatives is essential if you wish to keep them in good condition. Of course, in a place of this kind, remote from villages, it will be necessary for you to run a special camp for the purpose of boarding them.

MAP OF COLOMBIA.

Food and Supplies

Bananas and yucca are abundant in the little clearings up and down the river from you, and form the staple articles of diet. *Panela* (caked crude brown sugar), beans, rice, and tobacco you will have to bring up from the river. A meat ration, though rather costly, will help to keep your men with you, something of great advantage after you get them broken into the work. A camp of the sort described will cost about 30c. per day per man; and in addition, in this part of the country, wages will be 40 to 50c. gold per day, making the total cost for labor about 75 to 80c. per man.

Horses are hard to obtain in a country where all freighting is done by canoe; and furthermore they are absolutely unused to any kind of traction when you do get them, as they are used solely for packing. The result is that you will probably have to use man power for turning your drill. In deep holes this necessitates 8 men on the sweeps, whom you can interchange at intervals during the day with the 4 men on top of the drill, thus rendering the work a little easier and expediting it not a little. The Antioquanian is a fair mechanic, for a native, and soon learns just what you want him to do. He is usually cheerful and when he is not joking with his neighbor, tries to do the right thing. In handling this, as all labor in South America, one should continually remember that he is dealing with the intellects of children, and not expect too much. However, the engineer is not continually exasperated with the inefficiency and helplessness, as well as incorrigible laziness, of these people as he is, say, with the cheaper Peruvian labor of the Andes.

Cutting Trails

The country itself, at first sight, seems to be an impenetrable jungle. On commencing clearing operations, however, and cutting a way through for the drill, it does not look so formidable, and it is surprising how much ground can be cleared in a short time by a few natives, armed with their inevitable *machetes*. This latter tool, and the skill and speed with which they use it for every purpose imaginable, from building thatched huts to digging holes, is something of a revelation to one who has never seen it.

The larger trees are not too thick to interfere with the work, and their shade is often very grateful during the operation of drilling. For the most part their roots are all on top of the ground, which facilitates clearing immensely. Their interlocking branches are used as roads by the monkeys, who usually become very much interested in operations. Whole swarms of them will hang around the drill, scolding and roaring the while the men are working, and their actions are often very amusing.

These monkeys, especially the smaller ones (*micos*) are regarded among the natives as quite a delicacy, but naturally do not greatly appeal to a student of evolution. On the other hand, parrots and guacomayos are abundant and tough wild turkeys may be had if one cares to make the effort of hunting them—an effort which is well repaid in the enrichment of the bill of fare, and forms a welcome diversion for a few hours from the exacting work of careful drilling.

From a geological standpoint, this country is very simple. The underlying country rock is for the most part a very fine grained sandstone with limited areas of hard limestone which occasionally crops out in the rolling hills which divide the different river systems from one another in anticlinal folding. The meandering rivers turn forward and backward from one range of hills to another. There are few large boulders of country rock in the gravel, and a considerable proportion of soft sand and clay, especially in the lower reaches near the Magdalena. The gravel itself is rather easily worked from the dredging standpoint, being small and loose, with a very small proportion of clay except, as stated, within a mile or two of the main river.

Native Stream Testing

In many of these streams there is a small amount of flood gold on the surface which is yearly worked out by the natives with *bateas* whereupon another crop is deposited by the next season's floods. This gives rise to the idea that the gravel itself is rich enough for extensive working on a large mechanical scale; but this impression is apt to be misleading. Only careful prospecting will show whether the ground is worth while, and no attention should be paid to surface showings.

In considering operation in this country, the freight rates present a serious problem. Aside from the rehandling charges at Puerto Colombia and Barranquilla, and the excess rate of from 100 to 200% that is charged by the New York steamers and the Colombian railway for all pieces of machinery of great weight, there is a similar excess rate all the way up the Magdalena. If the property be above La Dorada, extra rehandling and excess on the railway will be charged. Aside from this, in case of operations on the upper reaches of any of these rivers, lighters and launches would have to be used. Present methods are expensive for operations on a large scale.

Proceeding up the Magdalena to La Dorada, the end of the lower river steamer line, the passenger transfers to the Ferrocarril de La Dorada, which runs almost parallel with the river to Ambalema, the principal towns on its line being Honda and Mariquita. These latter towns are very ancient, dating from colonial days, and derive most of their support from being the shipping points from the Magdalena over the Manizales trail to the Cauca River valley. A great deal of freight goes over this trail every day, the chief freight carriers, besides mules, horses, and burros, being steers. Looking back on the trail from the hills above Mariquita, the traveler sees an apparently never ending procession of these oxen, heavily laden with German packing cases, toiling patiently up the hill, urged on continually by the sharp cries of the drivers, but moving painfully slow.

An aerial tramway is now being constructed by an English company from Mariquita to Manizales, a distance of some 90 miles, which will upon its completion greatly expedite the handling of freight. The towers are of steel on concrete base, and will presumably be operated on the same system as the Bleichert.

Geology of the Country

A sharp change in the geological character of the country may be noticed immediately after leaving La Dorada. This change is probably responsible for the existence of the railway, as it renders the Magdalena more difficult of navigation. Flows of lava, dikes, and sills of porphyry (chiefly andesite and basalt), and batholiths of granite and diorite make sharp ridges where formerly there were low rolling hills. Also, the character of the vegetation changes accordingly. Where formerly there was nothing but thick jungle growth, now long plains of luxuriant grass are visible on all sides, and many little cultivated ranchos appear.

To the west of Mariquita rise the lower slopes of the Cordillera Central, which have been so heavily eroded that there is almost nothing left on top of the granodiorite which seems to be the chief underlying plutonic of the country. In this range, at Bocaneme, Fresno, and numerous other small settlements, there are small mines, chiefly of silver, with rather base ore. Although not what would be called a free gold country, there are nevertheless some placer mines, notably along the Rio Sucio, which empties into the Magdalena at Honda. In this connection one thing is apparent to the hydraulic miner. The granitic bedrock is so far decomposed underneath the gravel that if there is any heavy bedrock gold at all, it is necessary to wash from 5 to 12 ft. of absolutely worthless soft granite through the boxes in order to get it. This is a condition which I believe obtains only in tropical countries subject to violent atmospheric action and weathering.

Labor conditions here are even better from the operators' standpoint than they are farther down the river. The regular rate of pay is from 50 to 60c. per day, without board. And in this area I found the best, most efficient and industrious workers that I have yet seen in South America. How long this state of affairs will continue after the ropeways have opened up the country, and labor is more in demand I do not know; but at present a chance to work and make a little money seems to make a strong appeal to these people, and they work well.

While stopping at Mariquita, a party of young men from the Canal was encountered, who were engaged in preparing a 52-ton steam-shovel for a trip into the interior, where it was to be used for placer mining. What the prospects may have been for successful operation were of course unknown; but this machine, bought second-hand on the Zone for $4000 or $5000, by the time it was set up and ready to move into the interior, cost them two to three times that much. This is mentioned as corroborative evidence that early-day methods of the buccaneers of obtaining money have been improved by modern enterprise.

Leaving Mariquita, one takes the railroad again to Beltran or Ambalema, where connection is made with the smaller steamers of the upper river service on the Magdalena. In 24 hours one arrives at Girardot, a thriving little town of about 20,000 inhabitants, and the port of entry for Bogota, a day's journey away by railroad. A great deal of trading in hides and coffee is done from this point.

Here again the geological and physical characteristics of the country change. On the east, the mountains rise sharply for several thousand feet; but on the west side of the river is a wide, rolling plain, which grows more dry and arid as it extends from the Magdalena. Vegetation grows less and less, till, over on the tributaries of the Soldano river, one sees nothing but the parched dry grass of certain parts of the western United States. The country rock has changed from porphyry and granite to a very hard, indurated sandstone which is close to the surface and crops out in many spots, at times intermingled with a fresh water conglomerate.

Suddenly, however, you come to the sharp depression of the Soldano and its tributaries the Cucuana and the Ortega, which flow down from the now rolling foothills of the Cordillera Central. On either side of the former river the brown, dry hills give place to broad and verdant flats, covered with tropical vegetation. These flats have been worked by the Indians for hundreds of years with *bateas;* and more especially the higher ones of bench gravel, which run back into the hills. The gravel here appears more shallow than that lower down the Magdalena, however. It is also a little heavier.

Character of the Labor

The labor available is abundant, cheap, and of exasperatingly poor quality. Wages are 50 to 60c. per day. The natives are apparently less accustomed to hard work than the Antioquanians, and not anxious to become too accustomed. They are chiefly agricultural in their habits, raising a great deal of corn, bananas, and coffee. The principal means of transportation in getting their products to the market is by means of *balsas,* or light rafts, which they load heavily and manipulate by paddles down the river. Surprisingly large loads are handled this way; I having taken a complete Empire drill (previously packed in on muleback), two tents and a complete camp outfit, as well as five men, down the Soldano and Magdalena to Girardot on a raft which was far from being the largest procurable. It requires a fairly skilled pilot to handle one of these craft, as the river is narrow and swift in many places, as well as having many riffles. Several times on our trip down we passed whole groups of natives on the bank, engaged in repairing a wrecked *balsa* which had bumped against a point of rock and collapsed.

As yet, it is hard to make any definite statement as to the mining possibilities of this region, especially with regard to alluvial ground. As a whole, there are too

many silver and silver-lead mines in the region to characterize the country as a free gold country, as may be done in the portion farther west just over the Cordillera Central, and also still farther over, in the valley of the Atrato. On the other hand, the proportion of galena and copper sulphides is not high enough to characterize the country as base, the greater portion of the silver coming from stephanite and pyrargyrite ores, containing a considerable proportion of gold. Also, as more concrete evidence, there are, and have been for many centuries, alluvial mines in operation, with varying success. For this reason, until the country has been more thoroughly examined, and possibly developed, any statements of a wide general nature as to its possibilities should be avoided as far as possible.

With a light hand drill prospecting operations can be carried on under what are, for the tropics, rather favorable conditions, both with regard to labor and comparative freedom from fever. The gravel is for the most part light, the jungle growth is in no way a serious obstacle, and communication between one area and another is greatly facilitated by the abundance of waterways.

However, conditions for operation on a scale of any magnitude, especially from the standpoint of freight rates and rehandling as well as transportation up the shallower rivers, are such as to make it especially incumbent upon prospective operators to be sure of their ground first by thorough preliminary examination. The presence of a considerable quantity of fine gold near the surface of the gravel, which feathers out to nothing at depth, has been responsible for the wasting of a good deal of valuable time and money in tropical countries, and doubtless will continue to be. It should always be borne in mind that countries subject to sudden and extensive floods are deceptive in this regard. On the other hand, where the ground has been systematically and properly drilled by competent engineers, there is not much danger. Costs, even though excessive, can be figured beforehand; and recent figures on the output of the companies mentioned at the beginning of this article will give an idea as to their possibilities.

Something of the possibilities of placer mining in Colombia is indicated by the success of the Pato dredge which, after much delay, has now begun to make regular and satisfactory returns. The San Francisco property adjoining has been prospected and a second dredge is about to built on it.

FLINT PEBBLES worth $320,000 were imported into the United States from Denmark and France in 1913. In these countries the flint occurs as irregular nodules in chalk cliffs of the coasts. They are used for pottery work and in tube-mills. The supply is now interrupted on account of the war. Flints, which would have to be artificially rounded, occur near Austin, Texas; also rounded quartz pebbles in the valleys of many rivers draining regions of crystalline rock—for example, the Potomac near Washington, D. C.

Origin of the Diamond

Before the South African Association for the Advancement of Science, W. Johnson read a thoughtful paper on the origin and formation of the diamond, a subject that has often been discussed in the past, but one possessed of so much scientific interest that further examination of the problem is always worth recording. Mr. Johnson is reported in the *South African Mining Journal* as follows:

"My view of the matter is that graphite probably took no part in the formation of the diamonds at all, but that they were formed from another carbonaceous material before it had reached the stage of graphite. The factors determining whether a certain carbonaceous material should undergo a change to graphite or to diamond were a high pressure and a certain temperature, probably not very high, not higher, perhaps, than a low red heat. This view quite accords with the opinion expressed by Sir William Crookes years ago when he declared that the difference between graphite and diamond was probably a difference of pressure at the time of formation; that is to say, that other conditions being favorable certain carbonaceous substances undergoing metamorphosis might, if the pressure were sufficiently high, be transformed into diamond, whereas at a lower pressure they would be changed only into graphite. Such a view dispenses with a high temperature, and all the difficulties that attend the theory of the high-temperature formation of the diamond. It also accords with the fact that when the graphite that is found in the blue ground is examined it is seen to have the character of natural graphite. It still contains a small proportion of oxide of iron and silica like natural graphite, and reacts with strong sulphuric acid just as natural graphite does. * * * Regarding the different character of the diamonds, not only in different pipes and dikes, but also in different parts of one and the same pipe, the geologists up to and including Mr. Wagner very fully, and properly, have called special attention to it, and yet it does not seem to occur to them that it would be a very difficult matter to reconcile the fact that there are in some pipes, for instance, four or five different columns of kimberlite, each with different diamonds, with the supposition that all those columns came from a presumably white hot common centre of molten rock. Such differences are surely more likely to arise under conditions of igneous metamorphism than if all this vast rock magma in a white hot molten condition, and extending over hundreds of miles, were the proximate source of the materials filling the pipes."

MINERAL PRODUCTION of Maryland in 1913 was valued at $11,292,723, compared with $10,851,671 in 1912. Coal mining accounts for over 50%; clay products, 1.7%; and quarries, 9% of the total.

COKE OVENS in the state of New York number 555, supplied by coal from Pennsylvania.

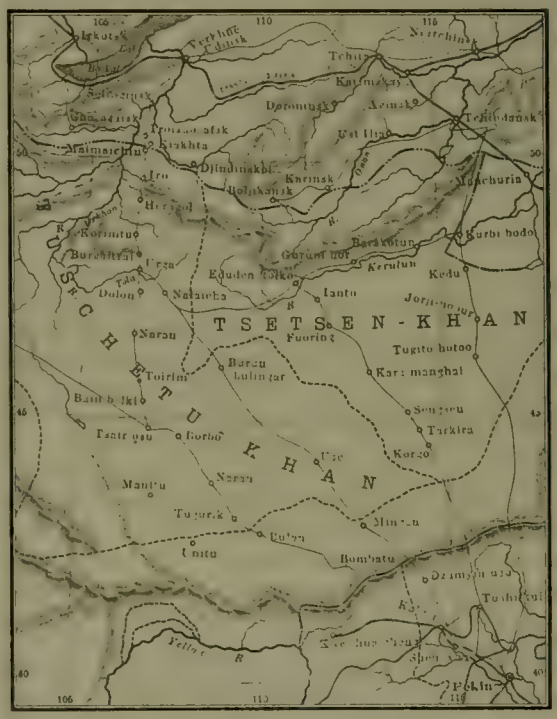
Gold Mining in Mongolia

A curious feature about the gold deposits of China is that they seem to occur mostly along her northern border. Gold occurs in limited amounts in many places throughout the Empire, but the most widespread and rich deposits occur along the Amur river, and on the west of it in Mongolia. The workings along the Amur river are very well known, as many English and American engineers have visited them and described the deposits and the methods of work pursued. One of the best of these descriptions is that by Chester W. Purington, which appeared in *The Mining Magazine*, January 1911.

An important district of which almost nothing is known is in north central Mongolia. Throughout this area there is a certain amount of native work, but the only large individual enterprise is that of the Mongolyor company. This is a Russian company which was organized by Baron von Grote, which has secured from the Chinese government a concession to prospect for a mine all the gold found in the two *aimaks*, or districts, of Tuschetu-khan and Tsetsen-khan. The directing of the work in Mongolia is now in the hands of I. V. Pokrovski. Some of the early development work was done by American engineers. The original proposal to use dredges and similar large scale work has proved impracticable and it is now being carried out along the lines familiar to Americans of an earlier generation. The log cabins of the native workmen are indeed strongly reminiscent of the old mining districts in the West. A lieutenant in the British army, C. G. Binsteed, has recently visited the district and the following is taken from his account of the work of the Company, published in the *Far Eastern Review*.

"The Company now works the following fields in the Iro River basin: Iro, Tologoika, Mogoi, Harganati, Narin-Harganati, Yalbik, Ulentoi, and Nikho, while outside the Iro basin work is carried on in the valleys of the Kudara, a tributary of the Chikoi in Mongolia, Tereltzi, tributary to the upper Kerulen, and Hera Gol at Tzo Modo. Prospecting, which is chiefly carried on during the winter, is being further extended in the Kerulen and Onon basins and southwest of Urga. Mr. Pokrovski himself hopes next year to reconnoitre the Onon and Uldza areas. The administration headquarters and head offices of the Company have just been moved to the Iro goldfield. These are connected by telephone with the other fields in the Iro basin, but the projected plan for a telephone line to Urga has not yet been realized. A map of the area from Kiakhta to Urga has already been partly made and is being completed. This survey will later be extended to the new areas in which it is hoped that gold will be found. A postal service connects the Iro headquarters with Urga. All the gold obtained by the Company is sent *via* Kiakhta and Russia to Belgian and French firms. The Russian government is a somewhat unsatisfactory purchaser for the reason that it refuses to pay on delivery for the total amount received; only consenting to pay for the nearest round number quantity in weight below what is actually delivered. As gold is very expensive compared to its weight, it often happens that large sums of money are left owing to the vendor until the next consignment of gold arrives. The Belgian and French firms, on the other hand, pay at once the exact price, and even at a somewhat higher rate than the Russian government, for the total amount delivered at each consignment.

"The Mongolyor company uses three methods for obtaining its gold. These are: (1) work by the Company



PART OF MONGOLIA.

itself by means of laborers hired by the day; (2) the lease of whole areas to capitalized organizations, who find all the necessary capital for exploitation, pay no rent, but are bound to sell all gold obtained to the Mongolyor company at rates from 24 to 27 rubles per Chinese liang of weight ($10 to $12.50 per troy ounce); (3) lease of small areas to minor combinations of laborers who are provided by the Company with the necessary equipment and are bound to sell all gold to it for about 24 rubles per liang ($10 per ounce). To its own day laborers the Company pays a daily wage of 1 ruble (51½c.) to Russians, and 0.80 rubles (41¼c.) to Chinese. The Company is now instituting more modern methods with machinery and horse traction for the earth carts. Inspectors are appointed to prevent any stealing of gold by day laborers or by the minor lessees of areas. Sealed dredges are also used for the purpose. All workers on the mines pay to the Mongol government

a tax of 1 ruble per head per month for the right to work in the fields, in exchange for which they receive a form of passport.

"On the whole, Chinese still predominate somewhat in the goldfields, though large numbers have departed recently, partly owing to the disabilities imposed upon them by the Mongol government, partly because of new regulations by the Company, whereby, instead of receiving a modicum of food during the winter, they are now left to find a livelihood for themselves, and partly owing to the great recrudescence of brigandage in the neighborhood. The latter circumstance accounts for the departure of very large numbers not only of Chinese but also of Russian workers from the goldfields. This summer brigandage became so bad that about 100 Russian soldiers from Kiakhta were sent into the area and were distributed from the Khangai range northwest of Kornakovka eastward to the Iro goldfield. The increase of brigandage is itself chiefly due to the fact that now numbers of Chinese are left without means of livelihood during the winter."

The following figures give the approximate yearly find of gold in the Mongolyor fields:

1901-1908	average	$120,000
1908-1909	"	773,000
1910	"	1,306,300
1911	"	1,306,300

The yearly profits of the Company were as follows:

1907-1908	$8,000
1908-1909	88,000
1910	192,000
1911	175,000

Auto-Reduction in the Precipitation of Metallic Gold

By VICTOR LENHER

*In the various studies which have been made on the precipitation of gold from solution, attention has been directed for the most part to the action of various reducing agents on gold solutions. The general chemical inactivity of gold enables us to deposit the metal in elementary form by most of the metals, the metallic sulphides, ferrous salts, various organic compounds, and, in fact, in the ordinary sense of the word, gold compounds are readily reduced to metal by the mildest of reducing agents. On the other hand, very little attention has been directed to the precipitation of gold in the metallic condition by oxidizing agents. A few isolated cases of the auto-reduction of gold from its compounds by certain oxidizing agents have been recorded, but the general principle of the auto-reduction of gold compounds has not received systematic study from the standpoint of the deposition of gold.

It has been known for a long time that hydrogen peroxide, when brought in contact with oxide of gold or oxide of silver, will reduce either of these metallic oxides to metal; water and oxygen being formed simultaneously.

$$Au_2O_3 + 3H_2O_2 = 2Au + 3H_2O + 3O_2.$$
$$Ag_2O + H_2O_2 = 2Ag + H_2O + O_2$$

In a similar manner, gold solutions in contact with hydrogen peroxide yield metallic gold, oxygen being evolved at the same time. This reaction of hydrogen peroxide with gold compounds takes place in either acid or alkaline solution. Sodium peroxide and sodium perborate precipitate metallic gold immediately from gold solutions. Barium peroxide and calcium peroxide act toward gold solutions in exactly the same way, precipitating metallic gold at once. These compounds are perhaps closely related to hydrogen peroxide and, as a consequence, act similarly toward gold solutions. Osmium tetroxide, or the so-called osmic acid (OsO_4), when dissolved in water will not reduce gold solutions, but when the free acid is neutralized, or when the solution is made alkaline with sodium hydroxide, sodium carbonate, or calcium carbonate, metallic gold is precipitated. The higher oxides of nickel and cobalt, prepared by the action of an alkaline hypobromite on solutions of nickel and cobalt chloride, when brought in contact with a solution of gold which has been rendered alkaline, precipitate metallic gold.

Lead peroxide, as well as red lead, precipitates metallic gold from either neutral or alkaline gold solutions. Ceric oxide, prepared in the hydrated form by rendering ceric chloride alkaline, precipitates metallic gold at once from a gold solution which has been rendered alkaline. The compounds of manganese present interesting deportment along this same general line of auto-reduction. Manganese dioxide, prepared by the action of bromine on a manganese acetate solution, precipitates gold from its solution either under slightly acid, neutral, or alkaline conditions. Potassium permanganate, on being allowed to stand for some time with auric chloride, causes metallic gold to be precipitated along with manganese dioxide. The minerals pyrolusite, wad, braunite, and manganite, when brought in contact with a gold solution, which is either acid, alkaline, or neutral, slowly cause gold to deposit.

Recently Brokaw[1] has shown that manganese salts, when made alkaline, or even manganese carbonate will precipitate gold from solution. The direction of the reaction between manganous salts and gold chloride is considered by Brokaw to be largely due to hydrolysis of gold chloride solutions, although the equations, as given, show that gold chloride and manganous salts react in neutral solution to form manganese dioxide and metallic gold. All of the reactions recorded by Brokaw have been

*From the *Jour.* Amer. Chem. Society.

[1] *Jour. Eng. Ind. Chem.*, 5, 560 (1913).

studied and corroborated. That manganese can be of considerable importance in the deposition of gold is unquestionably true, and its function may be that which Brokaw has suggested; but, in addition, manganese may play the rôle of a reducing agent, acting solely through auto-reduction.

Auric compounds, as is well known, are easily reduced to metallic gold, and, hence, can be considered as oxidizing agents and can, obviously, oxidize manganous hydroxide to manganese dioxide. It can therefore be considered that the mutual precipitation of gold and manganese dioxide by calcite, as cited by Brokaw, is simply the neutralization of the excess of acid, whereupon the oxidation of the manganese by the gold solution results in the precipitation of both manganese dioxide and metallic gold.

That this is the direction of the reaction is evidenced by the duplication of the phenomenon by replacing manganese salts with cerium compounds. Cerous hydroxide precipitates metallic gold in alkaline solution; the cerium being at the same time oxidized to cerium dioxide. Similarly, when a piece of calcite is introduced into a solution of cerium chloride and gold chloride, as the free acid is neutralized by the calcium carbonate a deposit of cerium dioxide containing metallic gold begins to form on the calcite.

The presence of gold in the manganese deposits, which has been studied by Emmons,[2] may be due to the fact that manganese is a significant agent in the superficial transportation of gold; but such is by no means necessarily the case. Two distinctly different kinds of reactions may be going on. In one case a chloride solution, containing free acid, on coming in contact with an oxidized manganese deposit will produce free chlorine, or its equivalent. This chlorine solution can then dissolve gold and cause the production of a gold-bearing manganese solution, which, so long as it contains considerable free acid, is quite permanent; but, when it comes in contact with any neutralizing agency, for example, limestone, metallic gold and manganese dioxide would be at once precipitated. This accords with experiments which have been reproduced in the laboratory, and which do not, as indicated by Emmons, require such a reducing agent as ferrous sulphate or other reducing agents as indicated by Wells,[3] to produce a precipitate. On the other hand, the gold present in the manganese deposits adjacent to other gold deposits may be due wholly to the fact that gold solutions in contact with manganese dioxide yield metallic gold, by virtue of the principle of auto-reduction shown by other peroxides with gold solutions. The auto-reduction of gold solutions to metallic gold has apparently, thus far, not been considered as an important geological factor in the secondary deposition of gold, but it is doubtless possible that in many instances one can conceive of the oxygen of the air as being the real agent which causes the gold to be reduced in presence of a manganese or similar compound which acts as a catalytic agent.

[2]Emmons, *Trans.* Am. Inst. Min. Eng., 1910, 768.
[3]*Trans.* Am. Inst Min. Eng., 1910, 793.

Estimating Arsenic in Ores

By BASIL G. DUNSTAN

This may be termed a general method, and is as follows: Weigh out from 1 to 5 gm. of ore, add 10 c.c. of tartaric acid solution and 15 c.c. strong nitric acid, cover the beaker and heat until the ore is decomposed, add 20 c.c. 1:1 sulphuric acid, cover and boil until all nitric acid is driven off. This is evidenced by a sudden rush of red fume toward the finish. When this occurs heat for half a minute longer. No charring of the tartaric acid should take place. Allow to cool, and dilute to about 50 c.c. with warm water, cool, filter, and wash the precipitate twice with warm water.

To the filtrate add about half a gram of sodium sulphite, and boil down to 50 c.c.; this completely reduces the arsenic and expels all sulphur dioxide.

To the cold solution in the flask add 100 c.c. strong hydrochloric acid, and saturate with sulphuretted hydrogen, usually about 5 to 10 minutes. Filter off the precipitated sulphides and wash twice with cold 1:1 hydrochloric acid, and twice with cold water.

Wash the precipitated sulphides off the filter paper into a small beaker, decanting back through the filter any excess of water. Dissolve the portion adhering to the filter with the mixture of one part strong ammonia and one part hydrogen peroxide, allowing it to run through into the beaker containing the rest of the precipitate. Boil the solution to effect complete solution and oxidation of the arsenious sulphide, filter if necessary, and boil down to 10 to 20 c.c. Cool, and add 10 c.c. strong ammonia. Cool and add gradually 5 to 10 c.c. magnesia mixture, stirring continually for about 5 minutes; and allow to stand over night.

The precipitated ammonium magnesium arsenate is filtered off through a previously ignited and weighed alundum filtering crucible, and washed three times with ammonia water (3 parts water to 1 part ammonia). Dry in water oven and ignite over the blowpipe for 10 minutes, cool and weigh as $Mg_2As_2O_7$.

The tartaric acid solution is made by dissolving 400 gm. tartaric acid in 400 c.c. water, and adding 400 c.c. strong nitric acid.

Magnesia mixture: take 110 gm. magnesium chloride and 140 gm. ammonium chloride and dissolve in 1300 c.c. water.—*The Chemist Analyst.*

UNDEVELOPED DEPOSITS of barytes occur in Mariposa county, California; Clark, Elko, Mineral, and Nye counties, Nevada; Blaine county, Idaho; and in Alaska. In 1913 the output of the United States was 45,298 tons worth $3.45 per ton. Imports were 35,840 tons worth $1.71 per ton. The European war has cut off foreign supplies, which should direct attention to domestic sources of this mineral.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Rand Banket

Reply to E. T. Mellor's Discussion

I was much interested to learn that E. T. Mellor had commenced his geological survey of the Witwatersrand district with inclinations toward the infiltration theory of the origin of the gold in the banket; but, that after four years' study he considers his investigations have not furnished any evidence in favor of that view, and that he claims to have met with much evidence in favor of a placer origin, in addition to that already advanced by advocates of this latter theory.

This is the opposite of what occurred in my own case. I was at first impressed with the seeming simplicity of the placer theory; but, my study of the deposits during my underground work in the mines and my comparison of them with deposits with which I was familiar in other parts of the world soon led me to abandon this theory as untenable, and after more than ten years' study, I consider that these auriferous conglomerates are merely an abnormal type of lode deposit.

Being acquainted with the silver-lead deposits of Przibram in Bohemia, I am able to appreciate Posepny's words in regard to them, and as I think these also apply in a great measure to the Rand, I quoted them in my paper; and it may not be amiss to do so again now. Posepny remarked,[1] "If we imagine ourselves standing in the deep region in front of the profile of an ore lode like the Adalbert at Przibram, for instance, 1110 m. (3600 ft.) below the surface and 564 m. (1850 ft.) below sea-level, we perceive a fissure-space of discission, filled with symmetric mineral crusts, chiefly argentiferous lead sulphide. Remembering that this filling has been stoped continuously to the surface we can find no other satisfactory explanation than the hypothesis that it was brought up from still greater depths, and, in view of the comparative insolubility and the large quantity of the metallic sulphide here accumulated, it must have been deposited from perpetually renewed, and, therefore, from *ascending*, mineral solutions. Whoever has had opportunity to study an ore lode in the deep regions can conceive no other explanation. The miners themselves have always held this opinion, they have all been *ascensionists*."

I arrived at my conclusions as to the origin of the gold in the bankets by inductive reasoning from my study and observations, underground, of the lodes themselves. To the geologist, doing his work almost entirely above ground, the placer theory is doubtless attractive; but, to the mining engineer studying these deposits in the mines the lode theory certainly seems the more rational one.

As stated in my paper, De Launay emphasized the fact that in a placer deposit a fall in the gold contents was to be expected as distance was gained from the former shore line; and, T. A. Rickard in his discussion pointed out that in the case of the Nome placer deposit the total distance, at right angles to the old shore line, over which the gold occurred, was at most only 100 ft. It will need a vast amount of ingenuity on the part of the placer theorist to reconcile merely this one fact with the wonderful persistence in depth of the mineralization of the banket.

I quite agree with Mr. Mellor that there has been considerable local re-distribution of the gold contents of the reefs. I pointed out that the zone of secondary enrichment extended beyond the bottom of the oxidized zone. Such secondary enrichment is a common feature of lodes.

As regards the influence of dikes, it seems to me to be no argument against the important part that they have played, that there are many which do not appear to be associated with specially rich portions of the banket; nor does it detract from the important significance of the fact that the big longitudinal, or strike, dikes contain gold.

I shall await with great interest the arguments that Mr. Mellor shortly intends to advance in favor of the placer theory of the origin of the gold.

C. B. Horwood.

London, June 1.

[1] "The Genesis of Ore-Deposits," by F. Posepny, published by the Amer. Inst. Min. Eng., 2nd ed. 1902). p. 56.

Application of Flotation to Gold Ores

The Editor:

Sir—I have just seen the reference to this subject in your issue of June 27. As a matter of record, your readers may be interested to know that the 'Elmore' flotation process has been at work on this mine for about 12 or 13 years. Both the original process of Messrs. Elmore and their later improvement, the vacuum process, have given highly satisfactory results. The vacuum process has been in continuous operation for a number of years and is still being used. The average value of the ore treated is about: copper, 1 to 1.25%; gold, 1.5 to 2 dwt. per ton of 2240 lb.; silver, 0.5 to 0.75 oz. per ton of 2240 lb. It will be recognized what excellent

work is being done by the Elmore process when I say that profits are made on treating ore of the above grade, after paying mining, development, milling, road transport of five miles, rail transport of about 100 miles to smelter, smelting charges, debenture interest, administration charges, London office, and all other expenses. There is milled about 80 tons per day of 24 hours.

The working costs of the Elmore process are low because coarse crushing (about 20 mesh), compared to the 80 to 100 mesh required by other flotation processes, is permissible, and the Elmore concentrate being granular and coarse, does not require any filter press or other artificial means of drying, and is not liable to be carried into the furnace flues in subsequent smelting. This is certainly the earliest application of flotation concentration to auriferous and argentiferous copper ores, and antedates by several years those mentioned in your note.

Dolgelley, Wales, July 17. JOHN BEVAN.

Juga Estimates

The Editor:

Sir—I notice in your issue of May 30 certain comments by your London correspondent concerning the estimates of engineers connected with the Juga (Nigeria) Tin and Power Co., Ltd., and a closing remark that they may have some explanation or answer to give in regard to the discrepancies between the reports.

In November 1912 I furnished the Company with a report giving the total tin content of the areas at one-fifth of that estimated by their consulting engineer, C. G. Lush, but they ignored the discrepancy. In fact, they considered my report pessimistic and relieved me of the management, stating at the time that they considered the areas required an expert in gravel pumping, and that they could then secure one. They have not stated the result of that expert's term of office, nor have they informed the shareholders that the sampler on whose work the greater part of my estimate is founded, had offered to return to Nigeria at his own expense and re-sample the mine provided the Company sent an independent engineer to view the work. I reminded the chairman of this fact two days before the general meeting, but still it was left unmentioned, and they did not avail themselves of it. Neither did they pursue an intention of twelve months earlier sending one of their own board, himself a mining engineer, to examine the mine. In expectation of this latter visit, I have refrained from making any comment. The difference between the reports of the consulting engineer and myself was ample justification for the board to call in other advice two years ago.

I gave what I consider the contents of the ground, and at the same time advised the directors that they could not run the machinery more than five months of the year. The output for the remainder of the year would have to depend on 'calabashing.' Much was made by the chairman of the fact that I did not accept an invitation to visit the mine when Mr. Hunter was there. I was prepared to return and justify my report in February 1913, but could not do so nearly a year later when I was in the service of another company and unable to get away.

Naraguta, Nigeria, July 25. A. W. HOOKE.

[We are glad to give publicity to this explanation. Our sympathies are strongly with the engineer whose estimates are withheld because they do not confirm those of the promoters, and we are confirmed in our belief that choosing a client, like picking your grandfather, is a delicate matter.—EDITOR.]

Real Estate in London

The Editor:

Sir—Your story in the issue of August 1 about the American visitor who was astonished at the Englishman being willing to maintain a little-visited museum in the heart of a district where land is valuable can be more than matched by an example visible from the office of *The Mining Magazine*. The American in your anecdote wondered that we could afford to devote land in a central district to the Museum of Practical Geology in Piccadilly, seeing that the galleries are as a rule absolutely deserted. But the Museum fills its functions. If it is not always crowded with sightseers, it affords the much-cherished opportunity to the genuine student, and the staff renders invaluable aid to all genuine enquirers on mineralogical and petrological subjects. The museum may therefore be said to fully earn its rent.

Now for my own example of London liberality. Salisbury House forms one of the quadrants of Finsbury Circus. The adjoining quadrant consists of London Wall Buildings. On the northern side is the building of the Institution of Mining and Metallurgy, the London Institution, and Broad Street Place. In the centre of the Circus is a garden of oval shape and covering exactly two acres. Here we find plane-trees, sycamores, aspens, fig-trees, lilacs, and hawthorns, flanking a velvety lawn of the greenest grass, in which are flower beds containing masses of fuchsias and scarlet geraniums, with wild flowers such as iris and willow-herb. The western corner is reserved for the use of children. Here is a playground and a sand-pit. Though in the centre of the richest city of the world, there are no rich children to play in this sand-pit. It is occupied by and is for the benefit of children in poor circumstances, the children from the humble streets adjoining City Road, and the children of the housekeepers who protect the mighty palaces of commerce during the night time and the week-end. Here is a quarter of an acre of ground worth I don't know how many millions devoted exclusively to poor children. Many a time have I drawn the American visitor to my window and shown him the merry crowd of shouting children in the sand-pit under the trees, and have told him the story as I am telling it to you now. The invariable comment is: "Gee! but it's a great country, is England!"

London, August 17. EDWARD WALKER.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

THE FINENESS of the Mexican peso is 902.7 parts per thousand, as against 900 for the American dollar, and 925 for the English shilling.

BULLION SCALES are not always available. To convert avoirdupois pounds into troy ounces, multiply by 14.585. To convert kilos into troy ounces, multiply by 32.154.

SILVER may be alloyed with aluminum to produce a white mixture capable of taking a high polish, and of offering considerable resistance to the oxidizing effects of the atmosphere.

THE INTERNATIONAL LEAD REFINERY at East Chicago has a capacity of 5000 tons of metal in 25 days per month, producing common lead, corroding lead, antimonial lead, and doré bullion.

RHODESIA is essentially a country for the small owner. Out of about one hundred and eighty producing mines, over one hundred are milling an average of less than five hundred tons per month.

A MANAGER of a dry-crushing mill has the men sweep the plant with brooms every morning. He states that it costs him nothing in the way of wages, as it requires only a few minutes' time on the part of each man to clean up his particular department. This manager says it not only helps to keep down the dust, but improves working conditions, and results in greater accomplishments on the part of the men. He says they are more energetic and more careful when working in fairly clean surroundings.

RACKS should be provided for the storage of slings and other hoisting accessories about mines. The equipment can thus be more readily located, floor space is saved, and stumbling accidents prevented. In foundries, molten metal is apt to spill on slings if they lie about; this has a tendency to erode and weaken them, and further damage is done in the attempt to forcibly remove the spilled metal. Moreover, they are likely to be bruised, hard to find, and are more susceptible to rust when lying upon the floor.

CELESTITE, strontium sulphide, has at present no market. A very small amount of this material is used in connection with fireworks, but the quantity is so limited that it is not important. Celestite is used in connection with sugar making, and the supply comes from England. American plants, however, arrange to use lime instead, and unless some sugar company could be persuaded to take up the matter and change its process, it is difficult to see how miners could get into the trade. Lime, of course, is very cheap and they would have to be prepared to meet competition at low prices.

SINKING DRIVING, AND RAISING proved that the value of ore indicated by diamond-drilling at Ajo, Arizona, was very accurate. The channel samples of test pits in carbonate ore averaged 0.005% lower than corresponding diamond-drill samples; the test pits and raises in sulphide ore averaged 0.05% lower than corresponding diamond-drill samples; and the drifts in sulphide ore averaged 0.26% higher than the assay value of blocks of ore through which the drifts were driven, as indicated by drill holes at the corners of the blocks. In making the ore estimate, diamond-drill samples were accepted wherever drilling was done, and channel samples of test pits were accepted where sinking was done in advance of drilling.

THE BEST RATIO OF FLUXES to be used with any particular cyanide precipitate is best determined by taking a number of assay crucibles and packing these in the melting furnace, as for assaying. Several weighings of equal amounts of precipitate are then made and fluxed with varying proportions of fluxes and oxidizers. These are then wrapped in thin paper cones and melted in the ordinary way. The time taken for complete fusion should be noticed in each case. After pouring, the slag should be examined, and if necessary assayed for beads of shot, the fluidity of the charge having been noted in each case at the time of pouring. The metal produced from the several tests is weighed and roughly assayed, the fluxes used to obtain the best results being noted for future reference.

THE INACCESSIBILITY of a large number of mining properties complicates the engineering side of the question of mill design. Where mules are the only means of transport, the weight of machinery parts must be restricted to a minimum, and must be sectionalized al most every piece of mine equipment. In some cases this means nothing more than an increase in the initial cost of the machinery. In other cases it means a considerable loss in efficiency when the machine is in operation. Some machines sectionalize well and are thoroughly efficient when erected; others are failures. Again, some machines sectionalize so that freight charges are normal, and the parts make convenient *cargas;* others sectionalize badly and transport costs are out of all proportion to the increase in weight of individual pieces. The weight and shape of wearing parts sometimes make running costs abnormally high.

MINING IN THE FAR NORTH*

The Koyukuk Mining District

By EMIL EDWARD HURJA

With a position farther north than any of the other northern mining districts, the Koyukuk has a higher per capita gold output than any other camp in Alaska. Recent finds made on Hammond river, in deeper gravels than any worked heretofore, have drawn the attention of prospectors and mining men throughout the North to it. There is a natural tendency among the men of the Koyukuk to look with disfavor upon any influx of outsiders. Because of its remoteness and difficulty of access, the district has had an even population for many years. Gold dust still is largely the medium of exchange.

Placer gold was first found in the Koyukuk between 1885 and 1890, when prospectors from the Yukon did some work on smaller tributaries. Gold to the extent of $4000 was mined on Hughes and Florence bars. Nearly all of the tributaries of the Koyukuk in the headwaters have been partly prospected, but on the tributaries of the middle fork the most work has been done. Placer mining is most uncertain in the Koyukuk, because of the character of the ground. Hammond river, in particular, is of interest because of the recent discoveries there. Big boulders offer the greatest hindrance to underground mining, drifts on bedrock being run according to the position and size of the boulders. The high cost of transportation has been the greatest factor in the slow development of the district.

The Koyukuk district is considered to embrace all the land drained by the north, middle, and south forks of the Koyukuk river, lying approximately between 65 and 68° north latitude and 149 and 150° 50′ west longitude, and covering an area of about 4000 square miles. On Chapman creek, tributary to the middle fork, considerable work has been done in years gone by. The stream empties into the middle fork about one-fourth mile above Tramway bar, one of the earliest sources of placer gold in the district. Twelvemile, Rose, Porcupine, Slate, and Myrtle creeks, all tributary to the middle fork, have been prospected, and some of them have even produced some gold. Myrtle creek, with its wide deposit of shallow gravels, has been worked nearly every summer. A small hydraulic plant operated there for a year or two. Emma creek is said to have produced nearly $200,000 from 1900 to 1910, but very little work has been done since that time. Des-

*[Previous articles in this series by Mr. Hurja on mining in Alaska and the Yukon have been 'Mining Revival in the Ketchikan District, Alaska,' July 4; 'Wrangell, Alaska,' special correspondence, July 11; 'Developments of the Alaska Gold Mines Co.,' July 18; 'Juneau, Alaska,' special correspondence, July 25; 'Cordova, Alaska,' special correspondence, August 8; 'Valdez and Prince William Sound,' August 15; 'Seward and the Kenai Peninsula,' August 29. Mr. Hurja in subsequent letters will give full accounts of present conditions in each of the great producing districts of the Far North.—EDITOR.]

SCOWING ON THE KOYUKUK.

ultory prospecting has been carried on during the past few years. On Wiseman creek, a tributary of the middle fork above the town of Coldfoot, what are probably the deepest placer shafts in Alaska have been put down without success. One is 280 and another 335 ft. in depth. Nolan creek has produced many thousands in gold, but very little work is being done there now.

Hammond creek or river is 45 miles long. It is a tributary of the middle fork from the northwest. The first rush to the Koyukuk because of the Hammond River finds was in 1900, and the second and lesser one in 1911. John Boman and S. Schofield, on 4 Above, last winter mined a dump estimated at $40,000. During a short space of time early this spring, they picked up in the bottom of their shaft $24,000 more in coarse gold. The 'pay' is from seven to eight feet in height, and $100 pans are not uncommon. Redmond, Murray, & Kinney have a lay on the ground above, but are having some trouble prospecting it because of the water. It is costing the laymen $30 per foot to work the ground. The Halser ground, farther downstream, is being worked by Knute Elingsen, F. Wilson, and Jack Halser. An average of $100 per day was picked up in nuggets on bedrock this spring. Vernon Watts, on his property, found gold in his second hole and in one day picked up $400. Cassiar Jim has found paydirt in a prospect hole back of Hasting's messhouse. Plummer has purchased the interest of Harry Foley in the Peter Dow ground, downstream from the Bowker brothers' holdings. Plummer lost $8000 by his season's work.

On Vermont creek, some work is going on. Gold creek is somewhat active, Johnson & Latimore, and Thompson & Buttovich having found workable 'pay' during the winter. They were starting to sluice their dumps early in July. Hughes and associates have found 'pay' on Linda creek. A shaft sunk by James Brandon and partners on Jim Pup, a tributary of California creek, yielded $559 from the bottom. Collins & Dingel sank a hole at Wiseman and reached bedrock at a depth of 267 ft. At the 235-ft. depth, they found 5 ft. of sc. gravel and have now started a level there with the intention of working this. James Tobin put down a 227-ft. hole on Bettles river, an eastern branch of the middle fork, but found no bedrock. Gold bench, of the south fork of the river, is deserted now. It has produced about $150,000. Prospecting on the north fork of the Koyukuk is centred on Mascot creek, Wild river, and John river. Nothing of great import has been found so far. Coldfoot, at the mouth of Slate creek, until 1904 was the supply centre of the mining district. Then it was moved upstream 16 miles to Wiseman, where the United States commissioners, deputy marshal's offices, the postoffice, and stores are.

Bettles is the head of navigation on the Koyukuk river, 515 miles from the Yukon. At a high stage of water steamboats travel with freight and passengers as far as Bettles. From there to Wiseman, 85 miles farther upstream, the stream is narrow and shallow, and horses are necessary to pull the loaded barges over the bars. There is some agriculture near Coldfoot and Wiseman, despite the fact that it is from 60 to 75 miles north of the Arctic Circle.

The Koyukuk district has been assisted less by outside capital than any district of Alaska. Its population is kept down because every person in the district has to work, and there is work for but a very limited number of men. There are probably 200 miners in the district now. The production in 1913 is estimated at $200,000; the season was backward because of the late winter and the consequent lack of water for sluicing purposes. The total production of the camp from 1900 to date is estimated at $2,894,300. The gold is of a very high grade, being worth from $18 to $20. Nuggets are common, chunks weighing from $50 to $1500 having been found. About 50% of the total output has been paid out in production costs. Equipment in the Koyukuk is nearly all of the patchwork variety, made up of odds and ends of machinery. Ordinary manual labor is paid from $4 to $6 per day, with food, which costs from $3 to $5 per day per man, depending upon the district. The annual outfit for a miner in the Koyukuk district is estimated to cost $1000. Steamers of the White Pass company make two trips to Bettles each summer. In winter, two trails are used, one by way of the Chandlar and the other by the Tanana. Freight rates from Seattle to Bettles are from 4 to 6 cents per pound, and from Bettles to Wiseman from 6 to 8c. per pound, or a through rate from the outside of from $200 to $280 per ton.

The Koyukuk region has been described by A. G. Maddren in *Bulletin* 532 of the United States Geological Survey. The first studies made in the district were those of F. C. Schrader, whose report was published in 1899. The northern part extends into the Endicott mountains, which form the watershed between the Yukon and the Arctic drainage. The southern part consists of the Koyukuk flats, a broad basin lowland. The crest line of the mountains is about 6000 ft. above sea-level, but peaks rise to 9000 ft. The mountains consist of altered Paleozoic limestones and Argillites.

HAMMOND RIVER GOLD CLAIMS.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

HOUGHTON, MICHIGAN

CURTAILMENT OF OPERATIONS AND REDUCTION IN WAGES AND SALARIES.—TAMARACK REGRINDING PLANT.—WHITE PINE PROPERTY.—TAILING TREATMENT.—CENTRAL PORTION OF DISTRICT.

The effects of the European war upon the Michigan copper industry are now beginning to be more seriously felt. If the war is continued for any length of time, Michigan miners will face a graver situation this coming winter than they experienced during the strike of last year. A great many of the men have not recovered from their losses of that period, and with the additional curtailment of operations in the district, they certainly have before them a most serious situation. While suspensions and curtailments of operations were announced early in August, Michigan so far has not suffered as seriously as the western districts. On August 6 the Winona property was shut down. That this action was necessitated was deeply regretted by the people of the copper country, in view of the fact that successful experiments have recently been completed with a new regrinding machine, and a leaching process was also under consideration. The following day operations were temporarily suspended at the Hancock Consolidated. This property had just reached a point where it was paying expenses, and work will be resumed as soon as possible. On August 15 the Baltic, Champion, and Trimountain mines, of the Copper Range Consolidated, were closed. It was announced at that time that the properties would reopen September 1, and continue operating on full time until September 15, when they would suspend work again until October 1. It was also stated that the pay of miners and trammers and all other employees would be reduced. A curtailment of the production of the Calumet & Hecla properties has been expected for some time. Beginning September 1, all the mines, mills, and smelters of this company will be operated three-quarter time, and the rate of wages existing immediately prior to May 1, 1912, when an increase of 10% was given the men, will become effective. A reduction of 15% in the pay of the officers and all those not affected by the increase of May 1, 1912, will be made. A similar reduction will be made in the pay of all officers and employees of the Boston and New York offices. Work on the leaching plant and the new regrinding mill for the stamp sand has been suspended, but the dredge is nearly ready for operation. It is expected that on September 1, the Quincy will order a 50% curtailment of production. A decrease in pay of 12½%, beginning on the above date, has been announced. The Tamarack has suspended work at its two operating shafts, but work on the new regrinding plant at Hubbell is being continued.

In the latter part of April, directors of the Tamarack voted to proceed immediately with the construction of a regrinding and leaching plant for the treatment of the large pile of stamp sand at the mill on Torch lake. The construction of the concrete foundation of this plant is now under way. The Tamarack sand has been accumulating for about 30 years and represents a tonnage of about 11,000,000. It contains about 12½ lb. copper per ton. It has been estimated that by the new process of regrinding and leaching, 9 lb. per ton can be recovered at a cost of about 6c. per pound. This shows a total profit of about $8,000,000. Until recently all the Calumet & Hecla smelter product that was treated electrolytically had to be shipped to its plant at Buffalo, New York. This eastern plant has been disposed of and the copper is now treated at a recently erected model electrolytic refinery at Hubbell.

At the extreme southern end of the district, the C. & H.'s White Pine claims are now making a success of mining the Nonesuch sandstone on property which was tested over 30 years ago. Ever since the C. & H. took up this property some five years ago, successful exploration work has been carried on. Four shafts have been sunk and three are being operated. About 100 acres of land has been cleared on which the Company has erected more than 30 buildings. A sawmill is in operation which turns out 12,000 ft. of lumber per day. Within a year the Company expects to have completed a modern and well equipped mill on the Mineral river. An electric generator will furnish power for 2 gyratory crushers, 64 Wilfley tables, and 12 conical mills. The water for the mill will be supplied by an electric pump a mile west on Iron river. The success of the White Pine is of great interest to the people of the copper country in that it opens up for profitable development a large area of unexplored land at the southern end of the district. At the northern end of the district, near Phoenix, the Keweenaw Copper Co. is actively exploring by diamond-drilling and shaft sinking, the old Ashbed lode. The shaft is now being sunk on the site of an old hole put down some 50 years ago. If, as a result of this revived interest, the Ashbed lode should prove profitable on deeper exploration, the two sections of the district where copper was first mined, one at the north and the other at the south, will again be producing.

Regrinding Hardinge conical mills have been in successful operation for some time at the Copper Range Consolidated mines. Electric haulage was adopted in the Champion mine after proving a success at the Baltic. A sand-filling system is in operation at the Champion. This saves the cost of blasting down poor rock to give the miners a footing in the stopes, and also disposes of the waste stamp sand. The sand is carried from the mills by rail to a small shaft at the bottom of which is a large pipe leading to various parts of the mine. At the end of the pipe the sand is blown out into the openings by compressed air. At the Winona, regrinding mills were installed and proved a success in handling the mill tailing. However, a considerable amount of the copper was still not recovered, so a series of experiments was made with the Lovett grinder. The Winona rock averages about 20 lb. of copper per ton, but because of the flaky character of the copper, only about 12½ lb. per ton has been recovered. By the Lovett process the copper is rolled into minute balls and slugs, which are more easily recovered on the concentrating tables. The experiments show that about 80% of the copper in the Winona rock, or about 16 lb. per ton, can be recovered by this process. Two leaching processes for Winona mill tailing have also been considered by the management.

In the central part of the district extensive exploration work has been going on at several properties. Large rockhouses for storage purposes have been built at a number of the mines. The Hancock Consolidated reached a point this summer where it was paying expenses and last winter the Isle Royale paid its first dividend of $1 per share after 50 years of operation. Over this active and producing mining district the great European war has cast its shadow. The Hancock and Winona have suspended operations, the Copper Range mines are running half time and practically all new construction work has stopped.

LONDON

Review of the Metal Situation, Especially Spelter, Tin, and Tungsten, Some Interesting 'Inside' Information on These Metals.

The metal markets of the world have, of course, been badly disorganized by the war in Europe. Much has been said in the *Press* on the subject, but it is probable that I shall be able to supplement that information in the case of zinc, tin, and tungsten.

As regards zinc, the most important interest in the British Empire is that centred at Broken Hill. The zinc concentrate produced there is almost entirely sold to Continental buyers, who distribute it, in a way impossible to follow here, among Belgian and German smelters. As mentioned in the last letter, the efforts of Broken Hill producers to treat their concentrate have ended in comparative failure. At the present time Broken Hill has no outlet. Welsh firms are not prepared to increase their plant to cope with the now plentiful supply. We do not know how long the war will last. Moreover, whether Germany loses or wins, she will eventually be in an improved position for handling all the zinc material offered. Thus the Swansea people are inclined to go slow. Perhaps the Broken Hill groups, Zinc Corporation and North and South mines, may be able to combine and complete a long-cherished scheme by erecting a smelter in South Wales. The Electrolytic Zinc Corporation would join them in evolving a scheme for smelting complex zinc-lead sulphides. In reviewing the present position of zinc smelting in South Wales, it is of interest to note that the German firm of Aron Hirsch & Son acquired the works of the Swansea Vale Spelter Co. two years ago and has spent large amounts of money in erecting modern plant. This move would tend to show that the conditions as regards labor and fuel in South Wales do not suffer by comparison with conditions on the Continent, so that the establishment of works in Swansea district for the treatment of Australian concentrate is well within the bounds of possibility. But a large expenditure would be required, and there are few people with both sufficient knowledge and funds. Undoubtedly, H. C. Hoover is the man to do it. Some people have proposed that Broken Hill sulphides should be shipped to the United States for treatment, but surely the cost of freight would be prohibitive, and the extra output of metal could not be absorbed or shipped to Europe at a profit. It is of interest to note that the two German zinc districts are at the opposite ends of the empire and are in the two theatres of war. The Prussian zinc industry centres round Aix-la-Chapelle, and the ores treated belong to the same mineral region that provides material for the Liége smelters over the borders in Belgium. The Silesian industry is situated at the far southeast corner of Germany abutting on Poland and Galicia. This country is inhabited by Poles and in fact is called German Poland. Part of the military scheme of Russia is to capture the whole of this territory. Roughly speaking, a line drawn from Danzig to Posen and from Posen to Oderberg encloses the Polish part of Germany that is desired by Russia.

The tin-smelting industry of this country has been utterly disorganized by the war, owing almost entirely to closing of the Metal Exchange. It is commonly supposed that this Exchange exists for the purpose of bringing together the producer and consumer. Unfortunately this is a myth. Its present function is to enable middlemen to fight each other, and incidentally to damage the mines and the users of the metals. When the Cornish mines offer their tin concentrate at the 'fortnightly ticketing' at Redruth, the price at which the contract is settled depends on the quotation at the London Metal Exchange. Since the declaration of war the Exchange has been shut, so there are no quotations, and a deadlock exists in Cornwall. It is true that the Exchange has been open in a restricted sense, for the purpose of squaring old commitments among members. But the Exchange has such cosmopolitan interests, with members representing buyers and sellers in all countries ranged on one side or other of the present war, that it is difficult to bring settlement out of chaos. It was of little use trying to arrange a price for Cornish contracts, and it was obvious that smelters were not inclined to make any offers for purchase except at a speculatively low price. The mines have so far rejected the bids, and the concentrates are accumulating. The firm of Bolitho, once bankers but now merged in Barclays, and until recently tin smelters at Penzance, have offered to advance money on the security of the concentrates, in order to enable the mines to keep working. It might be supposed that the closing of the German market for tin would induce other buyers to go ahead, but the South Wales tin plate makers have been holding back, and the American shipments from England are effectually checked by the stringent terms imposed by the British Government to prevent the reshipment of metal to Germany. As regards the supplies of tin for Germany, comparatively little is produced locally, chiefly in Saxony. Of imported ores most has come from Bolivia. It is probable that some of this Bolivian ore may be offered to Cornish smelters who have works at Liverpool, but at the present time these smelters are averse to entering into new contracts.

As regards tungsten, wolfram ores have always gone to Germany for treatment. There has never been a large enough home supply of wolframite to make it worth while for English metallurgists to take the trouble, and if a German firm was willing to do the work, the Englishman was content to let it be so. Tungsten is largely used for tool steel at Sheffield. The most interesting, though restricted, application is for producing the filaments for incandescent lamps. It has been a long and tedious business to make a tough and well-cohering wire of tungsten out of the fine powdered precipitate produced in the chemical reaction, and it is to the credit of the laborious German chemists that a satisfactory wire has been manufactured. It is not probable that English firms will undertake the production of tungsten products. More probably they will adopt alternative methods of obtaining the same results in steel and light.

NEW YORK

Resumption of Work at Several Mines in Mexico.—Copper Mines and Operations.

Mining conditions in Mexico seem to be rapidly improving. The American Smelting & Refining Co. re-started its plants at Chihuahua and Monterey about three weeks ago, and now has them running at about one-third capacity, or 150 and 400 tons per day, respectively. The chief trouble is the one which has been most serious for the past two years, namely, that transportation can not be depended upon. Another difficulty is that many of the former employees have left the district, so that when operations reach full scale it will be necessary to take on men new to the work. The Mines Company of America now has both its Creston-Colorado and El Rayo mines working, and when railroad conditions are better the Dolores and La Dura may resume. Epes Randolph is reported as expressing the belief that the Southern Pacific lines in Mexico would soon resume operations, Charles Hoyle now being manager. It is reported that the Mexico Mines of El Oro and the Dos Estrellas will be working again by the end of the month. Political conditions in Mexico are completely obscured by the European catastrophe. There is also very little mining news available in New York now. The stock market is the great cause for getting news here promptly, so that the supply of news has gradually dwindled away.

The copper situation is surprisingly good, considering the

possibilities that it exhibited a month ago. Most of the statistics which can be suppressed have been withheld, but the Custom House figures for August show that 38,302,000 lb. copper was exported last month. As this is more than half of the average for recent months, and is two-thirds of the monthly average last year, it is decidedly encouraging, as the difficulties of carrying on ordinary business have been almost insuperable. Correspondents abroad cannot be reached by cable in many instances, and it is impossible to obtain exchange at reasonable rates or even at any rate at all, while freight and insurance rates are equally prohibitive. It is impossible to learn how much copper domestic consumers

NEW MILL AT INSPIRATION AS SEEN FROM TRESTLE OF RAILWAY BETWEEN MINE AND MILL.

are taking, but the American Brass Co. is said to be operating at three-fourths normal capacity. It has all along been expected that a further reduction in output of the mines would be necessary, but if conditions continue as favorable it may be avoided. Several of the large companies have passed their dividends, and in other cases there was not a quorum at the company meeting, so that action was postponed. The Wolverine has declared a dividend of $2 per share, but most of the other companies are keeping their cash. The mines and mills of the Calumet & Hecla company are now being operated three-fourths time, and the wage scale of 1912 has been restored, while the pay of all the officers of the Company has been cut 15%. The No. 5 shaft of the Osceola has been stopped, and the La Salle has shut down. The Quincy has made a 12½% reduction in its wage scale and a corresponding reduction in its output. Reports from eastern Canada are somewhat depressing.

LEADVILLE, COLORADO

EFFECT OF THE METAL MARKET ON THE DISTRICT.—OPERATIONS AT THE WOLFTONE, LITTLE JONNY, NEW MONARCH, IRON & SILVER, AND YAK TUNNEL PROPERTIES.—NEW MILLING PROCESS.

The recent depression in the metal market affected mining in Leadville and the surrounding district as it did in many other parts of the country. A large proportion of the value in the ore here is in the silver, and when there was no regular market a number of the mines were compelled to reduce production or close. The Dinero tunnel, which is one of the most extensive silver producers of the district, was shut down, as were the Louisville and Virginius. This state of affairs is only temporary, and since silver prices have showed a tendency to rise steadily, and the smelters are again settling for ore at the full amount of quotations, a number of mines have resumed their regular output, with others to follow soon. Mining and smelting men of the district are enthusiastic in their belief that the price of silver is going to reach a high mark, and many of them are optimistic enough to assert that the white metal will be selling for $1 per ounce before the end of the year. In connection with the future price of silver a strong move is being made by the most influential men of the state to have silver placed on a basis of a 22 to 1 ratio with gold, and this price made the standard.

The zinc-producing properties of the district continued their operations in a rather uncertain manner for some time, but none of them in any way reduced their output. The new zinc oxide plant was closed down as mentioned in 'The Mining Summary' of recent issues of the *Press*.

In the Wolftone property of the Western Mining Co., the largest producer of zinc carbonate in the state, has been opened another great body of that ore. A drift has been driven over 200 ft. in carbonate, and the body averages 60 ft. in height. The mine has been shipping 500 tons per day for several years, and many people thought that it was about worked out. This new development adds to the already remarkable history of the famous mine, and it is now assured of two years of activity at its present rate of production. All of the ore that has been produced to date has averaged nearly 30% zinc. By the time this new body is mined there will be a market for the immense deposits of low-grade material which still remains in the property.

Lessees of the Little Jonny mine of the Ibex Mining Co. are making a great deal of money from gold ore, as shown in 'The Mining Summary' of the *Press* from time to time. The property as a unit is producing more ore than any other one concern in the district. About 200 men are working on the property, all of them being lessees or in the employ of lessees.

The New Monarch Mining Co., which is being operated on a plan similar to that used on the Jonny, is also producing a large tonnage of good ore. The property recently adopted the leasing system, and several good orebodies have been uncovered. Considerable high-grade ore is being produced in this mine, along with a large output of lower-grade material.

The Iron & Silver Mining Co., which is one of the largest operating companies, continues to produce its regular 200 tons per day, mostly of silver, lead, and zinc sulphide ores. The Company has opened many new veins of ore, and it still has a large tract of new ground to develop as operations proceed. The manager, George Argall, made no changes in his schedule during the time that the silver prices were at such a low mark, and smelters were settling for 25c. per ounce.

The great Yak tunnel is operating at full capacity. It has been advanced well into Mosquito range, but owing to inability to secure leases on the adjoining claims, progress in the breast has been suspended. Many of the claims which have been undermined by the tunnel are now being worked through this new and handy means of approach. It is one of the largest concerns now operating here and employs several hundred men.

The newest thing in the mining industry of the district came to light just this week when William J. Candlish, a Leadville man prominent in mining and political circles in the state, made known his invention of a milling process which will treat the low-grade sulphide ores. His process is a combination of gravity elimination and the pulsating jig. It will treat zinc, iron, and lead ores, and Mr. Candlish states that he is assured of 80% efficiency in separating these from each other. He has erected a mill which will be ready to begin the actual grinding of ore within 30 days. The mill has a good arrangement. From the time that the ore is unloaded from the railroad cars into the receiving bins until the product is discharged into the shipping cars, it is not handled once. The system of chutes, conveyors, and elevators which Mr. Candlish has installed carries the ore through without troub'e. There is also an unexpected lack of intricate machinery and driving belts such as are usually to be found in a plant of this type. Everything is based upon simplicity and economy, and for that reason a much lower grade of ore than has heretofore been handled will be sought. The first unit of the plant, which is about complete, will have a capacity of 100 tons per

day and will have 10 separating machines. Other units will follow rapidly, and several mills will probably be erected on many of the mining properties where suitable ore is being mined. The Lackawanna district is producing a good tonnage of high-grade gold ore. No milling is being done there now.

WASHINGTON, D. C.

PROPOSED BUREAU OF LABOR SAFETY AND EFFECT OF ITS WORK ON THE BUREAU OF MINES.—MINING MAN ON THE INTERSTATE TRADES COMMISSION.

The uneasy feeling over the possibility of the passage by Congress of the bill to create a Bureau of Labor Safety in the Department of Commerce is quite warranted from the looks of things; but inquiry at the Capitol discloses that the movement back of the bill has no other force at present than a little play on the part of Senator Shively of Indiana, for political effect at home. He is a candidate for reëlection, and the labor forces are strong in votes in his state. They must be tickled. He has reported the bill out of the Committee on Education and Labor of the Senate and placed it on the calendar of the Senate, but it is being said that the bill will repose there for some time. In the present stage of legislation the bill can only be passed by unanimous consent, and as the bill is opposed in the Senate and so would occasion discussion, its prospects of immediate passage seem remote. It is admitted by those who are disposed to oppose any legislation which would take from the Bureau of Mines its own management of the direction of safety work in the mines that it understands the Shively movement to have no other design than to make a political play, which is not to extend so far as the enactment of the bill. The Labor Department is ambitious. It is now one of the smallest of the departments in Washington, and a bureau of safety with a good deal of the activity of the Bureau of Mines in its control would suit its appetite admirably. The Bureau of Mines fears that it may be transferred entirely to the Department of Labor from the Department of the Interior; and indeed a bill to that effect has already been introduced in the House by Congressman Casey of Pennsylvania, with quite a screaming interview in support of the bill. The Bureau of Mines feels, and most mine owners and operators with it, that the proper place for this department, the value of whose work they recognize, is in the Department of the Interior rather than in the Department of labor, which is recognized as an adjunct of organized labor rather than a scientific branch of the Government of the United States. It is feared that under such control the Bureau would be operated in favor of the miners rather than for mining in general as a scientific and business proposition. It is indeed conceived that such control would be intolerable.

As has been stated, there can be no denial that the general principle behind the idea to create a Bureau of Labor Safety in the Department of Labor is admirable, and the probabilities are that in the long run such a bureau would be created, but inasmuch as the Bureau of Mines already exists, and gives its attention and operates safety devices in the mines for exemplification purposes, and by force of law if necessary, it would be better if the Bureau of Mines were excepted from the proposed law. This might in a sense be duplicating work, but it is one way of reaching a practical result. Both needs and desires could thus be most satisfactorily met. Probably this will be done. Meanwhile attention will have to be directed to the Casey bill, so that it may be thwarted.

The idea broached that a mining man should be on the Interstate Trades Commission which Congress is to create, should be given impetus. The greatness of the mining industry has been set forth and needs no repetition. However, the mining world has not been disposed to blow its horn very much except on the labor side, and so it has not been felt as an influence that should or must be consulted. If the mining world really wants to be represented on the trades commission it must make itself heard in a substantial way, but the energy must be directed not in support of some particular man to represent the mining world, but in support of the idea that the mining world should be represented on the board. That would be more than half the battle, if established. President Wilson is adverse to having men pushed upon him for appointment. He likes to do his own consulting and choosing, and he can be depended upon to look in the right direction for advice. If there is any campaigning at all it must be done for a group of desirable men, not for one man only. It is proposed to absolve mines from assessment work this year; the usual attempt made on the least excuse.

TORONTO, ONTARIO

FURTHER NOTES ON THE SILVER SITUATION AT COBALT.—CITY OF COBALT AND CROWN RESERVE MINES.—MINERS OFF TO WAR.—PORCUPINE NOTES.—CANADIAN IRON AND STEEL PLANTS CLOSED.

In addition to others, the Buffalo, Kerr Lake, and Drummond Fraction mines of Cobalt have closed down owing to the state of the silver market and the action of the American Smelting & Refining Co. in only advancing 25c. per ounce on silver. Other companies are curtailing their output considerably. The Cobalt Mine Managers' Association is taking active steps to bring about some arrangement under which sufficient money can be advanced to keep producing companies in operation. The matter has been taken up with the Hon. W. T. White, Canadian finance minister. The proposition is made that the Government should accept silver bullion as collateral and empower the banks to pay the companies the cost of operations in cash, which would enable them to meet current liabilities. As soon as the silver can be marketed to advantage, the mining companies will sell and repay the loans. It is probable that this scheme will be adopted. A favorable change in the situation has taken place with the resumption of bullion shipments, the express companies now accepting consignments for trans-Atlantic shipment at the same insurance rates as before the war.

Shareholders of the City of Cobalt Mining Co. have adopted a resolution providing for the voluntary winding-up of the Company, which has been merged in the Mining Corporation of Canada.——The Crown Reserve has cut a vein containing high-grade ore. The management has no present intention of curtailing operations. The usual monthly 2% dividend has been declared.

Many miners and prospectors of Cobalt and other silver districts have joined the Canadian contingent which will shortly leave for the seat of war. Those of them who have assessment work on claims falling due have been assured by the Ontario Government that all necessary extensions of time to enable them to secure their titles will be granted. A general extension of three months for assessment work on all Ontario mining claims on account of the prevalent financial stringency is being asked for, and will probably be accorded.

The Rea company has been reorganized as the Porcupine Aurum, with an authorized capitalization of 1,000,000 $1 shares. It retains 50,000 shares in the treasury and has also $40,000 in cash. Bush fires have been ravaging the country around Porcupine, and the plants of the Foley and Little Pet were destroyed.

The iron and steel industry has been paralyzed by the war, and the plants of the Dominion Steel Co. and Nova Scotia Steel & Coal Co. have been closed. The latter Company has also curtailed ore-mining operations at Wabana, Newfoundland. The works of the Algoma Steel Corporation at Sault Ste. Marie will run at half time beginning September 1.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

The discharge of the Yukon river at Eagle, which is just on the boundary of Alaska and the Yukon territory, is discussed in Water-Supply Paper 345-F of the U. S. Geological Survey, by E. A. Porter and R. W. Davenport. The Yukon is the fifth longest and has the fifth largest drainage area in North America, being 2300 miles long with a drainage area of 330,000 square miles. It rises in the northeastern part of British Columbia, flowing northwest and then southwest to the Bering sea. Up to Eagle the drainage area is 122,000 square miles. The mean annual temperature here is 23.7°F., varying from −23.6 to 59.6°. The mean rainfall of the Yukon basin is about 11.5 in. The break-up of ice at Eagle is during the first two weeks of May, and the freeze-up in the first three weeks of November. The average monthly discharge there in 1913 was 73,500 second-feet, ranging from 11,000 to

MAP OF ALASKA.

199,000 ft. The greatest discharge recorded was on May 22, 1911, when over a width of 1645 ft., and a depth of 28.7 ft., a surface velocity of 8.55 ft. per second, or 5.8 miles per hour, was 253,000 second-feet. This publication is interesting and valuable to Alaskan people.

The marble resources of Juneau, Skagway, and Sitka districts of the territory are described in *Bulletin* 592-C of the U. S. Geological Survey, by Ernest F. Burchard. The publication discusses the types and distribution of the rock, topographic and commercial relations, geologic relations, and the deposits of Limestone inlet, Glacier bay, Chichagof island, and Admiralty island.

Fairbanks

According to Frank Cook, agent for Wells, Fargo & Co., the output of gold from the immediate Fairbanks district for May, June, and July was 16,630, 41,031, and 23,853 oz., respectively, worth $1,462,931. The yield for the same period of 1913 was 17,758, 49,140, and 31,596 oz., worth $1,776,117. Sluicing and clean-ups have been started later this year, and a certain amount of gold has been sent out by parcel post. This season's yield is estimated to be equal to last.

Gold from clean-ups on Pedro creek are now going to Fairbanks. The two best returns so far are from Julius and C. P. Gins, who recovered about $18,000 each.——J. McPike, C. A. Deruchia, Mudge & Co., H. Atwood, and others are sluicing.——Good reports come from the Hot Springs district, the largest operator being A. Bock, on Woodchopper creek.——He is working rich ground, and the season's output will be about $200,000.——A. Hilty is clearing muck off his gravel with a Bagley scraper, which is one of the largest in the territory. Preliminary work has been under way for about two years. There is four years' ground ready for washing.

Iditarod

In the suit for possession of the Chicago bench, on Flat creek, which was jumped last winter by Adams and Knox, which ended in the District Court on July 27, Judge Fuller instructed the jury to return a verdict for the defendant, the Yukon Gold Co. The court ruled that the defendant was in rightful possession of the ground and that plaintiffs, Adams and Knox, could not acquire rights by wrongful entry.

Juneau

July returns from the mines on Douglas island were as follows:

Mine.	Alaska Mexican.	Alaska Treadwell.	Alaska United.
Ore crushed, tons	19,803	81,340	37,954
Concentrate treated, tons	347	1,813	912
Total realizable value of gold	$37,939	$224,837	$74,999
Net profit	15,884	133,740	16,347
Development, feet	131	322	1,023
Broken ore in stopes, decrease or increase, tons	—5,013	—57,403	2,698

In the 700-Ft. Claim of the Treadwell company there was completed 403 ft. of work.

Nome

A fierce gale, nearly as severe as that of last year, was raging at Nome at the end of last week. Three steamers managed to put out to sea.

ARIZONA

Gila County

The Calumet & Arizona company has suspended development of the property under option at Globe. A large quantity of machinery was installed for the work, including a transmission line 18 miles long, between Ray and Superior. Everything is to be removed. No reason is given for this move.

Greenlee County

At the Arizona Copper Co.'s smelter only one reverberatory furnace is in operation and the output of metal is only 50% of normal. The mines at Morenci and Coronado are being worked with reduced force. About 1000 men have been laid off. Copper is being stacked at the new smelter.——A feeling of uncertainty prevails at the Shannon mine.

CALIFORNIA

Eldorado County

After a temporary shut-down of two-weeks the Oro Fino mine at Big Canyon has resumed work. This property is owned by English people, and C. H. James is in charge. ——Good asbestos is said to have been opened near Garden Valley by W. H. Leverone.——Rich ore has been cut in the Bumgardner mine near Eldorado. A small mill is working.

Nevada County

A good tonnage of ore has been opened in the Meister, near

Washington, and machinery is to be installed. E. C. Klinker is manager. Los Angeles people have bonded the Eagle Bird, and are about to start development.

Placer County

Some activity is reported in districts adjacent to Georgetown and Cool. Good gravel has been opened at the Goggins. B. Rymal and W. Young propose to install a mill on their claim at Pilot Hill.

Shasta County

Redding people, comprising the American Mining Co., are preparing to work the old American mine in the French Gulch district. The property consists of 11 quartz claims adjoining the Gladstone, where 30 stamps are working. Ore worth $8 to $23 has been developed by lessees between No. 4 and 5 levels. A 10-stamp mill is on the ground, but must be overhauled.——The United States Smelting company has sent 11 men from Kennett to its property at Juneau, Alaska. These men will be employed largely for diamond-drilling, and include G. A. Little, W. F. Rucker, and G. A. Wommer, of the Mammoth mine.

Sierra County

It is planned to consolidate several properties in Sailor ravine, near Downieville, and to prospect for the Alleghany mineral zone. The claims so joined will have a total length of 12,000 ft., from the base of the mountain at Downieville to the ridge on the south slopes of Monte Cristo peak. They are all in serpentine contact formation. A 12,000 ft. double-track adit is proposed. Fred Bosch, a well-known Downieville miner, is arranging the consolidation. The mines will cost $150,000, of which $50,000 goes to Bosch Bros., and a similar amount to the Jason Frye interests in the Standard mine. A total outlay of $250,000 is estimated. John Hughes proposed this consolidation and had already driven several hundred feet.

COLORADO

Ouray County

The Camp Bird company reports as follows for the quarter ended June 30:

Development, feet	1177
Stoping, cubic feet	76,520
Broken ore in stopes, tons	16,911
Ore treated, tons	7352
Bullion sold	$124,920
Concentrate sold	66,253
Total yield	$191,173
All working expenses	71,038
Operating profit	$120,135
Profit from Santa Gertrudis (Mexico)	19,100

On No. 6 level east No. 2, work at raise A631 east has opened 6 to 7 ft. of profitable ore. In other stopes from 11 to 14 ft. of fair hematite ore was disclosed. Raise above No. 7 level is up 52 ft. showing 3 ft. of ore. On No. 8 level the east heading is out 285 ft. Up to 70 ft. the ground was barren, then fair ore was followed for 60 ft. varying from 18 in. to 10 ft. wide.

San Miguel County

The American Rapid Cyaniding Co. of Detroit, reports that it has installed a D. C. Reinohl 'rapid cyaniding apparatus' at the Suffolk mill, Ophir, operated by the Ophir Gold Mines, Milling & Power Co., of which George B. Pickett is vice-president and general manager.

Ore is run through crushers, then to a stamp-mill where it is further crushed in a cyanide solution and conducted through a tube-mill and reduced to about 200 mesh. The pulp is then delivered to a Reinohl apparatus, comprising a launder and a lixiviator, where the pulp is heated, additional cyanide supplied progressively to maintain its strength, and the pulp continuously agitated in the open. From the end of the lixiviator the pulp is conducted to settling tanks, clarified solution containing the gold and silver content decanted, filtered, and conducted through zinc boxes in the usual manner. A complete cycle of treatment from the ore-bins to the gold solution returned to the stock tank, is said to have been made in 11 minutes. Recoveries indicated 96% of the gold and 98% of the silver in the ores, at a loss of 5% of the strength of the solution. Demonstrations of the process were in charge of A. J. Weinig, metallurgical engineer of the Liberty Bell; while Walter L. Reid, metallurgist of the Smuggler Union, witnessed the plant in operation.

Teller County (Cripple Creek)

The estimated output of the district in August is as follows:

Plants.	Tons.	Average Value.	Gross Value.
Smelters	3,950	$55.00	$ 217,250
Golden Cycle	30,000	20.00	600,000
Portland (Colorado City)	10,000	20.00	200,000
Portland (Cripple Creek)	21,200	2.08	44,096
Stratton's Independence	11,200	2.72	30,464
Colburn-Ajax	4,400	6.75	29,700
Wild Horse	1,300	3.09	4,017
Kavanaugh-Joe Dandy	2,000	2.00	4,000
Gaylord-Dante	1,500	2.50	3,750
Isabella	1,000	2.10	2,100
Total	86,550		$1,135,377

During 1913 the Lexington Gold Mining Co. mined 641 tons averaging $15.22 per ton worth $9771, of which the net return to the Company after paying lessees, was $1385. Assets are worth $5308.

On company and lessees' account, the Vindicator mine produced approximately 3000 tons of ore in August, valued at $98,500. Development is most promising.——Work is to be resumed at the Last Dollar mine, now controlled by the Lews Gold Mining Co., by sinking the main shaft from 1300 to 1500 ft., and 200 ft. of driving. J. B. Page will be in charge of mining operations, while Robert E. Cranston is consulting engineer. The output to date is about $2,500,000.——Lessees at the United mines produced 350 tons in August. Prospecting at 175 ft. in the Fortuna, under George Harris, is encouraging.——The Acacia shaft is to be sunk from 1110 ft. to 1260 ft. Rich ore is being opened on No. 11 level. The August yield was 175 bars. Kenneth MacKenzie is manager. ——The Dillon shaft of the Granite company is down 1260 ft. Seepage water in the Gold Coin shaft is under control.

San Juan—La Plata—Mineral—Park Counties

During a recent trip to Silverton and Creede, our correspondent made the following notes:

There seems to be quite a little going on in Silverton, although the people there are complaining of dull times, as everywhere else.——The Gold King, Sunnyside, Iowa-Tiger, Silver Lake, Highland Mary, Shenandoah, and several smaller properties are producing right along.——The Buffalo Boy group is under option to somebody, presumably the Tonopah people, and the general local impression is that the deal is going through, which will mean another comparatively large producer before long, if it turns out as well as is expected. ——The slime plant which is treating old tailing that is being pumped out of Silver lake and piped down to the river is said to be working well, but the officials hope to improve it by adding flotation methods to those already in use.—— The electrostatic plant at the Sunnyside is also said to be doing good work, and it is said that the owners were experimenting with the Plumb jig, as shown in the *Press* of May 23, with a view to using it instead of the present method.—— People in Silverton are somewhat wrought up by the proposal of the postoffice authorities to discontinue the mail

route to Ouray. This would mean that if the railroad to Durango is out of commission, which it is for some period nearly every winter, they would be without mail facilities. Naturally they are doing everything they can to have the service to Ouray continued.

Nothing could be found out about the alleged new discoveries at Cave Basin, east of Durango, and presumably there was nothing but 'hot air' to the excitement of last spring.

Creede is about the same as usual. Everybody there seemed afraid and stopped shipping ore when the smelters stopped paying for silver, but they are at it again now, just as if nothing had happened, and were grumbling because they did not have cars enough. I saw a number going in as I came out, so no doubt they are all right now. There are about 150 men working in the mines there, and the three properties that are working, the Commodore, Del Monte, and Amethyst, are producing about 1000 tons per month each.——The Creede Mines Co. is getting ready to start the Humphreys mill early in September.——The Equity mine, which is seven or eight miles from Creede, on the extreme north end of the Amethyst vein, is said to have some good ore and to be preparing to build a tram to get it down to the railroad. The Equity company had a stockholders' meeting there, a week or so

ago, which seems to have been a 'knockdown and drag out' affair, from which several of the participants emerged looking the worse for wear.——The fluorspar mine at Wagon Wheel Gap has been equipped with a short tram to get the material down to the valley, and it is expected that it will be started again soon. It has not shipped anything for several months.

At the 'radium' mine near Garo, in South Park county, the owners certainly have some carnotite, but have not done enough work to show whether it amounts to anything or not. The mineral is in two different strata of sandstone (Jura-Trias), which there strikes nearly northwest and dips about 50° to the northeast. They have gone down about 25 ft. and struck water, and have 8 or 10 tons sacked, but have not shipped any ore to date. There is considerable copper in with the carnotite, some specimens showing chalcocite and others only green stains.

Denver, September 1.

IDAHO

Shoshone County

Connection has been made in the Hypotheek mine near Wallace, with the shaft being sunk from surface, and raise being driven from 700 ft. to meet it. The new shaft affords a much better outlet for the workings than the old one. The survey of this difficult work was done by F. Cushing Moore, and the connection was made at 156 ft. from surface and 550 ft. from the 700-ft. level. P. F. Rodgers is manager.——Cross-cutting in the Silver Cable, near Mullan, has opened 30 ft. of 30% zinc ore.——Patrick Eurke, managing owner of the Virginia mine, near Wallace, is to increase shipments of zinc ore from the property.——Prospecting and development on smaller properties in the Coeur d'Alenes have not diminished, and the Cedar Creek, Giant, Snowshoe, Sonora, and Liquidator companies are levying assessments.

The Ontario Mining Co. is suing the Stewart Mining Co. for $40,000 as damages for ore alleged to have been knowingly extracted from the Ontario claim. Stewart officials say that the Ontario company is mistaken.——The Morning mine of the Federal company has been shut down, and 250 out of 375 to 400 men will be laid off.

MICHIGAN

Houghton County

Work has been resumed at the Baltic, Champion, and Trimountain mines for two weeks.

MONTANA

Silverbow County

The Butte district has been fairly quiet during the past week, it being under martial law. Several arrests of union agitators were made, and 'Muckie' McDonald was finally captured. The Anaconda company has about 5000 men at work at 11 of its mines, which employ 7105 in normal times, as follows: Original, 605; West Stewart, 500; Anaconda, 730; St. Lawrence, 600; Leonard, 950; Berkeley, 400; Tramway, 900; West Colusa, 800; West Gray Rock, 600; J. I. C., 400; and Moonlight, 620 men. The Anaconda company's Diamond, High Ore, Pennsylvania, Badger State, Poulin, Silver Bow, East Colusa, Mountain View, Mountain Con., Neversweat, and Belmont mines are temporarily closed down. The Butte & Superior and Elm Orlu zinc mines are employing 1000 and 250 men respectively. Over 3300 men have been laid off on account of the copper market.——The boiler-house of the Pilot Butte mine was burned on September 1.

NEVADA

The output of gold, silver, copper, lead, and zinc from Nevada ores sold or treated in 1913, according to V. G. Heikes, of the U. S. Geological Survey, was valued at $37,097,710, against $38,358,732 in 1912. This is a decrease of $1,261,022, or nearly 3.3 per cent.

The total recoverable production of gold from Nevada ore sold or treated in 1913 was 570,589 oz., valued at $11,795,130, a decrease of $1,661,050, or 12.2%, from the production in 1912. Placer mines yielded 14,776 oz., of which 12,600 oz. came from the placers in Nye county. Dry or silicious ores contained 511,402 oz.; copper ores, 39,110 oz; and lead, zinc, and copper-lead ores 5301 oz. The dry or silicious ores yielded over 89% of the entire production of gold. Bullion from gold and silver mills contained 467,550 oz; concentrate, 49,127 oz.; and crude ore shipped to smelters, 37,899 oz. of gold. The mines of Esmeralda county continue to be the largest producers of gold, yielding $5,721,077 in 1913, against $7,014,559 in 1912. Of this amount, the Goldfield district yielded $5,019,419, a decrease of $1,220,328, or nearly 20% less than in 1912. Nye county produced $3,537,799 in gold in 1913, against $3,123,935 in 1912. Mines at Tonopah yielded $2,613,844 in gold, an increase of $389,966, or more than 17%, over 1912. The mines of the Comstock lode produced $853,564 in gold, against $855,494 in 1912. White Pine, Churchill, and Humboldt counties, mentioned in the order of output, each produced more than 15,000 oz. of gold in 1913.

In the past three years the output of silver from Nevada's mines has been steadily increasing, from 13,184,601 oz. in 1911 to 14,369,063 oz. in 1912, and to 16,090,083 oz., valued at $9,718,410, in 1913. Of the 1913 output, 15,245,541 oz., or over 94%, was credited to silicious ores, 313,779 oz. to lead ores, 241,756 oz. to copper ores, and 176,411 oz. to lead-zinc ores. Ores treated at gold and silver mills were credited with 11,-

MINE PRODUCTION OF GOLD, SILVER, LEAD, AND ZINC IN NEVADA, IN 1913, BY COUNTIES

County.	Number of producers.	Ore treated, short tons.	Gold,* fine oz.	Silver,* fine oz.	Copper, pounds.	Lead, pounds.	Zinc (spelter), pounds.	Total value
Churchill	12	83,901	15,630.15	1,383,257	4,292	162	.....	$1,159,263
Clark	47	36,355	6,970.35	198,922	351,855	6,265,783	14,369,709	1,399,174
Douglas	5	44	64.28	39	1,873	.....	.....	1,643
Elko	44	5,168	2,571.86	45,482	200,342	361,880	.....	127,611
Esmeralda	58	538,241	276,757.10	188,361	1,288,819	288,674	.....	6,047,316
Eureka	46	2,897	831.18	56,996	55,385	498,104	.....	82,110
Humboldt	121	25,585	15,409.56	757,505	17,865	61,072	.....	781,409
Lander	47	27,709	4,929.21	122,009	119,640	121,466	.....	199,477
Lincoln	22	96,555	3,282.84	475,105	661,494	7,701,311	49,962	794,879
Lyon	54	210,289	1,876.42	7,666	15,106,475	4,595	.....	2,385,125
Mineral	84	29,334	6,042.36	228,832	769,536	59,632	.....	385,023
Nye	133	696,779	171,141.03	11,634,033	1,925	28,563	.....	10,566,310
Ormsby	4	1,057	244.20	2,469	3,923	3,734	.....	7,311
Storey	36	157,562	41,291.15	729,972	1,870	4,037	.....	1,294,935
Washoe	47	6,402	2,826.41	64,719	135,141	197,679	.....	127,162
White Pine	26	3,449,333	20,921.31	194,716	71,974,116	747,331	.....	11,738,962
Total 1913	786	5,367,211	570,589,41	16,090,083	90,693,751	16,344,023	14,419,671	$37,097,710
Total 1912	704	4,763,965	650,942.71	14,369,063	86,477,494	19,500,100	13,322,988	38,358,732

*Includes placer production.

923,597 oz; concentrate, 2,135,714 oz.; and crude ore sent to smelters, 1,902,528 oz. Nye county produced 11,634,033 oz. in 1913, against 10,210,296 oz. in 1912. The Tonopah district yielded 11,563,457 oz., or 71.8% of the entire silver production of Nevada in 1913. This district yielded 10,144,987 oz. in 1912. The mines on the Comstock lode in Storey county produced 729,972 oz., against 806,853 oz. in 1912, and 618,006 oz. in 1911.

Since July 1, E. Steidle and George W. Riggs of the Bureau of Mines rescue-car have trained 224 men in various mining districts in rescue work and first aid to the injured. There are 41 self-contained oxygen-breathing apparatus at these camps. A total of 5200 people has visited the rescue-car while in Nevada.

ESMERALDA COUNTY

The Goldfield Consolidated company's estimated production for August is as follows: Ore mined, 27,210 tons; gross extraction, $297,500; operating expenses, $168,000; and net realization, $129,500.

The Jumbo Extension mine produced an average of 100 tons of ore daily in August, which was sent to the Goldfield Consolidated mill; also a total of 100 tons of $75 ore to smelters.——Six-inch pipe for the Meiger shaft has arrived, and the pumps are on their way from Dayton, Ohio.——Work on a full scale is to be resumed at the Silver Pick.——Some rich ore has been cut in the Talmage.——In a winze of the old Wheeler lease of the Florence company, 3½ ft. of good ore has been cut.

HUMBOLDT COUNTY

Orders for lumber to build a cyanide plant, and pipe for water supply of the new mill at Rochester have been given, according to John F. Cowan of the Rochester Mines Co. Most of the excavation is finished.——At a depth of 425 ft. from the surface, an 8-ft. vein of $15 ore has been cut in the Codd lease. Lessees in the Big Four are cross-cutting to get this ore.——Since January 1913 the district's output has been $700,000 of silver bullion, of which $600,000 was from the Rochester Mines property.

The new electric pump at the Seven Troughs Coalition mine does splendid work. Ventilation in the mine has been bad, due to recent changes in temperature. A 6-ft. exhaust fan of 236,000 cu. ft. capacity has been ordered for the 1000-ft. level. Profit from the mine in July was $26,000, the present profit being $1000 per day from the 5-stamp mill. The ore averages $200, and tailing $6 to $7 per ton.

NYE COUNTY

Seven mines at Tonopah produced 10,816 tons of ore, valued at $200,100, last week.——The Belmont company will pay 25c. per share or $375,000, on October 1. The new orebody at 900 ft. is 9 ft. wide.——The Extension will pay 7½c. per share, or $70,750, on October 1. Development at 950, 1020, and 1170 ft. is excellent.——The new shoot in the Jim Butler is 4 ft. wide. This Company has filed a reply to the West End company over the apex suit, and generally denies the latter's statement. The West End mill treated an average of 202 tons per day last week, of which 40 tons was from the Halifax.——The Halifax company may build a 100-ton mill.

WHITE PINE COUNTY

Mining claims, railways, dwellings, concentrator, smelting plant, etc., of the Steptoe Valley Smelting & Mining Co. have been transferred to the parent company, the Nevada Consolidated Copper Co. Strictly speaking, this is only a matter of bookkeeping.

UTAH

GRAND COUNTY

According to Samuel McGraw, an old prospector, La Salle Mountain mining district is promising, and about 50 men are employed. Gold-silver-copper ore of good value is being extracted at the Green Mountain mine, owned by R. S. Milbee of Milwaukee.

JUAB COUNTY

A large tonnage of low-grade ore exists in the mines at Tintic, and local milling is expected to make large strides. The Chief Consolidated has started the erection of a 100-ton test plant. This Company's dump contains about 10,000 tons of ore for the new mill.——Some high-grade silver-lead ore has been opened by lessees in the May Day, which extends into Chief Consolidated ground, so the May Day company has secured a lease of the latter's area containing this shoot. A night shift has been added to the Victoria mine.——The manganese deposit of the Homansville Mining Co. has been examined by George Kirby for Eastern people.

SALT LAKE COUNTY

Two feet of sulphide assaying up to 191.6 oz. silver, 7% copper, 5.5% lead, and 40c. gold, is now showing in the west face of the Alta Consolidated. Two faces in the ore-shoot are 65 ft. apart. A carload has been shipped.

SUMMIT COUNTY

Progress in the Snake Creek tunnel in August was 419 ft., for a cross-section of 6½ by 7½ ft., and a ditch 3½ by 4 ft. at one side. The J. A. McIlwee Contracting Co. is doing the work.

TOOELE COUNTY

Mines in the Dry Canyon district, near Stockton, continue to produce ore. The Hidden Treasure, at Gisborn, is shipping 1000 tons of zinc ore per month. D. W. Lynch and Lee Travis are in charge. Prospecting is being done at the Mono, Brooklyn, and Dry Canyon Consolidated.

CANADA

BRITISH COLUMBIA

Work has been restarted at the Josie claims at Rossland, and the output is to be 1500 tons per month.——The Consolidated Mining & Smelting Co. is trying to keep its smelter going, although so many mines are shut down in several districts.——The Standard company has paid 1½c. per share, or $25,000, to its shareholders. As the Trail smelter is not receiving custom ore at present, Standard silver-lead ore is being stored at its mill, and some zinc ore sent to Bartlesville, Oklahoma.

ONTARIO

Business has been resumed at the Standard Stock Exchange at Toronto, and the market shows that Cobalt and Porcupine shares are not in bad condition.

The Dome Lake mill is to start again in October, as development at 180 and 300 ft. has been good. Drills are working in three faces of ore.——Ore production at the Tough-Oakes is being accelerated, both to the mill and smelters.

KOREA

The Seoul Mining Co., operating the Suan Concession in Whang Hai province, reports the following results for August:

Stamps working	40
Time, days	26.25
Ore crushed, tons	5,765
Total recovery	$51,000
Operating expenses	22,500
Net earnings	28,500

The Oriental Consolidated output in August was $119,200.

MEXICO

CHIHUAHUA

The Batopilas Mining Co. states that its American staff left El Paso, Texas, for the mine on September 3. John R. Harbottle is general manager. Mexicans have been looking after the property for about a year.

HIDALGO

The Santa Gertrudis has published a report covering the term April 1 to June 30. Owing to the trouble at Vera Cruz the mill only worked to April 21, and treated 22,726 tons of ore yielding $200,327. Total expenses were $174,681, leaving a profit at the mine of $25,646. The interior 'Counter' shaft was sunk 129 ft. to a point 221 ft. below No. 20 level. In the upper part of the mine 1440 ft. of work was done. No noteworthy developments were made. All ore hoisted after the mill closed was stored on the surface, the dump containing 25,000 tons at the end of the quarter. Ore treatment was resumed at a reduced scale on July 6, the dump supplying 25%.

SONORA

The North Sonora Copper Co. has commenced operations on its property in the northern part of the state, 20 miles from Douglas, Arizona. New machinery has been installed, and a development scheme extending over 18 months is planned. The Company's offices are at Douglas, and Dallas, Texas.

Insurgent troops of Governor Maytorena are reported about to attack Cananea.

PERSONAL

J. W. RICHARDS is at Munich.

Address of N. S. KELSEY is wanted.

ROBERT A. KINZIE is in San Francisco.

MORTON WEBBER has returned to New York.

R. E. CRANSTON has returned from Colorado.

FREDERICK COOK, of Joplin, Missouri, was in San Francisco recently.

FRANK LAWRENCE, who has been in Nevada, has returned to San Francisco.

WILLIAM C. RALSTON, president of the United Comstock Pumping Association, visited the Comstock recently.

C. H. MUNRO, who was operated upon recently for appendicitis, is still in the hospital, but is recovering rapidly.

LUIS JACQUESSEN, manager of the Costa Rica mine, Nicaragua, has been ordered to France to join his regiment and has left for Europe.

GEORGE M. ICARD, lately of Grass Valley, California, will return to the Philippine Islands. He was one of the pioneer mining men of the Islands.

H. W. HARDINGE is in Porcupine and will return to New York on September 13. He had just returned from an extended western trip which took him as far as Dawson.

BYRON O PICKARD has returned to Phoenix, Arizona, from an extensive examination of the properties of the North Sonora Copper Co., for which he is consulting engineer.

R. G. MCCONNELL has been appointed director of the Geological Survey of Canada, succeeding R. W. BROCK, who accepted the position of dean of applied science in the University of British Columbia.

D. L. H. FORBES has been made chief construction engineer for the Chile Exploration Co. at Chuquicamata, Chile. He has been consulting engineer for the Trethewey mine at Cobalt for many years.

EMMET BOYLE has resigned from the Nevada Tax Commission to accept the Democratic nomination for governor. F. N. FLETCHER, of Reno, has been appointed by the governor, T. L. Oddie, to fill the vacancy on the Tax Commission.

E. B. PRESTON celebrated last Wednesday the close of 25 years of service as determinative mineralogist for the California State Mining Bureau. It had been planned to mark the day with a dinner to the staff, but Mr. Preston is unfortunately in the hospital at Santa Rosa. He is one of the best known mining men on the Coast, a Freiberger, a classmate of Louis Janin and others of the famous group of men who brought technology to the mines of the West, and his numerous friends will join in wishing him many years of usefulness.

Obituary

FRANCIS VYVER, a native of London, owner of the Paun mine, Santo Domingo, Nicaragua, died early in July at La Libertad, Nicaragua. Mr. Vyver came to Nicaragua over 28 years ago and has been owner of various properties in the district at one time or another. The property will now be managed by Henry Killig.

HARRY J. HUBBARD, who died of appendicitis July 31 on board the cruiser *California* at Mazatlan, was at the time of his death acting superintendent of the Minas del Tajo. Born in South Dakota in 1882, he graduated from the New Mexico School of Mines and took service at Divisadero in Salvador. After ten years there he joined George W. Tweddy in Sinaloa and remained at his post through all the Mexican troubles. He leaves a wife and two children.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, September 10.

Antimony	15 —15¾
Electrolytic copper	14 —14¼
Pig lead	4.15— 5.10
Quicksilver (flask)	$75
Tin	41 – 42½
Spelter	7¾
Zinc dust, 100-kg. zinc-lined cases	20

Quicksilver varies considerably from day to day, but the above quotation may give an idea of the trend of prices, last week being from $75 to $85.

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, September 10.—Copper still has no regular market; lead and spelter are both easier at 3.85 and 5.50c. respectively. Iron ore shipments on the Great Lakes in August were a little above those of July, but in the season to September, the movement is 10,740,000 tons less than the same period of 1913. The U. S. Steel Corporation is again selling ferromanganese, prices being around $85 per ton. The Standard Stock and Mining Exchange of Toronto reopened on August 24, and is holding daily morning sessions from 10 a.m. to 12:30 p.m. Only cash trading is permitted and minimum prices have been adopted by the Exchange Committee. The embargo on export potash from the Netherlands has been temporarily removed, and supplies can now come through from Germany. Imports of these salts into the United States in the past fiscal year were 1,086,243 tons worth $15,160,123.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	....
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

Prices in New York have been around 53½c., and in London 24d. per ounce, business being restricted in the latter centre. It is reported that the Secretary of the Treasury, W. G. McAdoo, has spoken against the Smoot bill, which passed the Senate, to purchase 15,000,000 oz. He said that the foreign demand is good, so there is no justification for the measure. Under the existing law he will exercise authority to purchase metal. The needs of the Treasury for coinage are well supplied at present.

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per pound more. Prices are in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

The copper market is steadier despite the failure to carry through plans for a pool. This was under discussion for some days, but Washington officials proved deaf to all appeals for help and would not even make a definite statement as to their attitude in event of the pool being formed. This is the more striking in view of the various proposals for government aid to other industries disturbed by the war. The attempt in itself operated beneficial, as the exchange of information among producers steadied those who might have precipitated market trouble, and, considering the dangerous possibilities, the situation is remarkably good. Banks are showing an accommodating disposition, and are not calling loans. While there is still no general or free market for copper, any more than there is for securities, such demand as exists is being supplied at normal prices and if restraint continues to be exercised by producers, it now seems unlikely that prices will go to pieces.

August copper production of several mines is as follows, that for July being in parenthesis: Mammoth, 1,575,000 lb. (1,725,000); Mohawk, 1,110,000 lb. (1,120,000), and Wolverine, 5,300,000 lb. (5,800,000). An official statement regarding the porphyry mines was published on September 4, and showed the following preliminary output for August, curtailment to a 50% basis not being ordered until August 6:

	July.	August.
Utah Copper	13,768,958	8,225,000
Chino	5,087,750	3,139,322
Ray Consolidated	6,008,061	3,300,000
Nevada Consolidated	5,477,313	3,200,000

Exports of copper for the first three days of September were 1265 tons, a decrease of 2289 tons. Prices range from 12.15 to 12.75c. per pound.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Sept. 3	3.85	July 29	3.90
" 4	3.85	Aug. 5	3.85
" 5	3.85	" 12	3.85
" 6 Sunday		" 19	3.88
" 7 Holiday		" 26	3.87
" 8	3.85	Sept. 2	3.90
" 9	3.85	" 9	3.85

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

Lead ore prices at Joplin, Missouri, are dull at $46 per ton, basis of 80% metal.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Sept. 3	5.50	July 29	4.75
" 4	5.50	Aug. 5	4.75
" 5	5.50	" 12	5.25
" 6 Sunday		" 19	5.60
" 7 Holiday		" 26	5.77
" 8	5.50	Sept. 2	5.75
" 9	5.50	" 9	5.50

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

There has been a temporary lull in the zinc ore market of the Missouri-Kansas-Oklahoma district, and highest prices are $48 per ton.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
Aug. 13	85.00	Aug. 27	80.00
" 20	No quotes	Sept. 3	75.00-85.00
		" 10	75.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	..
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	.. .
May	40.25	39.00	Nov.	39.40	.. .
June	41.00	38.60	Dec.	40.00	.. .

Prices are easier in New York, where they are from $70 to $75 per flask.

TIN

Straits tin is quoted in New York at 36c. per pound. With shipments to arrive, September will have enough metal for all requirements.

MINING DECISIONS

Taxation—Mineral Interests

It has been well decided in Minnesota that the owner of land may segregate the mineral estate from the rest of the land and convey either interest without the other. It follows that where such estate has been so separated, and held by an owner different from the owner of the surface, it may be taxed separately.

Wastburn v. Gregory County (Minnesota), 147 Northwestern, 706. May 29, 1914.

Adverse Claim—Sufficiency of Title

Where the plaintiff filed an adverse claim against defendant's application for a patent to a mining claim, as in conflict with the plaintiff's claim, and brought suit to support the same, and defendant conceded the overlapping of claims but proved that plaintiff's claim equitably belonged to defendant, a nonsuit was properly granted, although the evidence at the trial might not be sufficient to support defendant's title in its application for patent. The adverse claim was waived by transfer of plaintiff's interests to defendant, and that was the only showing necessary for the latter to make.

Curran v. Chloride Mining & Prospecting Co. (Colorado), 141 Pacific, 463. June 1, 1914.

Coal Mines—Encroachment on Dividing Line

A deed conveying coal underlying a tract of land described by metes and bounds, giving the grantee "all the usual mining privileges for the removal of the same and every part thereof," does not authorize the grantee to mine coal within five feet of the dividing line between the grantor and the grantee as prohibited by law. A coal mining company is liable for a violation of such a statute by its employees, independent of any knowledge of such violation by its officers. Each separate encroachment within five feet constitutes a separate violation.

Darby v. Davis Coal & Coke Co. (West Virginia), 81 Southeastern, 1124. May 5, 1914.

Lodes Within Placers—Degree of Proof

In a suit to quiet title to a placer patented claim against certain lode claimants, the latter alleged as a defense that the placer ground contained known lodes at the time it was patented and that such lodes were excepted from the patent. Held first that no sufficient discovery of a lode or vein was proved by the evidence to support the alleged lode locations; second, that the lode claimants were concluded as to their claims by a judgment rendered in an adverse suit filed by them prior to the placer patent, wherein the placer claimants were upheld. While such judgment was conclusive only as between the parties, and did not conclude the Government, the latter tested the final proof adduced by the placer claimant sufficient to grant the patent. Known lodes, in order to be excepted from the operation of a placer patent covering the ground in which they are situated, must be clearly ascertained to be of such extent as to render the land more valuable on that account and justify their exploitation, and evidence of a vein which might be sufficient to sustain a lode location as against a conflicting placer claim is not sufficient to establish the existence of a known vein or lode within the meaning of the statute. Decree quieting title in placer claimant affirmed.

Mason v. Washington-Butte Mining Co. (Montana), 214 Federal, 32. May 4, 1914.

MINERAL STATISTICS

The following data, supplied by the U. S. Geological Survey, covers the year 1913.

Lime production amounted to 3,595,390 tons, valued at $14,648,362, an increase of 65,928 tons and $678,248 in value over 1912.

Mineral-water production was 58,000,000 gal., worth $5,600,000, a decrease of 7 and 15% respectively compared with 1912.

The marketed production of salt in the United States, including Hawaii and Porto Rico, in 1913 reached the record-breaking total of 34,399,298 bbl. of 280 lb. each, or 4,815,902 short tons. The value of the product was $10,132,139. These figures are the greatest yet recorded by the Survey for the salt industry in the United States.

Pennsylvania mined more coal in 1913, both anthracite and bituminous, than in any previous year in the history of the industry, according to E. W. Parker in coöperation with state officials. The production reached the enormous total of 265,306,139 short tons, valued at the mines at $388,220,933. Of this, 91,524,927 tons was anthracite, valued at $195,181,127, and 173,781,217 tons was bituminous or soft coal, valued at $193,039,806. The total tonnage broke the previous record for 1912 by 19,079,053 short tons, or nearly 8%, the proportionate increase being about the same for both anthracite and bituminous. The gain in the value of anthracite, however, was $17,558,501, or about 10%, over 1912, and in bituminous coal $23,669,309, or 14%. The total gain over 1912 was $41,227,810, or nearly 12%. The magnitude of the coal-mining industry in Pennsylvania, as represented by the output of the anthracite and bituminous mines, is probably little realized. The combined production of 265,306,139 short tons in 1913 exceeded by more than 20% the total production of the United States in 1898, only 15 years previous. It exceeded that of any other country in the world, except Great Britain and Germany, and approached within less than 10% of Germany's output. It was nearly five times the production of the Austro-Hungarian empire, nearly six times that of France, nine times that of Russia and Finland, and ten times that of Belgium. It was equal to nearly 20% of the world's total production, and exceeded the combined output of all the countries of the world other than Great Britain, Germany, and the United States. From 1829 to and including 1900, Pennsylvania contributed over 50% of the total coal production of the United States, and the state still produces between 45 and 50% of the total.

There was a decided gain in 1913 in the number of working days made by the employees in Pennsylvania in both the anthracite and bituminous mines, the former making an average of 257 days, compared with 231 days in 1912, and the latter 267 days, compared with 252 days in 1912. The anthracite mines gave employment to 175,745 men and the bituminous mines to 172,196 men.

It is pretty generally conceded by those interested in the production of anthracite that the limit of annual production has about been reached and that the yearly output will remain fairly constant until the period of decline begins. Anthracite as a manufacturing fuel has been eliminated, and the increasing use of coke and gas for domestic purposes in the territory supplied by anthracite coal is approximately keeping step with the increase in population. Anthracite mining began between 1790 and 1800, when a small quantity was produced for local consumption. To the close of 1913 the production of anthracite had amounted to 2,184,550,000 long tons, or 2,446,696,010 short tons.

BOOK REVIEWS

Memoirs of Henry Foames Julian. By Hester Julian P. 320, portrait, and ill. Published by Charles Griffin & Co. For sale by the *Mining and Scientific Press*. Price $2.50.

When the *Titanic* went down it carried into the sea, among others whom the world could ill spare, one of the foremost authorities on cyanidation -Henry Forbes Julian. His loss has been widely felt among metallurgists and by none more keenly than the *Mining and Scientific Press*, of which he was a special contributor at the time of his death. His personal work has stopped, but he was among the fortunate ones in that he had cultivated the habit of committing to writing the results of his observations and researches, so that the profession has still the benefit of those of his investigations which were completed at the time of his death. Others, unfortunately, are in part at least lost.

There is, however, another side to the work of all those men who make the world move forward, and in that class Julian was well entitled to place. The cold results of scientific experiment are often warmed and vivified by the personality of the experimenter, and influence flows from example and personal contact as well as from formal writing. Julian was a man of strong personality. His life touched many men in many lands, and influence followed contact. So far as such a thing may be done, Mrs. Julian has put into her book Julian as a man—it is his personality she has preserved for his friends. His boyhood at Cork, his early life in his father's works in Lancashire, his technical work in South Africa and Germany, and his travels in Central Africa, Eastern Europe, Italy, Canada, the United States, and Mexico, all these throw interesting side lights upon his career. His comment upon New York, San Francisco, and other of our cities is keen but kindly, and his constant association with the significant men of the times lends an especial interest to what he has to say. One feature of his life that may well be noted by his American confrères was his continued interest in pure science. He traveled to Winnipeg to attend a meeting of the British Association for Advancement of Science and he was a constant contributor to the proceedings of several of the great English scientific societies. We can hardly imagine any American cyanider, equally busy with matters directly touching the commercial phases of his work, interrupting the latter to prepare a paper on physics for the American Association and then traveling to a prairie capital to read it in person. And if any American cyanider of first rank has an intelligent interest in the work of the Geological Society, we have failed to note it. In that they but reflect the attitude of American technical men in general. They are so centred upon their work that they have neither time nor energy for interest in pure science in related lines, whether amateur or professional. We have frequently mentioned the desirability of our engineers broadening out and having 'hobbies,' if that word may be used. It is one of the things the English do better, and it is worth noting that not only did the German *Gold and Silver Scheide-Anstalt* call upon Julian, an Irishman, for advice, but Charles Butters, our American friend who has made for himself so enviable a place among cyaniders, had recourse to the same Irishman for help in preparation of the great patent suit with which his name is associated. Deep scientific insight and broad culture count in technology as in other lines, and that is one of the lessons of Julian's life. That, and the further lesson that life is worth living as one goes along, is one we may take to heart.

Mrs. Julian's chapters are preceded by tributes to Julian from the Rev. J. O. Bevan, who writes of him as a personal friend, and from H. L. Sulman, who, in no less friendly tone, discusses his technical work and associations. It is not necessary to repeat to readers of the *Press* the details of Julian's professional career. His text 'Cyaniding Gold and Silver Ores,' written with Edgar Smart, was not only timely, it is of permanent value and all because it got down to the fundamental principles underlying the practice of the times. It was that feature which characterized the work of this genial Scotch Irishman, who crowned a busy career by giving his life that some other might be saved. H. F. B.

The Iron Ores of Lake Superior. By Benedict Crowell and C. B. Murray. P. 262. Ill., maps, index. Penton Publishing Co. (*Iron Trade Review*), Cleveland, Ohio, 1914. For sale by the *Mining and Scientific Press*. Price $3.50.

Few mining districts of the world have received as much attention as the iron ranges of Minnesota and Wisconsin near Lake Superior, which are of the utmost importance to the American iron industry. The general operations of prospecting, mining, and ore shipments have provided a fund of information for writers in technical journals, mining institute meetings, and books. The volume under review is in its second edition, being prepared by the heads of an organization of 40 experts connected with the iron industry of the district discussed. The chapters cover the following: early history of the region, geology, mineralogy, ore production, dock equipment, classification of ores, beneficiation of ores, methods of analysis, fuel engineering, location and description of mines, and a complete index of mines and ores. Since about 1850 the 10 ranges have produced a total of 626,353,084 tons of iron ore, the Mesabi leading with 313,105,968 tons. In describing mines, the location, character of ore, owner, officials, and shipments are given. The maps are new, and the whole compilation forms interesting and valuable reading.

Chemical Reagents. Their purity and tests. Authorized translation of 'Prufung Der Chemischen Reagenzien Auf Reinheit.' Von E. Merck. By Henry Schenck. P. 199. Index. D. Van Nostrand Co., New York, 1914. For sale by the *Mining and Scientific Press*. Price $1.

As its name implies, this work describes the composition and means of testing the purity of reagents used in chemical work. This is the second edition, and is generally similar in treatment to the previous one; but changes have been made, and 36 entirely new subjects have been added. There is also included references of important new contributions on the uses and methods of testing reagent chemicals. Standards to the needs of American chemists have been adopted in several cases. A parenthetical statement is appended to each test, giving in terms of percentage the minimum amount of the impurity which would be recognized by the test, with certain exceptions. The book must be considered useful to all laboratory workers.

Mining World Index of Current Literature. By George E. Sisley. Volume V for first half of 1914. P. 237, with author's and subject index of 29 pages. Mining World Co., Chicago, 1914. For sale by the *Mining and Scientific Press*. Price, $2.

The editor of the *Mining World* goes to a lot of trouble in compiling this volume each half-year, and in spite of the so-called depression throughout the mining world he has abstracted from 345 technical journals, and increased the size of the work by 47 pages compared with the last issue. There is little to add to previous reviews on this regular publication. It covers all of the English-speaking and foreign papers, and will be found useful to editors, libraries, societies, engineers, and those who have use for a bibliography of technical articles. Instead of the 6-point type in former volumes, this one appears in the larger 8-point size, making reading easier.

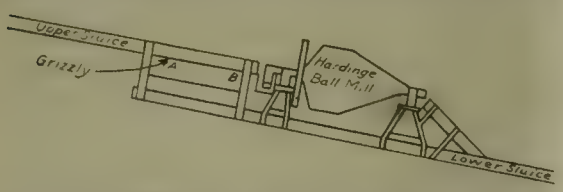
New Machines and Devices

Hardinge Ball-Mills and Cemented Gravel

By V. A. Stout

The usual method of treating cemented gravel from the drift and hydraulic mines of California and the West is to expose the lumps to the disintegrating effects of the weather and to wash it in the sluices. Some few attempts have been made to crush it with light stamps, but without a great deal of success because of the necessity of crushing the hard quartz boulders in the gravel. These boulders having been worn round by the action of the depositing waters, are extremely difficult to crush with stamps and contain no gold. Their reduction merely hinders the disintegration of the gravel, yet there is no means of getting rid of them economically except crushing them along with the lumps of gravel.

With the use of the Hardinge ball-mill for disintegration, this problem seems to be overcome. The hard boulders are not crushed in the mill, but aid the steel balls in their work. Any excess in the mill will take care of itself, and the boulders will be discharged with the disintegrated gravel. In



this way the cemented gravel, when brought to the surface in a drift mine, may be broken up and run through the sluices with an immediate recovery of its gold content. The use of the Hardinge ball-mill in drift mining should present no problems, mechanical or otherwise. In hydraulic mining, due to the quantity of material handled, some problems may arise. These will be dealt with later.

While these mills have never been tried as yet in this special field, there are no apparent reasons why they should not be successful. Their large capacity and small horse-power consumption should make them instant favorites among mining men having the problem of cemented gravel to meet. By utilizing the boulders, which cause so much trouble in crushing with stamps, to aid in the disintegration, they overcome a very difficult problem. In this way, too, the cost of wear of the steel balls is greatly reduced. It seems that some steel balls must be used, but it may be discovered in practice that the boulders alone will be all that is required. Because the mills have no screens, the rapid discharge of the disintegrated gravel and the excess of boulders is easily accomplished, and repairs are reduced to a minimum.

In drift mines the use of the ball-mill would be a simple matter. Output is comparatively small and limited in amount. One of the three sizes of the mill with its rated capacity known could be counted on to do the work, but in hydraulic mining there are the problems of capacity and installation to be considered, the last of which seems to be the most difficult. In the accompanying sketch, a possible method is illustrated. The only requisite is a drop in the sluice of five feet at the place of installation. At *A-B* a grizzly with any desired width between the bars is placed. All the fine material would then pass through the grizzly and continue on down the lower sluice, and the pieces of cemented gravel and boulders which could not pass through the grizzly would roll down into the feed-box of the mill or directly into the mill itself. Nothing larger than five inches in diameter could pass through the hollow trunnion of the largest size mill. An attendant might be necessary to pick out the boulders larger than this and to break down with a sledge the larger chunks of cemented gravel. The disintegrated gravel and the excess of boulders would discharge from the mill into the lower sluice. Here the gold content of the gravel would be caught in the riffles and the material discharged in the usual way at the end of the line of sluices.

Rivet Set Retainer

What is claimed to be one of the most novel rivet set retainers is that now put out with the Little David pneumatic riveter, manufactured by the Ingersoll-Rand Co., New York. The retainer consists of a single piece of heavy spring steel, closely wound into a spiral form. One end of this spring fits over the outside of the hammer nozzle and hooks over a projection integral with the nozzle. The other end is wound to a smaller diameter. The device is so effective, it is said to positively prevent the rivet set or piston from being driven out, even when the hammer is run free. There is but a single ground joint between handle and barrel, and these parts are securely held together by two bolts, one on either side of the barrel, which construction eliminates the need of a vise in taking the tool apart for inspection. There are no threaded joints on the barrel. The valve chamber is placed beside and parallel to, instead of in line with the cylinder, for the purpose of obviating the possibility of injury to the valve by the piston, which construction also gives a shorter tool.

Commercial Paragraphs

Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, Mo., has recently published a small attractive bulletin which describes with illustrations the Diesel installations in ice and refrigeration plants in New York and Chicago.

Two Diesel engines for the Burro Mountain Copper Co., Tyrone, New Mexico, have been constructed by Carels Freres, of Ghent, Belgium. These engines will operate at an elevation of 6700 ft., and will develop 1000 hp. each.

Alberger Pump and Condenser Co., New York, has recently published Catalog E, devoted to Alberger centrifugal pumps and steam turbines. The catalog is fully illustrated and contains a large amount of valuable information and tables regarding the construction and operation of turbines and pumps.

The National Tube Co., of Pittsburgh, *Bulletin* 7D deals with regrinding valves. These are made at the same works as 'Kewanee' unions, testing machines for which were tried on 'N. T. C.' valves. Several of these ¼-in. valves were taken from stock, and on one testing machine the regrinding valve was opened and closed 3,046,280 times. Construction of the valve is described.

The Wellman-Seaver-Morgan Co., of Cleveland, Ohio, *Circular* No. GP-2 deals with Hughes continuous gas producers. Claims for this machine are elimination of labor in poking, better distribution of coal, better distribution of ash, better quality and more uniform supply of gas, and more gas produced per square foot of producer area. Illustrations in the publication show the producers in detail.

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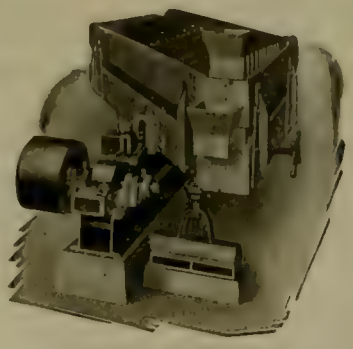

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EDITORIAL

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AMONG Belgian firms temporarily suffering from the war is Carels Frères, makers of Diesel engines near Ghent. This concern was just building up a thriving trade in the United States.

SPANISH sources of potash seem likely to become more important, in part due to the temporary withdrawal of German producers from the market. A French syndicate has been drilling near Barcelona, and last year it was announced that irregular but probably important deposits of carnallite, sylvite, kieserite, and rock salt had been found. It is now stated that reserves equal to 200,000,000 tons have been proved and that production may be expected within a year. American production, from Searles Lake, will begin early in 1915.

PHOSPHATE deposits near the Red Sea, according to a recent consular quotation from the *Egyptian Gazette,* have during the past few years assumed importance and the output has increased from 700 tons in 1908 to over 100,000 tons in 1913. Such deposits have been known on both sides of the Nile valley for a number of years, but those on the Red Sea afford the only mines of commercial importance and are responsible for practically the whole output. A movement is said to be under way at the present time for the manufacture of super-phosphates at Alexandria.

COUNTRY smelter management receives consideration in this issue by Mr. Herbert Lang, who through years of experience is enabled to present the managers' viewpoint in an instructive manner. In former years local smelters were common; but, as our readers are aware, changed conditions have brought about the concentration of smelting in the larger centres, bringing to an end the activities of many of the isolated plants which were once so numerous. With modern methods of construction and power equipment it seems possible that the smaller works have a new chance for life and usefulness. In one respect at least local smelters have the advantage over their great competitors. The fume difficulty, which weighs more heavily upon the large smelters, by reason of their usual location in settled districts, must favor the local concerns, in their isolated and sterile situations. Unless the fume question be settled effectively, the tendency of the future may be to conduct smelting operations at the place of production.

BUTTE copper mining companies have issued a general notice to the effect that they will no longer recognize either the Western Federation or the Butte Mine Workers Union. While existing wages, hours, and conditions of labor will be maintained, the companies refuse to compel employees to join either union or to permit representatives of either organization to visit the mines to inspect cards, buttons, or other evidences of membership. In effect this opens the mines of Butte to non-union labor, and it is easy to foresee that in time the absurd prices and conditions foisted upon the community by unions in the other trades will be seriously modified. The miner at Butte has carried the other workers on his back till the burden has become like that of Sindbad. As we pointed out recently, the operators at Butte have been wonderfully patient with their men. We believe that in the end both men and companies will be the better for the change now made.

NOW that the tumult and shouting of various primary elections have died down, it is possible to survey the field at leisure. In California, Mr. W. C. Ralston and Mr. C. M. Belshaw, both well and favorably known among mining men, after a gallant fight for nomination for governor on the Republican ticket, went down to defeat. In Nevada, on the other hand, Mr. Emmett Boyle was chosen as Democratic candidate for the office mentioned. In Iowa, Mr. Charles R. Keyes, among those mentioned some weeks ago, decided not to be a formal candidate in the Democratic primaries. Among nominations to minor offices may be mentioned that of Mr. J. Nelson Nevius for senator in the Thirty-sixth California district. We are glad to see mining men taking part with other citizens in political affairs. While in Colorado, Montana, and other Western States there have always been a few men from the mines in the legislature, they have seldom been engineers. Usually, with some honorable exceptions, they have been 'hired men,' legal or otherwise. We must confess to a feeling that the country has suffered from too general a disposition to let 'some lawyer do it,' when it came to spending time in the routine work of making and enforcing laws. To the young lawyer, whose practice has not yet become a burden to him, experience in the legislature is valuable, and in view of the disposition of others, including mining men, to shirk, it is not surprising that the lawyers have predominated in the public service. If, however, best results are to be achieved,

the legislature should be made in fact as well as in name an assemblage of representative men in all lines of industry. Our sympathies therefore are with the mining men, without regard to party, who have made or are making races in politics. It is a public service that deserves support.

AMERICAN DREDGES FOR FOREIGN COUNTRIES

The article on dredge construction in Portuguese East Africa, by Mr. Charles Janin, which appeared in the *Mining and Scientific Press* of August 1, has awakened considerable interest among those concerned in dredge construction. Mr. Janin called attention to the fact that the American dredge was slowly but surely invading the foreign field, that nearly all the American dredge builders were successfully represented, and that there was a good future abroad for the American-built dredge.

While the first modern California-type dredge in operation in a foreign country was built by the New York Engineering Company in Eastern Siberia in 1911, an earlier type of the California gold dredge was shipped to Siberia in 1900 by the Bucyrus Company. This dredge was equipped with 5-foot buckets. A similar Bucyrus dredge was shipped about the same time to the Magdalena river in Colombia. The old Risdon company, which was bought out by the Union Iron Works in 1910, sent dredges to Mexico, Tierra del Fuego, and West Africa about 1903, and to the Philippine Islands a little later. The New York Engineering Company also shipped some earlier dredges, one to Brazil and another to Colombia. Among the first American-built dredges were some for New Zealand built by an iron works in New York about 1900.

Of the modern California-type dredge shipped abroad, the Bucyrus Company, in addition to the one described in our issue of August 1, sent one to Burma about 1910. This dredge, however, was not erected. The New York Engineering Company built a 5-foot dredge for the Guamos company in the Philippine Islands in 1913. The Yuba Construction Company built the Pato dredge for Colombia, which started in January 1913, a 5-foot dredge for the Malaguit Gold Dredging Company in the Philippine Islands in 1914, and supplied the machinery for converting the Pokrovsky scow of the Orsk company in Siberia to a three-foot close-connected bucket dredge. The Marion Steam Shovel Company has supplied the machinery for a 7-foot dredge for the Ural district in Siberia this year.

The Union Construction Company designed a dredge for the recovery of tin in Portugal. This dredge was built by Fraser & Chalmers of London, and is the first American-type dredge built for tin recovery in a foreign country. It is perhaps the work of this dredge, and that built several years earlier by the Union Construction Company for Cape York district, Alaska, that has encouraged American dredge companies to investigate the foreign tinfields with an idea of supplying dredges. Several of the larger companies have sent or are contemplating sending representatives to the Far East, and a fact of considerable interest is that Mr. E. A. Peacock, who is interested in tin dredging operations in the Malay States, when in California a few weeks ago was so impressed by the progress made in dredge construction and the work done by the California dredge, that he canceled, by cable, orders which he had previously given to dredge builders in Australia and is having plans drawn here for a modern California-type dredge especially designed for tin recovery. Bids have been submitted by at least two companies, and the dredge will undoubtedly be built in the near future.

Facts such as this should waken the American dredge builder to the opportunity knocking at his door; it is our pleasure to help show him the path, and his to make good as he has done in the past, and can do in the future.

A CALIFORNIA MINE OPERATORS ASSOCIATION

California operators are invited to meet at the rooms of the Engineers' Club, Hotel Sutter, San Francisco, next Monday afternoon at 2:30 to join in forming a mine operators' association. This movement is being started by Mr. Albert Burch, who, as manager for the Goldfield Consolidated Mines Company, has had many opportunities to see the substantial benefits that have accrued to mine operators in Nevada from membership in their local association. It is not too much to say that thousands of dollars have been saved to the operators since the Nevada association was formed, and there are equal opportunities for savings in California.

Membership in the Nevada association is restricted to "persons, co-partnerships, and corporations" engaged in mining "as operators of approved standing," and the purposes are broadly stated as being "to subserve, promote, and protect the interests of operators engaged in the prosecution of the metal mining industry in this state, and in that behalf to secure betterment in all branches of the industry; also to promote the health, safety, and welfare of miners and employees engaged therein, and to promote harmonious relations between employer and employees." In practice the Nevada association is a business organization, as, in fact, are all the really successful associations of operators. It maintains a secretary who acts for the executive committee as a bureau of information and also as a central purchasing agent. Through the data collected by this central agency the operators were able materially to affect the revision of the taxing system, and by buying in large lots those materials that every mine needs, large savings have been made.

California operators have been too slow in getting together. The increased cost of living affects mining companies as well as workmen, and it is time to look at these matters from the business standpoint. Mr. Burch has

the promised cooperation of Mr Seeley Mudd, Mr. J. C. Hutchinson, Mr. G. W. Metcalfe, Mr. W. F. Kett, and others equally closely identified with the best in California mining, and we strongly urge all operators in the state to attend the meeting, and affiliate with the new organization.

LABORATORY STUDY OF SECONDARY ENRICHMENT

Investigation of the phenomena of secondary enrichment, especially in copper deposits, is now as much the thing among geologists as the development of foreign trade is among merchants. The sudden crescendo of interest in a topic which has long been under discussion develops much the same advantages and disadvantages in each case. It brings to bear additional effort, with a corresponding increase in the results attained, and it also incites many people to join in the chorus by repeating what is old or disproved, or by making statements which are unsubstantiated by valid evidence or fundamental principles. The danger of the latter, in the case of secondary enrichment, is lessened because most of the workers are presumably trained investigators, but it is also increased by the fact that this is a peculiarly difficult field of investigation. The changes which take place in the enrichment of a mineral or group of minerals are obviously chemical and physical, and it might be at once assumed that a physical chemist is the proper person for unraveling them. But the possible changes to which a group of minerals may be subjected are almost infinite in number, and many or most of them would throw little or no light on the actual phenomena observed in the field study of the ore deposits. Investigation must be selective, therefore, and here the danger enters. Few geologists who are experienced field observers have a sufficient grasp of physical chemistry intelligently to direct such investigations, while the number of chemists who are experienced field geologists is almost zero. There is thus a lack of coördination of the knowledge necessary for a right treatment of the subject.

It is worth while to recall the genesis of present ideas on this topic. Only a short time ago, historically, geologists were storming the breastworks of religious folklore in order to establish the conclusion that the Universe was brought to its present condition by the action of natural forces. One line of attack followed another; the recognition that sedimentary deposits are formed through the washing away of surface rocks brought out the fact that the mineral composition of the deposits thus formed is not the same as those from which they are derived, and the alteration of one mineral into another was thus clearly established. Increase of observations multiplied the number of instances in which one mineral was known to alter into another, but it is only recently that any exact knowledge of how such changes take place has been available. Any lack of ability to explain these changes was generally excused on the ground that it is impossible to reproduce natural conditions of temperature, pressure, and length of time involved. Fortunate experiments in which the results found in nature were actually attained in the laboratory have shown that the difficulty is not in reproducing conditions, but in knowing which are the important and which the negligible ones. Simply reproducing in the laboratory the results of natural processes is much like setting a tuning fork in vibration by crashing down with both hands on the keyboard of a piano. One mineral is not converted into another, unfortunately, by such simple and direct processes as those by which a live pig is converted into hams and bacon. In order to understand the complex changes involved, it is necessary to unravel them and study them separately in detail.

Most mineral substances have, from the chemist's standpoint, discouragingly wide variations in chemical composition, and a more exact systematic knowledge of them than we now possess is highly desirable. Not only are they variable in composition, but they are exceedingly impure, and the chemist who knows the effect of the presence or absence of a few tenths of a per cent of carbon in iron is appalled at the possibilities disclosed by a careful analysis of such comparatively simple minerals at chalcopyrite, sphalerite, galena, and so on. FeS_2 sometimes crystallizes in the isometric system and sometimes in the orthorhombic, showing at the same time considerable differences in other characters. It is only recently that we have learned why, and the fact indicates the great desirability of exact knowledge of the temperature range within which the common minerals are stable. The dissociation temperatures and pressures of these minerals should be known. More light on these points will doubtless indicate the necessity for further data and in time a fund of knowledge will be built up that will make easy the solution of what now appear as exceedingly difficult problems.

It is in such fields of work as that above outlined that the necessity for institutions devoted to pure scientific research, such as the Geophysical Laboratory of the Carnegie Institution at Washington, is made evident. Work of this character is not and can not be done in laboratories of the colleges and technical schools. Professors are unable to devote their time to work which is so unproductive of visible result, and few of them indeed are fitted to perform it. It is totally beyond the powers of their students, and it is not too much to characterize many of the contributions to the knowledge of this subject which have come from college laboratories as being rather obfuscations of knowledge. Sweeping the heavens with a field-glass is not likely to add astronomical knowledge, and soaking powdered minerals in solutions of various salts is not apt to prove more efficacious in advancing our knowledge of mineral chemistry. This is peculiarly a field in which advance must be left to a comparatively few trained men who have both the desire and the mental and physical equipment to carry on the work.

As War Looks in London*

By T. A. RICKARD

Ross Hoffmann and his brother Jack arrived yesterday from St. Petersburg. They went by train to Archangel, and there chartered a small boat for Vardo, just across the Finnish border in Norway, whence they took the regular steamer to Bergen, from there to Newcastle, and so to London. They suffered no privation.

W. J. Chalmers, the original Chalmers, of Fraser & Chalmers, now a young man of 65, alert and keen-witted as ever, has arrived from Carlsbad. He was 16 days on the way and was arrested 49 times—after that he ceased to count. His wife had been taking the cure at Carlsbad. They came away with a party of friends in three motor-cars through Pilsen, Budweis (and other places that beer has made famous), Salzburg, Innsbruck, Feldkirch, and then across the Rhine into Switzerland, avoiding German territory and fearing to enter Italy lest that country might also be at war. They did not know of the Franco-Prussian or German-British declarations of war until a week after the events, and only figured on the Austro-Servian conflict. Chalmers was wise enough to leave every scrap of writing at Carlsbad, to have the passports of his party *visé* by the Hoffmeister and Governor, and to procure Austrian, German, Swiss, and French currency—and lots of it. As he says, by keeping your temper, by being courteous, and by lavish tipping (in gold) you can get most anywhere. He did. At Zurich they found a crowd of refugees. He speaks highly of the Swiss banks, which advanced £8 twice per week on letters of credit and raised it subsequently to £12; these local banks arranged to honor drafts in payment of hotel bills; and generally relieved the financial complications in a most intelligent manner. He speaks bitterly, I am sorry to say, of the Swiss agents of Thos. Cook & Son; these closed their doors, refused to make refunds on tickets that they had issued, and declined even to honor the checks of their own firm. This looks like a stupid blunder—to put it mildly. Mr. Chalmers—bubbling over with health, bright and cherry—says that the Americans in Germany and Austria will be subject to great hardship. At health resorts like Carlsbad, there are hundreds of poor people that have come there to take the cure and are without money, ill, frightened, distraught. He considers—and I agree—that the Americans in England are having a picnic and that your relief committees ought to attend promptly to the care of those of your people in our enemy's country.

August 20.

There are persistent rumors, accompanied by circumstantial statements, that train-loads of Russians are arriving in Scotland and crossing England on their way to France. These allied troops are said to have come by sea from Archangel, around Norway, to the Scottish ports. Gilman Brown says that some of the Russian members of the staff at Kyshtim and Tanalyk were ordered not to go to their usual centre of mobilization, but to prepare for special duty, on account of their knowledge of English. Then Curle tells me that there is a big lumber trade on the river Dwina, debouching into the White Sea at Archangel, and that the numerous saw-mills there can furnish thousands of soldiers. Besides, there is plenty of shipping, some of it captured German vessels, at Archangel, available for army transport.

August 28.

That rumor about the Russians is confirmed. J. F. Erdlets, who, as mining engineer, has been in Russia, tells me that he saw a batallion of them at King's Cross station. H. W. L. Way, who used to be in Colorado, saw them passing in trainloads through Cambridge a few days ago. So it appears that they have traversed England on the way to France. British troops from India are arriving at Marseilles. I hope they will arrive in time to face the great attack that the Germans are expected to make in celebration of the anniversary of Sedan, on September 2, the day after tomorrow.

American friends, like Heinrich Ries and W. J. Chalmers, have confessed how useful an American accent proved to them in their escape from Germany and Austria. At these times we realize that we do not speak the English language in quite the same way, although we write it much alike. It is better to be a Philadelphian than a Bostonian just now at Dresden or Carlsbad. On the other hand, it goes hard with those here who speak with an obvious German accent, as is the case with friends of mine that I know to be not only naturalized, but loyal, British. One man and his family were unable to get porters to help them with their luggage at a railway station, on account of their hostile pronunciation.

August 31.

Will Irwin, of San Francisco, the correspondent for *Collier's Weekly*, has passed through London. He was at the battle of Mons and happened to be at Louvain when it was destroyed. According to him, some boy-scouts did attack the Germans, killing three officers, and that is why the old city was sacked. It appears also that whenever a shot was fired from any house, the Germans killed everybody in it—men, women, and children—as he came to know by going later to the house where he had lodged. This exasperated the Belgians so as to drive the boys to retaliate. It makes the story more horrible, but it does not excuse the enemy's barbarity. Frederick Palmer, I hear, is the only correspondent accredited with the allied forces; he was chosen to represent the American press.

September 2.

*In this series of war letters, the *Press* will print extracts from Mr. Rickard's personal letters from London, believing that an account of the war as seen by a mining man in that great centre will be of interest to mining men everywhere. Mr. Rickard is an Englishman who was born in Italy, passed his early boyhood in Russia, managed mines in France and Australia, and lived in the United States more than twenty years. His sympathies are naturally with the Allies, but he will endeavor to be as impartial as he may.

REPUBLIC, WASHINGTON, LOOKING DOWN CLARK AVENUE. REPUBLIC AND NORTH WASHINGTON MILLS IN THE DISTANCE.

Mining and Milling at Republic, Washington

By E. C. MORSE

For the past 15 years Republic has been best known to mining men by reason of its meteoric history, its 'ups and downs,' its spectacular periods of production, and its sudden declines. The district deserves more attention from mining men of means than it has been receiving lately. There has been a good deal of money earned in the past few years by lessees. The operating companies which succeeded them were generally struggling concerns, operating with the same equipment employed by the lessees and little if any more capital and generally with a large burden of indebtedness representing the purchase price of the property upon an inflated valuation. As fast as any good ore was found it was mined out, and shipped to a smelter or mill, so that few of the properties have any ore blocked out, except such as was too low in grade to yield a profit, at the time the mining was done. A brief description of conditions prevailing at the principal mines around Republic may not be out of place here.

Long Mineralized Zone

The mineralized zone in which the orebodies occur is about five miles long and extends from the Mountain Lion and Tom Thumb region on the north to the Republic and Jim Blaine on the south. The aggregate yield to date of these ore-shoots has been more than $5,000,000. A large part of it has come from high-grade ore in relatively small ore-shoots which have been mined by lessees and small companies, the production being distributed over the entire zone.

The Mountain Lion is one of the most northerly properties in the district. It was an extensive shipper for a number of years. It has a wide vein which was fairly exhausted down to the adit level, at a depth of about 300 ft. Sinking has been done for several hundred feet below the adit and good ore of at least milling grade has been developed, though it has been but partly blocked out. The Mountain Lion ore is the most uniform in grade of any in the district and the pay-shoots are said to be large. One of the early mills was built on this property. It contains a good steam-power plant, twenty 1250-lb. stamps, four Huntington mills, and an early type of MacArthur Forrest cyanide plant. It was not adapted to the ore, only recovering about 50% of the gold. The Mountain Lion is owned by the McLarren estate at Ottawa, Canada, and has been idle for the past six years and may not resume operations until the cheap electric power, which appears now to be in sight, comes into the district.

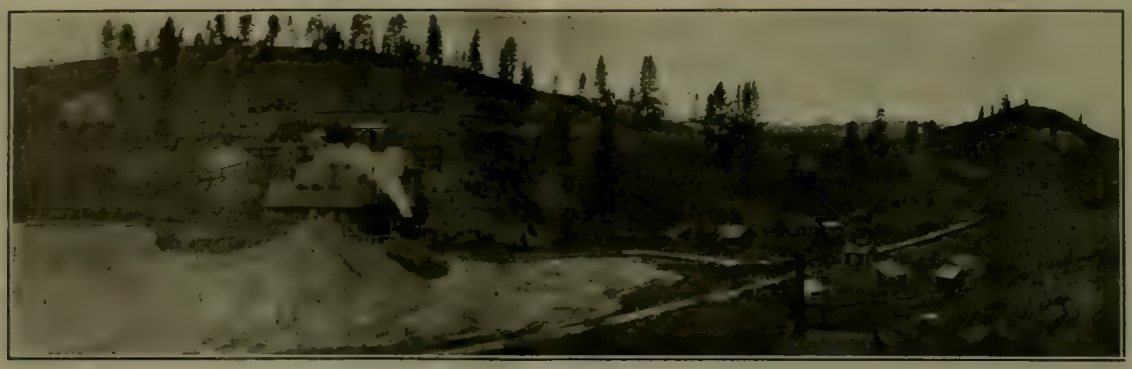
The Tom Thumb is a group of claims owned by a Walla Walla company which has good mining equipment and is supposed to have a wide vein of ore averaging perhaps $7 or $8 per ton, but none rich enough to ship to smelters. This property is also idle. The Knob Hill mine has had a good ore-shoot which has produced a large quantity of high-grade ore and has paid the purchase price of the mine. The property is at present paying for a systematic development campaign. High-grade ore is shipped to smelters and low-grade ore to the San Poil mill. Sinking is also in progress.

Eureka Gulch

In Eureka gulch for about a mile and a half there are two separate vein systems which parallel either side of the gulch. On the west side is the San Poil group, the Ben Hur mine, the Trade Dollar, and the Gold Dollar claims. For the most part this is not such a strong vein as the main or 'mother' vein of the east side, which is generally called the Surprise vein and extends through Quilp, Surprise, Hope Group, Lone Pine, Pearl, Little Cove, Knob Hill, and Mud Lake claims.

The Ben Hur mine is being operated by the Ben Hur Leasing Co. and is down about 600 ft. Three years ago this mine was supposed to have been exhausted, but it has shipped approximately 100 tons per day to the smelter during the past year, besides sending low-grade ore to the San Poil mill.

The San Poil mine made a good showing during the



SAN POIL MINE AND MILL. LITTLE COVE SHAFT IN THE FOREGROUND. KNOB HILL AND BEN HUR MINES IN THE DISTANCE.

first year's operation of the mill. The past year's work on the lower level has not been satisfactory, though promising ore has been reported recently. Considerable custom milling has been done.

The Republic Mines Corporation, one of the most important groups in the district, owns the Surprise, Lone Pine, and Pearl claims. The property extends for three-quarters of a mile along the Surprise vein, but owing to the fact that much of it was on relatively low ground and not very well known to early lessees, only one ore-shoot has been opened, though there are many good indications of others.

The Surprise mine, a relatively short shoot, has been worked for a depth of 700 ft. and in two years time produced more than a million and a half in shipping ore. This has paid for the mine and a number of dividends, and also contributed largely to the building of the North Washington mill. On the 700-ft. level the ore is richer than elsewhere and the shoot is longer.

An adverse court decision in an injunction proceeding brought by the Quilp company, in the initial stages of an apex suit, seriously crippled the Company and a factional quarrel which followed completely wrecked it. At present this property is about to be sold under the hammer.

The Lone Pine's Good Showing

The Republic Mines Corporation has not only the Surprise mine, with whatever claim it may have to the disputed ground and the Surprise vein, but also a number of cross-veins on the Lone Pine and Pearl claims, which have received more attention than the main vein. On the Lone Pine, lessees and early operators in search of high-grade ore, exposed a large ore-shoot about 500 ft. long for a depth of several hundred feet. In places this was more than 30 ft. wide and of good milling ore. A $7 average is claimed. Under the direction of the trustee the Pine workings were recently pumped out and systematically sampled, with gratifying results.

One of the cross-veins just mentioned is in the Insurgent fraction and the Last Chance claim. A leasing company mined the streak of high-grade ore in the Insurgent to a depth of 700 ft. and left ore ranging from $8 to $10 for a considerable width. This has exposed a good face of high-grade ore on the end-line of the Last Chance claim 700 ft. deep.

The Hope company has the old Blacktail properties, which contain a network of veins and apparently a large tonnage of milling ore. The Company also owns considerable ground along the Surprise vein which has received little attention so far, together with a good mill-site. The Quilp mine, adjoining the Surprise on the main vein, has shipped large quantities of ore to the smelter and is supposed to have a large tonnage of milling ore. The Quilp claims ownership to the disputed ground which contains a large part of the so-called Surprise ore-shoot.

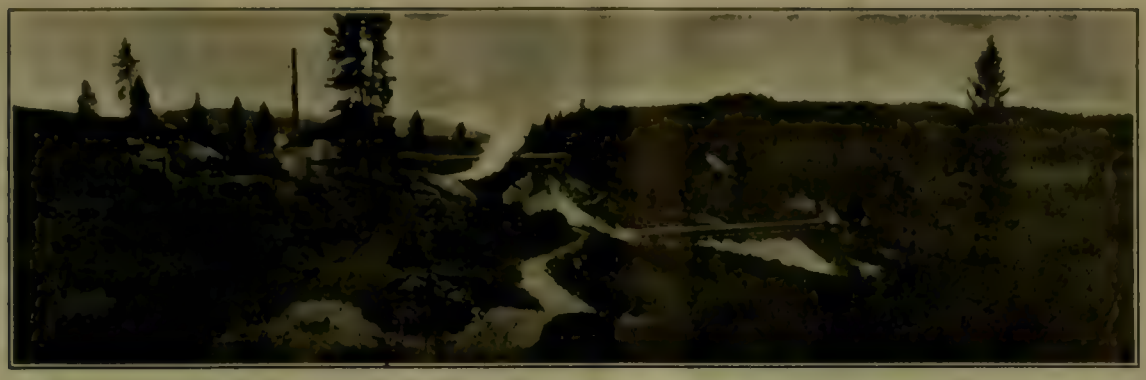
Rathfon Reduction Co.

A persistent campaign of exploration work at the Republic mine is being pushed by the Rathfon Reduction Co., a group of experienced mine and mill operators headed by Messrs. Rathfon, Bewley, and Bradley, who control the property. They are developing a large body of low-grade ore which they think will be profitable when cheap power is provided and the property is equipped with a suitable mill. They also have good sized shoots of better grade ore, and frequently ship carloads that range from $100 to $150 per ton, to help pay for development. There are a number of promising prospects around the Republic and between there and the Quilp, but there is not much activity there at present.

Transportation facilities are good. The district is served by two railroads, the Great Northern and the Spokane & British Columbia. One or the other and often both of them reach all the important mines. As milling progress has reduced milling costs, so has there been a reduction in smelting charges, which are little more than half what they were three years ago. This is partly due to the increased demand for silicious ores at the Granby smelter at Grand Forks, the Trail smelter, and the British Columbia Copper Co.'s smelter at Greenwood, British Columbia.

Milling Republic Ores

Four factors interfered with the success of the half dozen earlier mills, besides the lack of a continuous ore supply of suitable grade: the high power cost, which is



THE BEN HUR MINE. KNOB HILL, LITTLE COVE, PEARL, AND LONE PINE MINES IN THE DISTANCE.

still a drawback: the hard quartz, some ribs being as high as seven in the scale of hardness; necessity of pulverizing the ore till 90% or more passed a 200-mesh screen to release the gold; and suitable grinders, agitators, and filters were not developed and consequently not used in the earlier mills.

The power cost with steam, using coal at $6.60 per ton, is the largest item of cost, making nearly half of the total working cost in the San Poil mill. Shields and McKane of Spokane recently applied for a franchise for transmission of electric power from the Bannington Falls wires at the Canadian border through Ferry county to Republic. If this project is successful, it will reduce mining and milling costs $1 per ton on 100-ton plants, which would greatly increase the available tonnage in all the mines.

The San Poil Mill

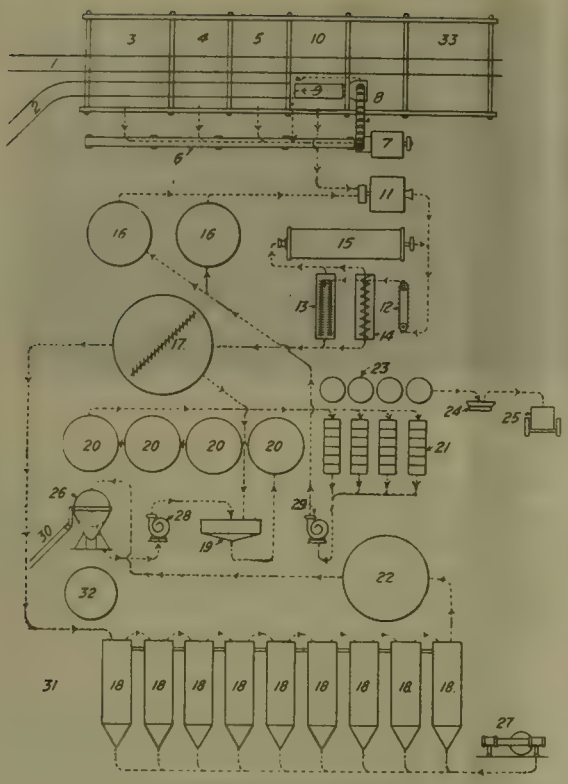
The San Poil mill has been in operation nearly two years and treats 100 tons per day. In the matter of tonnage, much depends on the kind of ore that happens to be treated. For example, it is as easy to crush 120 tons of Ben Hur ore, as it is to crush 85 tons of the hardest Lone Pine ore. These ores represent the two extremes in grinding costs. In a general way, extractions range from 88 to 95% of gold and silver on mixed Republic ores. Much depends on the grade of the ore being treated, for their is little difference in tailing assay whether the ore be high or low grade For the most part it has been customary to grind until 94% of the material passed 200 mesh. Mixed Republic ores usually contain 5 oz. silver to 1 oz. of gold. About 30% of the gold content is combined with silver sulphides, so that a considerable portion of silver must be dissolved to render a high extraction of gold possible. This necessitates the use of a fairly strong cyanide solution. Experience has caused the adoption of about a 7-lb. per ton KCN strong solution and 5-lb. KCN working solution. Cyanide is added at the strong solution tanks at the head of the ball-mills and pebble tube-mills. Lime is added to keep up the required alkalinity. From 1 to 2 lb. cyanide is consumed per ton of ore treated, generally about 1½ lb. About ⅔ lb. lead acetate is added per ton of ore and the zinc shaving consumption is about one pound per ton of ore. Under these conditions milling costs in April, including office, assaying, and corporation expenses, were given as $3.33 per ton and in May, $3.35 with a short month's run. Cast white iron liners with ribs are used in the tube-mill. The flow-sheet is so near the standard practice that only portions of it require special mention.

The Crushing and Grinding Plant

Three machines with the necessary launders, conveying, elevating, and classifying arrangements constitute the crushing and grinding plant. The equipment consists of one Williams chain hammer mill, one 6 by 6-ft. ball tube-mill of Traylor Engineering Co.'s manufacture, and one 5 by 22-ft. pebble mill supplied by the Allis-Chalmers Co. A loss in the running time of the ball tube-mill has been experienced owing to the use of brittle white iron linings in place of the standard chrome or manganese steel linings. In other respects the methods and results are well up to the average of ball-mill and pebble-mill work.

Ore is delivered to the bins from the San Poil mine by cable tram which passes over the top of the bins, or, if it be custom ore, by bottom dump cars from a Great Northern railway siding which also passes over the bins. From these bins the crude mine run ore is fed by hand to a belt-conveyor which transmits it to a Williams chain hammer mill. Pieces up to a foot in diameter can be fed into the mill. This crusher breaks everything to pass a ⅜-in grizzly.

A bucket-elevator lifts the crushed ore to a trommel, which is used if it is desired to crush finer than one-quarter mesh, the oversize being returned to the mill. The trommel is rarely used at present. From the elevator the ore drops through a sampler to a storage bin from which it is fed into the ball tube-mill, which grinds the ore to pass 20 mesh. From the ball-mill it goes to a bucket-elevator which delivers it to a Dorr and an Akins classifier arranged in tandem, the finished product going to the first Dorr thickener and the oversize to the pebble-mill and through it to the elevator and back to the classifier, and so on until 94% is reduced to 200 mesh. The only feature in the arrangement not often met with is the Williams chain hammer mill.



FLOW-SHEET OF SAN POIL MILL.

The accompanying flow-sheet will give a clear idea of the arrangement and operation of the mill.

1. Great Northern railroad spurr over top of bins.
2. Tramway from San Poil mine.
3. Bin for ore from San Poil mine.
4. Custom ore-bin.
5. Custom ore-bin.
6. Belt conveyor feeding hammer mill.
7. Williams chain hammer mill.
8. Bucket elevator to sampler and trommel.
9. Trommel with ¼-in. screens.
10. Bin for storage of hammer mill products.
11. Traylor ball tube-mill 6 by 6 feet.
12. Elevator to classifiers.
13. Duplex Dorr classifier.
14. Akins classifier.
15. Gates pebble tube-mill, 5 by 22 feet.
16. Strong solution tanks.
17. Dorr thickener, 24 by 10 feet.
18. Nine Pachuca agitators, 12 by 18 ft., in series.
19. Cone bottom clarifying tank.
20. Four settlers in series clarifying for zinc-boxes.
21. Zinc precipitation boxes.
22. Dorr thickener, 20 by 12 feet.
23. Clean-up settling barrels and filters.
24. Dryer for precipitates.
25. Donaldson tilting furnace.
26. Oliver continuous filter, 16-ft. drum.
27. Vacuum pump.
28. Centrifugal solution pump.
29. Solution pump for return solutions.
30. Belt conveyor to tailing stacker.
31. Shop.
32. Water tank.
33. Coal storage bin.

The Hammer Mill

The hammer mill is a near relative of the Quinner crusher, so successfully used in dry placers in northern Mexico. The present hammer mill has been in successful operation for more than a year, and it is so satisfactory in all respects that it deserves more than passing mention. The first hammer mill placed in the San Poil mill gave trouble because of too light a frame construction, and the Williams company replaced it with the present machine, which has overcome these objections. An inspection of the illustration will enable one to understand the principle upon which the machine operates.

There are fourteen 40-lb. hammers fastened to a central shaft with chains which whirl around at the rate of 300 r.p.m. Outside of this, but covered by a metal housing, is a squirrel-cage grizzly trommel built up of 1 by 2-in. bars on edge and spaced according to the fineness to which it is desired to crush the ore. This cage revolves in the same direction as the hammers, but at a speed of only 60 r.p.m. The ore is fed to the machine through a hopper. The whirling hammers break it up until it is fine enough to fall through the grizzly spaces of the trommel. Good work has been done with the machine with spaces as close as $\frac{3}{16}$ in., when the ore was dry, but where the ore is wet, it is not advisable to set the machine to crush finer than ⅜ inch.

On hard Republic quartz crushing to ⅜ in. the machine frequently reaches a capacity of 20 tons per hour; its average capacity is about 15 tons per hour. The horse-power consumed depends on the rate of feed and speed of crushing. About 30 hp. is the average. Ordinarily 6 hours running time is sufficient to supply the mill for 24 hours. But this time is divided over several periods, for the storage bin is only 16 ft. deep. Two shifts are employed on the hammer mill. The hammer mill-man attends to repairs, looks after conveyor, elevator, trommel, and assists with feeder to ball-mill.

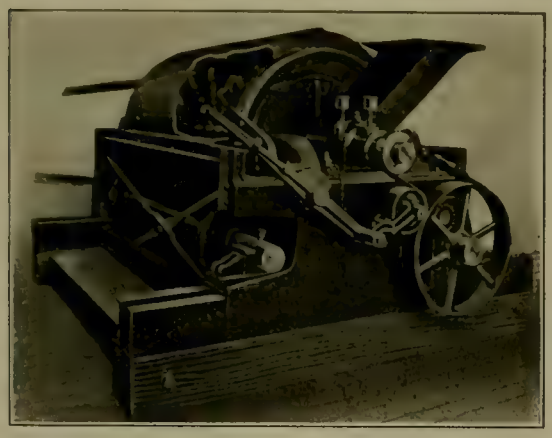
Costs of operating the hammer mill using white iron hammers, soft steel chains, tool steel grizzly bars, under power conditions prevailing at Republic per ton of ore crushed are approximately as follows:

	Cents.
Power for crushing, elevating, and conveying	4.6
Labor for crushing, elevating, and conveying	8.0
Repairs for crushing, elevating, and conveying	8.0
Hammers and chains	4.5
Total	25.1

Repair cost is the only objectionable item. The principal part of this is represented by renewal of grizzly bars. A set lasts about four months. This item has been between 6 and 7 cents per ton where tool steel has been used. Manganese steel bars are being tried at present and it is hoped that better results will be obtained in this respect. Much of the hammer consumption is due to breakage of white iron hammers rather than to their wearing out. It has been shown that there would be a saving of about 25% by the use of manganese or forged steel hammers, but no arrangement has yet been made for a regular supply, so the white and

gray iron hammers cast at local foundries are still being used. The cost of operating compares well with any combination of machines which cost several times as much money. It does good work on a more economical scale in crushing to ½, ¾, or 1-in. size and is suited as a preliminary crusher to prepare material for Chilean mills, Hardinge mills, ball or tube-mills, stamps or rolls, or for making jig feed for concentrating plants.

The hammer mill has often been compared with stamps by its critics. To say that the hammer mill is equal to the stamp as a hard-rock crusher under any conditions, is saying a good deal, for there is nothing that equals stamps, in simplicity, reliability, ease of adjustment, or repair, and they are also possessed of that desirable quality of being as nearly 'foolproof' as a



SKELETON VIEW OF WILLIAMS CRUSHER.

crushing machine can be. However, where it is only desired to crush to ¼ or ½-in. mesh and follow with Chilean or Hardinge mills, after the manner of the Nevada Hills or Commonwealth mills, the hammer mill is a good substitute for stamps. Without discussing the matter further, I will say that the hammer mill approaches the stamp in efficiency when it is only desired to crush to ⅜ or ½-in. size. One hammer mill can be depended on to do the same volume of work as a rock-crusher and fifteen 1250-lb. stamps. It costs about the same installed as one 5-stamp battery, so it will appeal to concerns of modest means or those whose operations are of a relatively temporary character.

The mill was originally designed and built by contract for $45,000, including ore-bins, building, shafting, power plant, transmission of power, light plant, Dorr thickener, Dorr classifier, Oliver filter, nine small Pachuca vats, tanks, and a crushing plant consisting of one hammer mill, a set of rolls, and a Gates 5 by 22-ft. tube-mill, everything on concrete foundations, but not including railway, water supply, tramway, or refinery.

For $10,000 more money the Hammond Manufacturing Co., which had the contract, offered to substitute 30 stamps of 1000 lb. each for the hammer mill and rolls, but cash had to be provided for the stamps, while the other machinery could be bought largely on time. While in the end the San Poil company developed a good system of preliminary crushing, it would have been ahead at least $25,000 if stamps had been taken even at an added cost of $10,000, for that amount would have been saved in remodeling, alterations, experimental work, and lost time.

With the present rapid progress in metallurgy and the wonderful development of mechanical appliances of every description, it is not strange if any design of mill grows old fashioned in some respects even while it is being built. For instance, it would now be a mistake to design a mill so that elevators have to be used in the classifier and tube-mill circuit, in view of experience in the Tonopah Belmont and Commonwealth mills. It would also be a mistake not to use counter current or replacement washes with additional Dorr thickeners between the sets of agitators at least on silver ores, as applied in the Buckhorn mill. After a trial of both, I like a number of small Pachuca agitators in series better than a few large ones, but I believe the Dorr agitator is better than either.

Zinc dust precipitation as applied by the Merrill Metallurgical Co. is undoubtedly the right thing for large plants, but zinc shaving is satisfactory for small mills, particularly where considerable silver is present in the ore. I would not now attempt to use anything but a Dorr machine for 200-mesh classifying. The Oliver filter seems to be especially well suited to Republic conditions.

Some metallurgists hold that by using concentrators in the tube-mill circuit, returning the concentrate to the mill until ground fine enough to float off in the tailing, would enable one to make the extraction at 100-mesh and thus largely reduce grinding costs. Laboratory tests indicate that this is true of some of the ores. The San Poil company never felt able to try this in a commercial way.

Future of the District

It is generally agreed by all familiar with conditions, that with cheap power, a mill of economic size, and mining in larger way it is possible to make a profit on ore assaying more than $4 per ton in the larger veins and over $5 per ton in the smaller veins around Republic. It is also known that in the aggregate there is a lot of ore present. There is not enough blocked out in any of the mines to justify fancy selling prices. There is considerable prospective ore in a good many of them. Unless it be true of the Republic Mines Corporation there is no one property with enough ore in sight to justify a very large reduction plant. A consolidation of the more important properties could probably be financed by an exploration and milling company, and this would solve the problem. Or a leasing and milling company safeguarded in such a manner as to insure the continuation of development, after the manner of the Ben Hur Leasing Co., only in a larger way, using either of the existing mills as a nucleus to be altered or enlarged as circumstances warranted, would probably handle the situation.

Management of a Country Smelter

By HERBERT LANG

It is privately thought by persons of experience in this line that the management of a smelting establishment, especially one devoted to custom work is the most difficult and trying of all human occupations. Some have held, but perhaps too extravagantly, that to carry on such work demands more brains, experience, and technical skill than any other pursuit. One needs not accept this, but there is no doubt that smelter management of the right kind requires high mental qualities, along with a great fund of experience and skill. These qualifications are not always present among managers, but I have no doubt that, taken as a whole, the class of managers and practical adepts would stand a rigid comparison with the best financial and technical lights throughout the world. Excellence in metallurgical pursuits, as in most others, can be attained only by those gifted with brains, aided by the experience of many years in the various subordinate branches of metallurgic art. It is a good—even an indispensable—thing for the manager to have had personal experience in most of the trades and professions directly connected with his craft. He must be a good business man; he ought to be a good technical man whenever, as happens in small plants, conditions prevent him from calling to his aid an ample staff of highly skilled subordinates who can relieve him of the technical part of his load. The manager who is *au fait* with all departments has a right to be a little vain-glorious, and, it may be added, he is none too common.

Selection of a Crew

In no department is the manager's wisdom more to the point than in the selection of the crew, for so much depends on the character and aptness of the people associated in the undertaking. The shrewdest judgment must be employed in choosing from among the miscellaneous crowd of job-seeking aspirants fit individuals to carry on the work. It might be thought by those who casually visit some great metallurgical establishment and observe the kind of men largely employed there, that muscle rather than brains was the desideratum, but this is a mistake. The 'bone-head' contingent may largely predominate, it is true, but this, to a certain extent, is a necessity of the case.

It must not be supposed that effort is lacking to substitute mechanical for human means in doing the routine work of the smelter, for unlimited brains and ingenuity are constantly being expended in such directions. Increasingly in this, as in all other industrial occupations, machinery is taking the place of muscle, but there still remain many necessary tasks which, to the chagrin of the manager, must be performed by raw human strength. This is regrettable most of all to the designer, whose ideal is always an establishment wherein the total of the work would be performed merely by the touching of buttons and the pulling of levers.

The Ore Supply

The local smelter obtains its supply of ore either by purchase from the surrounding mines or by working ore deposits on its own account. Ordinarily both methods are followed, since it will be understood that the purchase and treatment of outside material is the less reliable source; in short, it is a less dependable and usually less lucrative business. It is easy to make contracts on more or less advantageous terms with mine-owners, but difficulties arise when the sellers are required to produce and deliver particular kinds of ore, such as may be demanded by the exigencies of the smelting operation. The convenience of the smelter man is not much regarded by the miner, nor does the economical work of the mine harmonize with that of the furnace. It is advisable, consequently, to go outside of the contracting mines, and by working suitable properties to furnish acceptable ores in quantities to suit the furnace requirements.

It is needful to take at least the preliminary steps toward securing a proper ore supply before beginning construction, or in fact before news of the project is reported. The operator should go into the chosen field before the inhabitants have wind of the undertaking, and proceed in the quietest way to make contracts for the largest deliveries of ore, covering the longest possible period, securing thus both mines and ore whenever feasible. The miners, awaiting the advent of some such works, or very likely almost unaware of their appropriateness or utility in the district, are generally favorable or even enthusiastic toward such a proposition; but there are others who, from motives of their own, oppose, or greet it with coldness. After the project has taken root, however, their sentiments in many cases take a new turn, and those who have not supported it primarily are apt to take the ground that as long as the new concern exists it will need their product and will ultimately be compelled to pay a high price therefor.

This somewhat selfish view should be foreseen, and a sufficient amount of ore secured in advance, so that the backward mines may be left out of account if desired. Such men often overreach themselves by waiting too long and trying to drive too hard a bargain. I have seen, and I was not sorry to see, cases where valuable mines were left unworked during the whole time of the smelter's activities in the camp, and left so after its work was finished and the establishment dismantled, because the mine-owners insisted on terms which the ore purchasers thought it unwise to grant. Decidedly, it will not do for some mines of a district to lie idle

while the others are being exhausted when they should be worked together for fluxing, for upon the constitution of one or two deposits may depend the availability of all the others.

Fluxing the Ore

This consideration leads us to a discussion of the whole matter of fluxing, so important to the welfare not of the smelter alone, but of the whole district. This is aside from the main topic, but it is appropriate to say that in the practical smelter's mind a flux is a barren material put in to enable the charge to run properly to serve some function connected with the formation of metal or matte. Everyone knows how rare it is to find ores which perform all these functions alone; therefore, it is necessary to add in almost all cases some otherwise valueless material, which in some cases may be iron bearing, in another lime bearing, and in another silicious. Some ferrous sulphide, which is not usually regarded as a flux, may be necessary occasionally or regularly, for example. Fluxing ores are those which fill these requirements while carrying valuable minerals.

As the object is to avoid as far as possible the addition of barren matter to the charge which would increase the cost and the loss in slag, the proper ores are sought with avidity, and their procurement becomes a matter of vital moment. The requirements differ in different districts. In a region blessed (or cursed) with a superfluity of metalliferous quartz, the proper fluxes are limestone and iron; in a country characteristically ferruginous—in plainer language, where iron chiefly prevails—the fluxing material must be silica, with some limestone. Should lime prevail, we must provide sufficient quartz and iron, even by importing them from a distance. By 'iron' I mean iron-bearing ores in some convenient form. Thus, in some cases the flux would be silica; in others, iron or lime, or both. Thus we enlarge somewhat upon the ordinary conception of a flux, which includes simply the basic matters; that is to say, those that combine with silica. Fluxing ores are valuable to the smelting project in proportion to their scarcity. Thus a single vein of gold-bearing quartz in a district prevailingly ferruginous or calcareous, being indispensable in slag formation, might save the project from failure. Likewise a single, and perhaps restricted, deposit of some iron mineral in a region of quartzose ores might be equally valuable. These considerations are introduced to show how important it is to a new smelting project to take account of all the ore deposits in the district, and viewing them in the large way, to settle upon the proper policy as to their procurement.

Selecting the Ores

The experienced operator, carefully traversing the district for the purpose, and considering the character of the ore of those veins which are to be worked, will be able to fix definitely upon the kind of fluxing material wanted, and will know where it is to be found. Thorough inquiry into the matter will reveal to him the existing sources of such materials, and will settle the question of their composition, fitness, and quantity. Besides the run-of-mine ores which always form the staple of such operations, there are frequently other sources of material valuable to the smelter, such as the concentrate from gold-milling, the tailing left after chlorination of the same, the accumulation of scrap iron about old millsites, and the old and abandoned mills themselves. Idle chlorination, amalgamation, and lixiviation plants often yield valuable materials, such as the brickwork of their furnaces and the woodwork of their vats, which will invariably be found to have absorbed the metals. There may be metal also in the dust collected in their flues. All such sources of profit should be looked carefully into by the intent metallurgist or manager whose perspicacity and business skill will have full play during the early days of the new institution.

Sampling and Buying Ores

The means by which the value and chemical composition of ores are ascertained are well understood, but deserve consideration in connection with local smelters, since they are occasionally modified there to suit peculiar conditions. Machine sampling, so much in vogue at large and well established works nowadays, is not entirely in place in the mining camps, partly on account of the suspicion existing among the comparatively unsophisticated inhabitants, and also because of the lack of the necessary apparatus. But as the miners come to understand the unerring action of machinery, in contrast with the older methods of hand labor, it appeals more and more to them. This, however, implies education and the lapse of time. Machine sampling is not only the most economical and expeditious, but it is also the most accurate, all things considered, of all the means by which the value of an ore can be ascertained. In consequence, however, of ignorant suspicion so frequently encountered, it becomes necessary for the smelter to adopt at times hand methods, and to use much tact and discretion in ore dealings, giving way as far as may be to whims and prejudices, and taking much pains to avoid harmful antagonism. It is sometimes necessary to take samples of ore in very inconvenient localities. I have felt obliged on occasion to send men to some isolated mine or prospect situated, perhaps, on a steep hillside, where absolutely no conveniences could be found, to draw the samples from dumps of ore which the seller would not allow to be removed to the smelter before being paid in full. Such are extreme cases, no doubt, but well illustrative of the obstinacy and stupidity of some miners. In such a situation, I cut down the heap by hand, broke the larger lumps, and after a great deal of labor obtained samples sufficiently accurate to base the price on, and by prompt settlement did a great deal to remove the miner's prejudice, thus leading eventually to considerable profitable business.

Nearly all beginners in mining are prejudiced and permeated with suspicions which arise from the stories current in the camps as to the dishonest methods of ore dealers, which, by the way, are an undeserved aspersion on the character of an uncommonly honorable fraternity. The Mexicans are the worst in their treatment of ore buyers, but even their prejudices may be removed in time by tact and patience and by compliance to the greatest possible extent with the whims and notions which have persisted for centuries. Ore buying in their country demands a knowledge of local conditions and practices, and especially of the laws, which are somewhat severe upon the 'tenderfoot' buyer. The experienced ore purchaser in that country or this, is in a position largely to benefit his company by the exercise of business sense and by his knowledge of the fluxing powers of different materials, although in the latter respect he will be directed by the metallurgical staff.

He should be wide awake to every detail of his employment, and should overlook no opportunity to secure even the smallest job lot of ore, concentrate, or other suitable paying material to be had. In the purchase of small lots of rich ore quite disproportionally large profits are frequently made. But unfortunately these batches are too frequently the result of 'high-grading' operations in distant mines, and their receipt causes a good deal of embarrassment to a management desirous of clean dealings and of securing the best bargains possible. The manager may have well grounded fears that his concern may become a sort of 'fence' for the receipt of stolen goods, for no one outside the business can have more than a faint idea of the extent to which these thieving operations are conducted. But these small transactions, however profitable they may be, are of little consequence to the actual running of the furnaces, since the total weight of such small lots is hardly comparable to that of the run-of-mine ores which are the main dependence.

Ore Buyers and Contracts

It was formerly customary for the principal custom smelters of the West to keep their ore buyers in the field, bidding for ores in competition with each other; but since the consolidation of the smelting companies this practice has ceased, and one or two traveling men do all the work which once occupied a large number. Longer contracts are now made, in some cases the whole output of a productive mine being taken for terms of as much as ten years. It will be readily understood that if the larger properties of a district have been thus tied up, the chances for independent establishments getting a foothold will be pretty small, and that local plants will find little opportunity against such competition. However, as I have indicated, the policy of owning or at least controlling the ore supply will relieve them measurably from competition and outside oppression. The difference in the cost of freighting to the outside plant and to the local one will be the measure of the profit of the latter, for the difference is not small as a rule. It must not be assumed, however, that it is all profit, since the cost of reduction is almost invariably greater at the local plant, added to which the smelted product usually has to be freighted to a distant refinery at comparatively higher rates than those which are paid for shipments of raw ore. It is not to be forgotten that the operations in the local works are few and simple. Generally they are confined to sampling, roasting, and smelting; or, more frequently still, to the single process of smelting, leaving the product in a comparatively crude form to be shipped away and subsequently converted into commercial form by other processes.

Relations of Smelter to Producer

The attitude of ore sellers toward the buyers, while ordinarily friendly enough, is not always so. In mining camps there is heard a great deal about the tyranny of the smelters and their disposition to freeze out the miner, the most of which is unadulterated bosh. All such allegations could be dismissed without remark, simply remembering that both parties are apt to behave precisely as business men should, each being intent on making all the profit possible in the transaction. I consider that the smelter is entitled to all he can make, taking square issue with those who appear to hold that he should take all the risks and pay as near to 100% of the contents of the ore as the miners might wish. I know of no reason in justice or equity why a smelting establishment should be run on an eleemosynary basis, notwithstanding the common notion that they should exist solely to 'develop the country' and 'give the miners a chance.' The only sound reason for the existence of a smelting works is money-making.

One Source of Friction

Although miners rail at the prices exacted for treating their ores—prices, by the way, which are wonderfully low if we consider the nature of the work—they frequently say severe and even less justifiable things reflecting on professional honesty. To understand this, we should put ourselves in the place of the mine or prospect owner. It is natural for him, looking most probably for capital to purchase or work his property, to put up the best possible front, and to exaggerate its richness. No one likes to confess his mine a failure, so when it is put to the crucial test of a trial shipment of the ore, the owner's feelings are much wrought up. If at such a time the ore is found to assay lower than had been claimed, it is only natural, though not by any means excusable, to put forward claims that the smelter has robbed the owner. Such allegations are not readily forgotten, and too often form the subject of everyday conversation in the camps. That the most of such allegations are false, there is no doubt; but much may be forgiven to the man who has to undergo the harrowing realization of his property's worthlessness.

Production of Radium in America

By CHARLES H. VOIL

The production of radium in the United States from ores occurring in this country, and the proposed legislation whereby the Bureau of Mines would undertake to produce radium have been the cause of a great deal of comment on these subjects during the present year. Many of the statements which have been given the widest circulation and have enjoyed a general credence have been made with a view to accelerating the pending legislation, and the truth frequently has been overlooked in the effort to make a stronger appeal to the sympathy of the public.

A Radium Famine?

The statement coming from Washington recently to the effect that America is to suffer from a radium famine because of the war in Europe cutting off that source of radium well illustrates how little the truth is considered. As a matter of fact, far more radium is now being produced in the United States than in all the rest of the world. In view of this little understood fact it may be of interest to give some facts with regard to the radium production in the United States. Experimental work on radium production is now being carried out by the Bureau of Mines in coöperation with the National Radium Institute, a corporation which will ultimately receive the radium so produced, and numerous experimental plants are engaged with the problem of extracting radium from the low-grade ores available, but, so far as I know, only two companies have actually produced radium in the United States. These are the Standard Chemical Co., of Pittsburgh, Pennsylvania, and the Radium Company of America, of Sellersville, Pennsylvania. Of the quantity of radium produced by the latter concern I have no authentic information and the quantity is probably small.

The Standard Chemical Co. is the largest producer of radium in the world. The output of radium salts produced by this country is three times greater than the aggregate output of all the rest of the radium producers in the world.

Present Production

The radium produced from January 1, 1914, to September 1, 1914, in the Radium Research Laboratory of the Standard Chemical Co. contained 14,000 milligrams (14 grams equal one half ounce avoirdupois) of pure crystalline radium bromide ($RaBr_2 \cdot 2H_2O$). This corresponds to 7500 milligrams of actual radium element in the radium preparations, all of which consisted of 50 to 75% pure radium salts. Radium sulphate, bromide, and chloride are the salts most commonly used.

The production at present is at the rate of 2240 milligrams of pure radium bromide per month (1200 milligrams of pure radium element), and before the present European war cut off a large part of the market for radium, making necessary a corresponding curtailment of production, the output of radium by the Standard Chemical Co. in the year 1914 was conservatively estimated at between 22,400 and 24,200 milligrams of pure radium bromide, corresponding to from 12 to 13 grams of radium element. Because of the war the output for 1914 will be somewhat less, although as has been stated, the production to September 1 already amounts to 7.5 grams of radium element. In 1915 it is expected that the output will average 1500 milligrams of radium element per month, making a total of 18 grams of radium element for the year. This is equivalent to 33,600 milligrams of pure radium bromide, a quantity equal to one-half the world's total present accumulation of radium.

THE RESULT OF CONCENTRATING 300 TONS OF CARNOTITE ORE, 500 TONS OF CHEMICALS, NOT INCLUDING WATER; 1764 MILLIGRAMS OF RADIUM BROMIDE, ACTUAL SIZE.

The Standard Chemical Co. produces radium from carnotite, a uranium vanadate from Colorado and Utah. The Company owns many claims in these carnotite areas and mines its own ores. At present from six to ten tons of ore must be mined in order to secure one ton of shipping ore. After mining and sorting, the ore is packed by burro to the foot of the trails, and from there it is hauled 60 miles by wagon to the nearest rail station, from whence it is sent to the Company's reduction mill at Canonsburg, Pennsylvania, where the ore is treated. After the radium has been extracted from the ore, together with the barium, the radium-barium salt is sent to the Radium Research Laboratory in Pittsburgh, Pennsylvania, where it is subjected to a long process of concentration, the radium finally being separated in the form of 60 to 75% pure radium salt.

To produce radium from carnotite involves the treat-

ment of enormous quantities of ore, because the greater amount of carnotite ore is of a very low grade. Ore containing 1 to 1.5% of uranium oxide (U_3O_8) can be worked, although 2% ore is more desirable. The world's future supply of radium will probably come from these carnotite deposits in Colorado and Utah—and since the ore is mainly low grade it will be necessary to work up material containing 1% or less of uranium oxide. To produce a gram of radium element in the form of pure radium salt requires the working up of 400 to 900 tons of ore, and the treatment involves the use of almost twice this weight of chemicals—exclusive of water—and about 150 days are required for the production of the finished radium ready for delivery.

Prices and Grade

From this standpoint of cost of production the present price of radium is exceedingly low. At present (September 1, 1914) the market price is $120 to $160 per milligram of radium element contained in a preparation. Barring a few sales by the Curies and Giesel in the earliest days of radium production—where the selling price bore no relation to the cost of production—the price for radium in the past few years has been between $187 and $280 per *supposed* milligram of radium element.

Much of the radium sold earlier than 1912 and some in the market since, has been found to have been greatly overrated as regards purity. Now that the international radium standard has been prepared, all preparations are standardized by gamma ray comparison on this basis, and purchasers should demand a guarantee of the actual radium element content of preparations of a certificate of measurement by the Bureau of Standards in order to assure themselves of what they are getting.

In spite of the great difficulty in preparing radium, and the really small quantity of it in an available form, a great deal of work has been carried out since 1903 on the therapeutic applications of the radium rays, and it is now conceded that radium has a definite place in therapy. It has been used very successfully in the treatment of certain forms of cancer and in the treatment of a great many non-malignant skin growths. In spite of its price radium is even finding a considerable use in internal medicine.

To produce radium from such ores as the carnotites of Colorado and Utah requires first, that a sufficient supply of ore be assured, since the handling of the ore necessitates the investment of much capital in expensive equipment. Because the Standard Chemical Co. has assured itself of a supply of ore adequate to its needs for some years to come it has been unjustly accused of seeking a monopoly in this field. The present price of radium is called exorbitant, in spite of its being the lowest in years, and in spite of the fact that radium salts are now guaranteed to contain radium—whereas in the past they were supposed to contain this element—and usually were greatly overrated as regards content of radium element, and in spite of the fact that radium is now being made from a low-grade ore which is much more expensive to treat.

The war abroad will cause no radium famine in America—and if the radium industry is to grow—if radium is to be produced from American ore in America for Americans, as the Secretary of the Interior and the Directory of the Bureau of Mines have been urging—more can be accomplished now by encouraging private capital to continue in this field than by discouraging it by such legislation as is now contemplated, looking towards the production of radium by the Bureau of Mines. Government production of anything is notoriously slow and expensive, and it is my opinion that the worst thing that could happen to the radium industry, and the science of radium therapy would be the governmental production of radium in America. The delusion of cheap radium would delay the acquisition of adequate supplies of radium by hospitals, and radium treatment would continue a luxury for the few. Experimentation would be sadly hampered, and by cutting off the market in the United States, producers would be forced to sell their radium abroad, or go out of business.

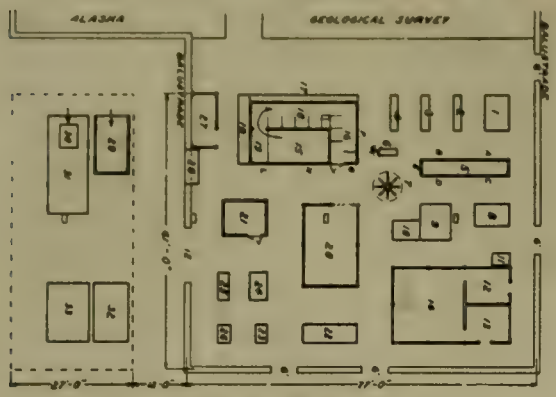
Handling and Use of Fuse

Have careful tests of the burning rate of the fuse made periodically, especially whenever a new brand is purchased. Different makes and brands of fuse burn at greatly varying rates, and a miner accustomed to a slow-burning fuse will perhaps not realize the necessity of cutting the faster-burning fuse longer so that he may have time to reach a place of safety before the detonation takes place. There are several causes that may increase greatly the rate of burning of the same brand of fuse, and there have been cases where an injured fuse burned almost instantaneously. Chief among the causes are abrasion, blows, or too great pressure. Therefore, in addition to informing the miner as to the normal burning rate of the fuse, see that fuse is in good condition when taken into the heading and that it is handled properly after it gets there.

See that the fuse is properly stored, for a large percentage of the accidents from misfires are traceable to fuse that has been damaged in storage. Never store fuse near boilers, steam pipes, or other sources of heat where the temperature is apt to be high. Exposure to heat causes a marked retardation in the burning rate. Never store fuse in a cold place. Cold fuse is dangerous, because cold often causes fuse to crack when being handled, so that misfires result. Keep fuse dry. It is difficult to dry out a powder train that has become damp, and when the fuse burns, the dampness will be driven ahead of the fire in the form of steam, so that, even if it does not accumulate in sufficient quantity to quench the fire in the fuse, enough of it may be driven into the detonator to prevent that from igniting and thus cause a misfire. Always provide a dry place with an even temperature for the storage of fuse.—*Miners' Circular, Bureau of Mines.*

Bureau of Mines Exhibit at the Exposition

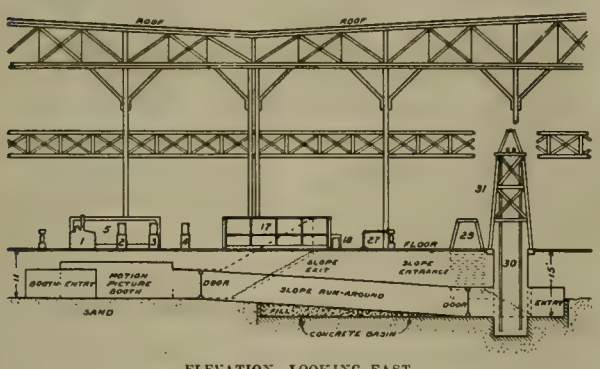
The United States Bureau of Mines is planning a comprehensive exhibit at the Panama-Pacific International Exhibition. In arranging the exhibit, the Bureau has had in mind, not only the value of interesting those engaged in the various mining and metallurgical industries, but also the education of the general public to a better knowledge of the magnitude of these industries, and to the efforts which are honestly being made by miners and mine operators, with the assistance of the Bureau, looking toward a more safe conduct of mining, and a more efficient utilization of the products of the mines after they are won from the earth.



PROPOSED PLAN OF EXHIBITS.

LEGEND, FLOOR EXHIBITS.

1. Fuel efficiency.
2 and 3. Coke and by-products.
4. Coal analysis.
5. Smoke production.
6. Explosives.
7. Explosives.
8. Model change house.
9. Metallurgy.
10. Metallurgy.
11. Duplex stereomotorgraph.
12, 13, and 14. Hospital receiving room, ward room, operating room.
15. Mine exit.
16. Radium booth.
17. Radium products.
18. Radium ores.
19. Passway.
20. First aid.
21. Smoke room.
22. Rescue apparatus.
23. Lamp testing box.
24. Testing apparatus.
25. Lamp rack.
26. Duplex stereomotorgraph.
27. Office.
28. Publications.
29. Mine entrance.
30. Shaft.
31. Head-frame.
32. Fan.
33. Hoist.



ELEVATION, LOOKING EAST.

The exhibit is situated in the Palace of Mines and Metallurgy. An automatic duplex projecting machine will continuously show lantern slides illustrative of the activities of the Bureau, and simultaneously give descriptions of the lantern slides. Nearby will be shown the layout of a model hospital, including a receiving room, ward room, and operating room, fully equipped for demonstration by the U. S. Marine Hospital Service; also a model of a change and wash-house, another welfare feature which is being installed at modern mining and metallurgical operations. A plan of an ideal mining town will be shown.

First-aid demonstrations will be given frequently. An air of reality will be lent to the demonstration by the removal of apparently injured men from the exhibition mine beneath the building, by helmet and rescue crews. A complete display of rescue apparatus and safety lamps will be given in a glass smoke-room. Tests of safety lamps will be made, showing their tendency, under unfavorable conditions, to ignite explosive gas, and also showing methods of testing for explosive gas by means of their caps. An exhibit of the physical and chemical characteristics and constituents of explosives is being arranged.

Visitors going through the exhibition mine will regain the surface through the radium booth, in which actual radium emanations will be shown. Surrounding this booth there will be complete exhibits of various radium-bearing ores and of radium products. The metallurgy of various products will be shown by a comprehensive exhibit.

The opportunity for increased efficiency in the use of fuels will be demonstrated by a device showing the proportionate amounts of fuels which go to make up the various losses incident to consumption, in comparison with that which ultimately goes to useful purposes. Typical analyses of coal from the various fields will be shown by models and samples, as will also the yield of coke and by-products obtained by various coking processes. It is expected to show smoke-preventing and smoke-producing methods of stoking by means of an ingenious motion-picture device.

An officer of the Bureau will give his whole attention to visitors. Copies of the Bureau's publications will be available for free distribution to visitors who may be particularly interested.

This exhibit, in connection with the exhibition mine immediately beneath the Bureau's space, should be interesting and instructive to those engaged in the mining industry and to the general public.

VALUE of the mineral production of the United States is over $2,500,000,000 per annum.

Electric Hoists in the Cleveland-Cliffs Mines

By F. E. STANFORD

Two types of electric hoists have been developed, each occupying its own field. These are the direct current hoist, operated by the 'Ilgner' system, and the induction motor driven hoist. Wherever the desired product of a mine can be hoisted in three-ton loads at a speed of 1000 ft. per minute or less, induction motors directly geared to the hoist are used. Where a greater product is desired the 'Ilgner' system is used. The experience which we have had in the past few years in the practical operation of electrically driven hoists indicates that the conclusions arrived at are entirely sound and that the load and speed indicated is the proper division as between the use of the two different types of hoisting apparatus. With a larger generating station, larger induction hoist motors could be used. In designing hoists for electric drive, it is desirable that they shall be made for as low a rope speed as possible, rather increasing the weight of the live load as necessary, than going to high speeds with light loads. At present only one 'Ilgner' set is in service. This is a Westinghouse set having a 350-hp. induction motor, a 400-kw. 600-volt direct current generator, a 150-kw. 200-volt direct current generator, a 25-kw. 200-volt exciter, and a 25,000-lb. flywheel mounted on one shaft. The direct current generators are connected directly to a 500-hp. 600 r.p.m. first-motion hoist motor for ore skips, and to a 200-hp. 250 r.p.m. motor with helical gears for the cage or man hoist. The flywheel set has an automatic slip regulator, which by an automatic changing of the resistance in the rotor of the induction motor, gives a variation of speed from 550 to 720 r.p.m., depending upon the load. The armatures of the generators and hoist motors are connected directly by 1,000,000-cm. cables without intermediate circuit-breakers, the motors having constant excitation in the fields, and the control being by varying the field of the generators. This gives a very reliable service, as the flywheel will usually have sufficient stored energy to complete any trip, even if there is an interruption in the current supply. The ore hoist is designed for a 90-second cycle under a 1000-ft. hoist and gives a maximum hoisting speed at full load of 1500 ft. per minute.

TEST OF FLYWHEEL SET

Depth of shaft (sump to dump)	900 ft. vertical
Net weight of load per trip	9290 lb.
Weight of skip (self-dumping)	5330 lb.
Size of rope, 1¼ in. diam	2.2 lb. per ft.
Hoisting	balanced
Size and shape of drum	cylindrical, 8 ft. by 66 in. wide
Weight of drum and shaft (from drawing)	31,650 lb.
Radius of gyration of drum	3.86 ft.
Total revolutions of drum	35.8

*From 'The Electrification of the Mines of the Cleveland-Cliffs Iron Co.' read at the Marquette meeting of the Lake Superior Mining Institute.

DIRECT CURRENT HOIST MOTOR, 500 HP., 525 VOLTS, SHUNT WOUND, 60 R.P.M.

	First cycle.		Second cycle.	
	No. 1 skip.	No. 2 skip.	No. 1 skip.	No. 2 skip.
Time for hoisting, sec.	66.4	86.85	82.9	78.3
Time of caging, sec.	17.9	20.15	16.9	20.2
Maximum r.p.m.	74	71	70.5	75
Maximum rope speed, ft. per minute	1,858	1,782	1,770	1,882
Time of accelerating	10.5	15.5	20	16
Time of retarding	36	32	38	47
Average r.p.m.	38.4	29.5	27.7	30.7
Average rope speed, ft. per minute	965	792	696	772
Maximum motor current	1,160	2,230	1,410	1,680
Maximum motor voltage	550	520	520	552
Average motor current	495	710	520	683
Average motor voltage	276	212	200	222
Average motor input, hp.	183.2	201.8	139.5	194.2
Av. motor input, hp.-sec.	12,150	17,500	11,560	15,190
Motor copper losses, hp.	10.5	21.6	10.8	20.1
Motor copper losses, hp.-sec.	699	1,875	895	1,573
Average brake current	450	235	210	180
Average brake voltage	47	62	90	115
Duration of brake	13	7.75	5.5	5.25
Brake, hp-sec. generated	368.5	151.2	139.2	145.7
Brake, hp. copper losses	23.25	16.7	16.55	16.25
Brake, hp.-sec. copper losses	302.5	129.5	91	85.3
Net hoisting work	10,780	15,344.3	10,434.8	13.386
Average generator current	495	710	520	683
Average generator voltage	276	212	200	222
Output, generator, hp.-sec.	12,150	17,500	11,560	15,190
Average generator copper loss, hp.	12.4	16.15	12.79	15.62
Average generator copper loss, hp.-sec.	825.5	1,402	1,060	1,223
Average wdg. fr., and iron loss, hp.-sec.	628	674	634	647
Total generator losses, hp.-sec.	1,453.5	2,076	1,694	1,870
Speed of set at start of hoisting	690	680	664	685
Speed of set at end of hoisting	655	600	647	662
Speed of set at end of cycle	680	664	685	690
Output of flywheel, hp.-sec.	4,200	9,000	2,000	3,000
Input to flywheel, hp.-sec.	3,000	7,000	4,500	3,400
Input to generator, hp.-sec.	13,603.5	19,576	13,254	17,060
Input to alt-cur. motor, hp.-sec.	26,800	36,300	32,500	30,000
Input to alt-cur. motor not absorbed by flywheel	23,800	29,300	28,000	26,600
Alt.-cur. motor losses in hp.-sec.	2,145	2,575	1,928	2,045
Slip regulator losses, hp.-sec.	652	2,140	405	504
Shaft, hp.-sec.	15,200	15,200	15,200	15,200
Overall efficiency	62	44.7	50.2	52
Kw.-hr. per ton	1.1	1.5	1.35	1.3

There are connected the following induction-hoist motors:

Chase mine, one 200-hp. double-reduction geared hoist with direct control—Allis-Chalmers.

Morris mine, two 400-hp. double-reduction geared hoist with remote control—one General Electric and one Westinghouse.

Lloyd mine, two 400-hp. double-reduction geared hoist with remote control—General Electric.

Cliffs shaft mine, one 500-hp. double-reduction geared double-drum hoist with friction, remote control—General Electric.

Salisbury mine, one 400-hp. single-helical geared double-drum hoist, with friction, remote control—General Electric.

Princeton mine, one 200-hp. double-reduction geared hoist with direct control—General Electric.

Princeton mine, one 75-hp. double-reduction geared hoist with direct control—Westinghouse.

Austin mine, one 150-hp. double-reduction geared hoist with direct control—Westinghouse.

Gwinn mine, two 400-hp. double-reduction geared hoist with remote control—one General Electric and one Westinghouse.

Gardner mine, one 400-hp. single-helical geared hoist with remote control—General Electric.

Mackinaw mine, one 400-hp. single-helical geared hoist with remote control—General Electric.

Athens mine, one 400-hp. single-helical geared hoist with remote control—General Electric.

South Jackson mine, one 75-hp. double-helical geared hoist with remote control—Westinghouse.

With the smaller motors, the direct control was found, with an oil-immersed primary reversing drum, to be fairly satisfactory when the control is properly designed. The secondary contacts must be of ample capacity and with positive 'snap' into position. The primary reversing contacts should have a quick and positive make-and-break before the secondaries come in. The oil tanks should be so designed that oil will not be thrown out, and the leads must be brought out where they may be readily inspected. Ample barriers should be placed between phase leads, because with the accurate spotting sometimes necessary with a hoist a quick make-and-break will likely cause surges which may cause a flash-over.

For the control of large hoist motors, solenoid-operated contactors are used exclusively. The only primary switches found, that are entirely reliable, have an air brake. While this causes an annoying flash and noise, it is good evidence to the operator that the switch is working properly.

The line-contact points must not make a 'butt' contact, but should have wiping contact. This is because the contacts may possibly burn together and fail to open when the controller is thrown off. This form of contact is also best for secondaries for the same reason. Just such a burning together of contacts nearly caused a serious and fatal accident with an old form of contactor which we had in service; the motor failed to stop at surface when the control was off. The single-phase type of control operation seems to be simpler than dividing the contactor closing coils into three phase.

Hoist motors must have very rugged and substantial frames, as the pounding of gears and frequent starts and stops is very severe. Phase leads and coils should be rigidly supported to prevent vibration or distortion under excess current. Adjustable bearing brackets are desirable. The usual excuse that these things are non essential should not be passed, because when a hoist is once in service it must be ready at all times for service and frequently the lives of men are dependent upon its reliability. The banding of the rotor should be extra strong because of the possibility of overspeed. We require that lowering shall be with the current on to prevent overspeed.

An electric safety overwind has been developed which has been found very reliable. It is similar to most others which have been brought out, but has been somewhat simplified. The operation is as follows:

A contact-making device is attached to the indicator on the hoist with one contact made about 100 ft. below the collar of the shaft. This is controlled by a foot switch operated by the brakeman; if the hoist is under control and the switch is opened it does not operate. The final contact closing is positive and is at danger point. As soon as closed it actuates the circuit-opening relay which trips the low-voltage release, and opens the motor lines. This permits the holding coil to open and operates the air brake. The trip may also be operated by an overspeed governor placed on the end of the motor shaft. If the current supply fails for any reason, the brake immediately sets. It will be observed that this device does not in any sense relieve the brakeman of his responsibility, and while it is in a certain sense automatic in its operation, the intermediate stop, which is under the control of the brakeman, necessitates that he shall have his mind centred upon the work in hand at all times. This practice seems to be more desirable than to introduce a device which would entirely remove 'the personal element.'

THE IMPORTATION OF ICHTHYOL, a peculiar asphaltic material found in Australia, which finds application, after appripriate chemical treatment, as a very important medicament, has been, along with many other products, cut off by the war. The raw material comes from a fossiliferous deposit near Seefeld, in the Austrian Tyrol. It is carefully selected and subjected to dry distillation. The distillate thus obtained is then sulphonated and subsequently neutralized with ammonia. The use of this material has greatly increased in the past few years, and it has proved very beneficial. Almost immediately following the beginning of the war its price doubled, going to over 60 cents an ounce. Already, however, a firm in St. Louis has a material on the market which has been favorably recommended as an efficient substitute closely resembling ichthyol itself.

Mining in the Tavoy District, Lower Burma

By E. MAXWELL-LEFROY

The town of Tavoy, on the river of the same name and 32 miles from the mouth, is the head town of its district, which is a part of the Tennassarim division of Lower Burma. In addition to being the official headquarters, it is also a business centre for the import of goods, has numerous stores for the supply of mining material, hardware, etc., and headquarters of the mining companies whose interests are placed in the mining or dredging of either tin or wolframite ores within a

MAP SHOWING POSITION OF THE TENNASSARIM DISTRICT.

radius of 60 miles, or to the Siam border, less than 50 miles to the east.

The district has been studied and more or less completely mapped by several officers of the Geological Survey Department of India, notably by J. A. Page, and, more recently, by Dr. A. W. G. Bleeck.* The geological conditions, in brief, are a granite or granitic base overlain in parts by schist, sandstone, and quartzite. These constitute the Mergui series of the geologists and may be taken as the local equivalent of the Dharwar series of South India. The chief topographical features are steeply inclined hills rising out of wide, long and nearly flat valleys. These were former arms of the sea, then rivers, and now are rice-flats.

The hills have heights to 5000 ft. as a maximum and average about 2000 ft. It is on these hills that the three classes of quartz lodes are found: (1) wolframite-bearing; (2) cassiterite-wolframite; (3) barren.

They are undoubted fissure-veins due to cooling of the plutonics and of the overlying metamorphosed schist. Frequent slickensides in the latter indicate that dynamic forces were at work to carry the fissures out of the zone of cooling. As far as it is possible to judge at this early stage of development there is little change in strike, dip, or mineral content of the lodes after entering the granite from the schist; the width appears not to be maintained; this being about 2½ ft. in the metamorphics and 1¾ ft. in granite. Those lodes that exist entirely in the latter have the same apparent features as veins in schist; such as cross-courses of chloritic granite, muscovite on the contact walls, sudden swelling and contraction of the lode.

Wolframite occurs in massive, crystalline, and crystal form, and from almost microscopic size up to bodies of several hundredweights. The milky quartz is brittle and vitreous. Associated minerals are tungstic ochre, as a wash or stain, columbite, pyrite, molybdenite, cassiterite, galena, and mica. Pyrite is scarce and only below the oxidation zone; columbite is found amorphous and generally on the walls; molybdenite is common but in negligible amounts and is but medium grade under test for molybdic acid. Cassiterite is of economic importance, unlike galena, in many lodes and occurs patchily throughout the numerous veins that carry it and wolframite. Though usually massive or micro-crystalline, it also is found in large and perfect crystals lining cavities. Samarskite, monazite, and gold are reported to have been found in the district.

Investigation of a lode or lode-series for mining possibilities show that three main points require consideration, namely, the continuity both laterally and in depth, the percentage of wolframite, the grade in units of tungstic acid.

Owing to the height of the hills in which lodes have been worked, the strike-length of these and the recent date (since 1909) of even prospect-mining, there has arisen no necessity to explore the veins in depth and they have to be traced up the hills to obtain any idea of their vertical continuity. On the Hpaungdaw mine, which has been in my charge, one lode out of 15 known to exist on a hill has been almost continuously traced from top to bottom—a distance on the slope of 7020 ft. or 1912 ft. of vertical height. The base length is about three-quarters of a mile. On other portions of the prop-

*'On Some Occurrences of Wolframite Lodes and Deposits in the Tavoy District,' Records Geol. Survey of India, Vol. XLIII, Part 1, 1913.

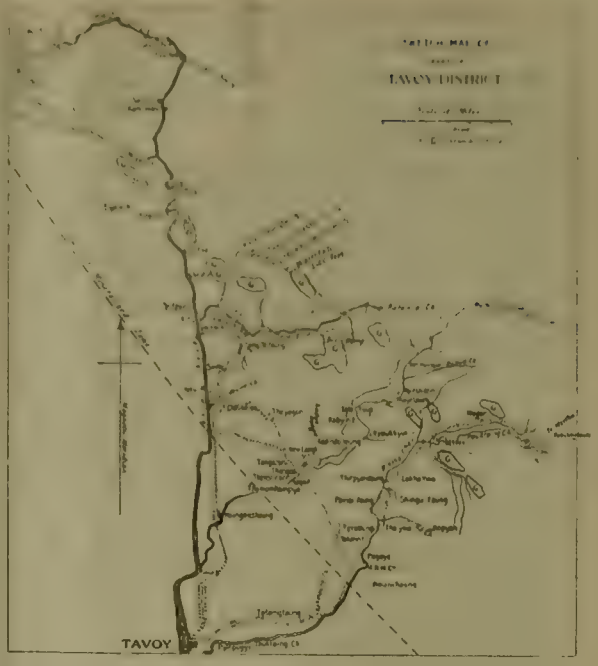
erty a different lode series has been traced for from 500 to 600 yd. without sign of termination. It is with magnetic bearings ranging from 290 to 320° that these lodes strike, whereas the former series lie due north and south.

To ascertain the amount of wolframite in each lode is impossible in many cases, as no records have been kept, but it is possible to get a fair approximation by measuring all available workings, adding to this the average obtained therefrom for all caved adits and open-cuts; converting this total into tons and comparing with the total tonnage of concentrate gives the percentage of WO_3, which in the case of the Hpaungdaw worked out at 2½% for the entire mine. This is higher than the average for the district and is about equal to the Hermyngyi mine of the Tavoy Concessions.

The final consideration is the proportion of tungstic acid. Private mines and syndicates that sell direct to the German buyers at Hamburg accept the figures of the German government analysts who assay for duty-collecting purposes. Concentrate with less than 60% of acid is of no value. Dr. Bleeck gives 76% as the maximum, but the average grade is not less than 65%, for it is on this basis that the buyers of the German firms give advances against ore delivered at Tavoy. The unit-price remains steady at about 32.5 marks.

One of the greatest drawbacks to any work in Burma requiring labor is the absence of it. The native has only to scratch the soil to get a sufficient return, and in this tilling his women help him; therefore he loafs. In consequence, all mining is done by imported labor, Chinese from the Straits, Ghurkas, Telugus, Ooryas, Tamils, and Pathans from India. The methods are simple and suited to untrained workers.

Having located a lode or lodes, a head-man is given a contract to work it by driving adits at such points as he likes, or, in the case of properly managed concerns, as he is directed. The ore broken is daily looked over, the apparently worthless thrown on the dump together with the country-rock, and the obviously wolframite-bearing rock is hand-crushed, solid ore is picked out, and the mixed product concentrated in a cradle at a stream.



The contractor gets paid at from 10 annas (pence) to 13 annas per *viss* of 3 lb. 8 oz. A deduction of 6% is made for moisture and bag. The bags are double hessian and are returned from Hamburg. A charge is made for candles. Dynamite is free, and is wasted in the most appalling fashion. The contractor is responsible for putting in timber when ordered to do so. No raising or sinking is attempted in many mines. The more vigorously worked properties are getting below the zone of oxidation and find therefore that the cost of driving is increasing so fast that it will probably be found necessary to install two or three small compressors for operating hammer-drills.

Want of capital, dread of a drop in the price of the product, and lack of sufficiently trained managers has prevented the installation of power-drills or of crushing and milling plant, but this reproach is slowly being re-

CRADLE WITH WOLFRAMITE ORE, HPAUNGDAW MINE.

SUCTION DREDGE, HINSHU CHONG MINING & DREDGING CO., LTD

moved. However, the largest producer, the Hermyngyi mine, obtained all its March output of 54 tons of concentrate by hand-crushing and cradle-dressing, as did the Hpaungdaw with 18½ tons. The former used about 700 men, the latter 190.

Cradle losses have been proved as high as 28%, and as only rich stones are crushed the amount dumped at the adit mouth is fully 95% of that broken. This is worthless according to the Chinaman, and actually it is without practical value as long as hand-crushing is in vogue.

Various means of transport are employed, such as launches, mules, carts, lorries, or combinations, that is, mules for getting over a mountain and along a jungle tract to the main road where the bags (65 lb. each) go into carts. A mine on or near a river that is tidal to many miles above Tavoy, sends its ore by launch or country-boats. Cost would not exceed 15s. per ton. Against this is the mule and cart transport, which in dry weather will be £4, rising to double in the wet season. The rainfall for the year ended March 31, 1914, was 196.62 in. (the average is about 180 in.), and it is in this season that sluicing is done.

All the ore obtained has to pay a royalty of 2½% *ad valorem* to the Government. In the case of wolframite, the value is assumed at £100 per ton irrespective of grade.

The heavy rainfall and precipitous hills connote water-power, and, without doubt, much will be available as the country is developed. A supply of cheap fuel is at hand on every property in the dense jungle of trees (up to 180 ft.) and bamboo, the cutting down of which will conduce to improved health by extinction of mosquitoes. Producer-gas can be obtained at low cost or the bamboo and timber used for boiler-firing.

During the year ended March 31, 1914, the total tonnage of concentrate was: wolframite, 1622 tons; cassiterite, 68 tons. The output of the latter should be increased, as mixed ores, which are sent to Penang for separation, are recorded as pure wolframite.

A summary of costs gives the following figures, which are above the average:

	£	s.
Mining (timbering, crushing, dressing, incl.)	32	00
Supervision	7	00
Transport (bags included)	4	00
Office, insurance, freight, charges	17	00
Duty	2	10
Total cost per ton	62	10

The Government assumption of the average gross value of a ton of wolframite concentrate is £100. The Hpaungdaw mine on its average tungstic acid content, over 18 months, of 72.8%, shows a value of £125 per ton. Local sales from other concessions are made as low as £88 per ton.

MINERAL PRODUCTION of Iowa in 1913 was valued at $25,602,015, an increase of $2,701,665 over that of 1912. Coal mining and day working account for 80% of the total output.

Mining Near Kiaochow

Coal mining is among the important industries in the German zone in China, now besieged by the Japanese. The following table, printed in the *Daily Consular and Trade Reports*, shows the output of coal and its disposition at the two local coal mines—the Fangtze and the Hungshan—the property of the Shantung Mining Company:

Output and disposition.	Fangtze mine. (Tons.)	Hungshan mine. (Tons.)
Output:		
1912	199,073	374,604
1913	178,600	370,000
Disposition of 1913 output:		
Used at mines	49,200	27,200
Sold at mines	16,200	38,000
Sold along railroad	52,100	110,300
Sold to railroad	14,500	19,500
Bunker and export	5,000	165,000
Sold in Tsingtau	41,600	10,000
Total	178,600	370,000

The same authority says the Fangtze mine has shown a general decline since 1909, when it was at the high-water mark of its prosperity. It is becoming more difficult to work, showing signs of exhaustion, and it will be noticed that 49,200 tons of the 178,600 tons extracted was used in the mines themselves. The output of the Hungshan mine was approximately the same as that of the year before. As the crops were exceedingly good, a cheap fuel has been supplied to the Chinese to the detriment of the coal interests. In January 1913 the Shantung Railway Co. took over the Shantung Mining Co. Mining shares having depreciated on account of the lack of success of the Fangtze, the railway allowed $1,285,200 in railway shares at par value to the stockholders of the mining company for their $2,856,000 of mining stock. It was hoped that the Shantung Railway Co., with its advantages of transportation to and from Tsingtau, would make the mines pay.

It was reported in the *Weekly China Tribune* of May 3, 1914, that valuable iron ore had been found in the Kiaochow district. The paper adds: Recent investigations have shown that samples contain 65% iron, 0.24% manganese, 0.03% phosphorus, and 0.08% sulphur, while the veins of ore are 25 to 50 yd. in thickness. It is estimated that there are about one hundred million tons of ore in the district. Its value is still further increased by the fact that there is a plentiful supply of coal in the vicinity. New ironworks will be erected at Tsangkau, and will have two blast-furnaces, each with an output of 150 tons per day. The capital to be invested will amount to about $2,500,000 gold.

SIXTEEN NISSEN STAMPS have been added to the 80 ordinary stamp-mill of the Modderfontein B. mine, Transvaal. This is the largest number of this type of stamps in any plant on the Rand. It is reported that 12 Nissens are to be installed at the Eileen Alannah mine in Rhodesia.

The Caving System of Mining in Lake Superior Iron Mines*

By J. PARKE CHANNING

The recent statement by me that the late Joseph Sellwood was responsible for the introduction of the caving system of mining in the Lake Superior iron mines has called forth criticism as to the accuracy of my statement, and it is claimed that this method was first used at the Cleveland Hematite mine, which was a soft-ore property lying about half way between Ishpeming and Negaunee.

In 1886, when I went to the Gogebic range for the first time, the Brotherton mine, near the village of Wakefield, was being operated by Joseph Sellwood; he had for the superintendent the late John Pengilly, who had as his two foremen John Harris and Thomas R. Hocking. The mine was wrought on the sub-level system of caving, which I fully described with illustrations in an article entitled 'Lake Superior Iron Ore,' published in Volume III of the 'Mineral Industry,' being for the year 1894. Later on when Mr. Sellwood took charge of the Chandler mine on the Vermilion range, he transferred Mr. Pengilly to that property, and this mine was wrought on a similar system.

In 1890 I left the Gogebic range and went to Ishpeming, Michigan, to take charge of the East New York mine, and took with me for mine foreman Mr. Hocking, who had, up to that time, continued as one of the foremen at the Brotherton mine. We changed the method of mining at the East New York from square sets to caving, and at the same time Thomas F. Cole, who was in charge of the Queen group of mines at Negaunee, introduced this system at his mines with great success and economy. After coming to reside in Ishpeming I visited all the mines in the district, among them the Cleveland Hematite, and I am quite sure that the caving system was not in use at that time.

I have been told that George R. Wallace, afterward manager of the Fayal mine on the Mesabi range, introduced the caving system at the Cleveland Hematite at the suggestion of two North of England miners, who had been accustomed to its use at home. If this is so, evidently the experiment was not considered a success, or else at the time of my residence in Ishpeming it would have been in use at the Cleveland Hematite.

It is a well known psychological fact that similar problems are often solved in an identical manner by men who have had no communication with each other. It is said that Wallace was at work on the 'Origin of Species' at the same time as Darwin, and it is interesting to note that Guy R. Johnson introduced a sub-drift system of mining at Longdale, Virginia, at the Longdale mine, which was almost identical to that of the Brotherton. This method he described in a paper on page 96, Volume XX, of the *Transactions* of the American Institute of Mining Engineers for the year 1891, under the title of 'Methods of Working and Surveying the Mines of the Longdale Iron Company, Virginia.' Mr. Johnson himself told me many years ago that he had never heard of the Brotherton use of this system, and if my memory serves me right, he also said that he had not known of it as the North of England system of mining, but that he and his staff worked it out as the best solution of the problem presented them.

Time is passing and a new generation of mining men is coming in. The Lake Superior Mining Institute is becoming a record of the history of Lake Superior, and I, as one of its charter members, would welcome any information on this interesting question. Most new inventions and discoveries are 95% past experience of others and 5% novelty. He who adds but a little to the world's efficiency deserves credit, and I would be the last one to hold it from him.

*Read before the Lake Superior Institute of Mining Engineers, Marquette meeting.

Mining in Alsace-Lorraine, Germany

This territory is now the scene of considerable fighting, and the mineral output in 1913 should prove of interest.

Product.	Men employed.	Number of mines.	Metric tons, 1912.	Metric tons, 1913.
Iron ore	17,713	48	20,083,238	21,135,554
Coal	16,822	4	3,538,722	3,795,932
Salt	275	8	72,541	76,672
Potash	2,890	17	137,243	350,341
Petroleum	516	6	47,176	49,584
Asphalt		1	5,161	6,354
Total	38,216	84	23,884,081	25,414,437

There were also 293 men employed at quarries and in boring, etc. The potash, salt, and by-products consisted of kainite, 12 to 15%; harkalz, 15 to 20% (a mixture of NaCl, $MgSO_4 \cdot H_2O$, and KCl); fertilizers of 20, 30, and 40%; and chloride of potassium.—Abstract from *Daily Consular Report*.

Phenomena of Adsorption

The effect of the concentration of a solution on rate of adsorption can be very simply shown by the use of an ordinary piece of filter paper. If the dissolved salt is adsorbed faster than the water, a water ring will be formed; if the water is adsorbed faster than the salt, a ring of concentration will be formed. According to the concentration and nature of the solution either one of these may take place. Georgivics and Dietl have recently investigated the physical constants of the sorption of acids by wool and conclude as a result of their work that the process is a combination of adsorption and of solution in the adsorbent. The temperature coefficient for the adsorption of acetic and hydrochloric acids by wool was found to be 1.5. The experimenters point out that the establishing of equilibrium in adsorption may require as much time as several weeks, the process not being as rapid as commonly supposed.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Rand Banket

Remarks by Mr. Horwood on T. A. Rickard's Discussion

I greatly appreciate Mr. Rickard's kindly remarks and criticisms. I am glad that in discussing my series of articles on the Rand banket he used the opportunity to review the arguments that have been advanced to explain why the gold is practically confined to the conglomerate beds, and generally occurs only as traces in the intervening quartzites.

Mr. Rickard mentions that I point out that the depth of the deepest existing workings is less than one-fiftieth of the length of the lode as measured along its strike, and that owing to the walls being kept apart by intervening pebble beds, I argue that the extent of profitable ore on the dip is likely to be equal to that ascertained along the strike. He has misunderstood and misquoted me in the latter part of this reference. After pointing out that the economic areas of normal gold quartz veins are usually somewhat fan-shaped in vertical section, resembling sections of inverted cones, I showed that in this particular deposit the function of the fissures had been performed by well defined beds of conglomerate that have necessarily differed from ordinary fissures, inasmuch as they have formed porous channels for their full length along the strike down to a great depth, owing to the walls having been kept apart by the intervening pebble beds. Consequently, instead of the profitable ground tapering downward, it should have, in depth, as great extension *along the strike* as it has at the outcrop. This is a very different thing to saying that the profitable ore should extend on the dip to a depth equal to its length along the strike; such a statement would, of course, be absurd. What I said merely implied that the economic area will be represented in vertical section by a rectangular figure instead of a section of a cone; and that the gradual falling off in value with depth will take place, speaking broadly, along the same horizons from end to end of the banket deposits.

Mr. Rickard says, that when discussing the persistence of value in depth, I dragged a red herring across the trail, and he suggests that I have not admitted a diminution in value with increasing depth. This is incorrect. What I said, in reference to these gold-bearing conglomerates, was "as in all deposits from mineral solution (either liquid or gaseous) that have ascended directly from great depths, or that have been given off as hot primitive solutions by cooling igneous intrusions, a fall in the grade of the ore with depth is to be expected. This is the natural consequence of reduction of temperature and pressure as the solutions ascended nearer to what was then the surface. The laws governing such cases are well known and well understood." I also stated that, "a gradual decrease in the gold tenor with depth is only natural if the bankets represent lodes that have been mineralized by ascending deep-seated solutions (either liquid or gaseous), and, as will be shown, is in this case no cause for alarm. Against the fall in grade with depth, is the important fact that several mines are now working at a profit on low-grade ore yielding about 5 dwt., and even less, and that the working costs at several mines, including these, only average about 13s.6d. per ton." Further, I said, "neglecting the oxidized zone, and any secondarily enriched portions extending below it, the deep-level ground is not so rich as that worked by the outcrop mines."

Mr. Rickard's description of the placer deposits of Nome is very interesting, and, the dissimilarity of such a deposit to those of the Rand is at once apparent, and he rightly contrasts the very slight width of such deposits (in this case 100 ft. at most, corresponding to 100 ft. on the dip of the banket) to the great persistence in depth of the gold contents in the case of the Rand banket.

The analogy he draws between the copper-bearing conglomerates of the Lake Superior district is a very appropriate one. He aptly remarks that "no effort has been made by any American geologist to establish an alluvial origin for the copper"; and, as regards the source of the copper he points out that it is a recognized fact that the basic lavas of the region generally contain native copper; and that the 'copper banket' has been formed by infiltration of solutions from which the metal has been deposited in its native state.

C. B. Horwood.

London, June 1.

True Fissure Veins

The Editor:

Sir—There has been much discussion in this camp as to what is the real meaning of the term 'true fissure vein.' One man that claims to know, says that a *true* fissure vein must cut the formation of the country at an exact right angle to the stratification. I differ with him on this point. I can find nothing in the textbooks that says that it has to cut the formation at right angles. We

would like to learn through your columns the truth about it.

H. C. Burton.

Rosamond, California, August 20.

[With regard to the definition of a 'true fissure vein,' we believe that the term represents more a state of mind than a state of nature. All veins, of course, die out in depth—some of them more quickly than others. Whenever a man has strong hopes that his vein will last indefinitely, he calls it a 'true fissure vein.' Originally, the strongly marked veins which crossed the formations and extended to depths beyond which the miner knew, were called fissure veins. About 1855, J. D. Whitney, in studying the lead and zinc deposits of the upper Mississippi Valley, brought out the fact that the veins there, although of considerable extent, did not extend below the limits of what is now known as the Galena limestone, which is about 250 ft. thick. He had an idea that these veins were formed by contraction of the rock as it solidified and that they were incidental to the particular formation. He therefore called them 'gash veins,' to distinguish them from veins which extend indefinitely in depth and which came to be known in contra-distinction as 'true fissure veins.' For out part, we fail to see any real difference. The veins at Dubuque are often as large and strongly marked as any in the West, and are as true fissure veins as any. The term does not appeal to us as a good one.

Any open fracture in the rock is a fissure, and if it has been filled or partly filled with vein material, it becomes a fissure vein. This is true whether it is 1 ft. or 1000 ft. long and whether it goes down 10 ft. or 1000 ft. Any votes to the contrary?—Editor.]

Revision of the Mining Law

The Editor:

Sir—If evidence were needed to prove the immediate necessity of a widespread 'holler' by those interested in mining, I think it is furnished by Frank P. Davis' own letter in your issue of June 13, and the fear that he may not be alone in the opinions he so clearly sets forth. Since he seems to have covered the ground pretty thoroughly, I shall take the liberty of adopting his framework and clause numbers. With some of his suggestions I agree, as for instance: (1) confining right of location to present and prospective citizens; (7) abolition of extralateral rights; (8) claims to be recorded within a specified time; (10) fine and imprisonment for back dating; (11) the first of July to be the first of the year for mining locations.

Some I regard as debatable. Among these are the following:

2. Changing the size of claims to 1320 ft. by 660 ft. This would have the disadvantage of reducing what is none too large now, though it would have the advantage, in addition to those mentioned by Mr. Davis, of bringing lode claims into conformity with placers; particularly if these dimensions were explicitly stated for placer claims. At present these are without definition except as to area.

13. The security of title conferred by a patent is doubtless a strong argument in favor, but, in view of the fact that in a majority of cases patenting has resulted in a seemingly permanent withdrawal of the territory involved from exploration and development, I believe that the industry in general would be served by the abolition of mineral patents.

Some I sincerely hope may never be adopted, as:

3 and 4. In place of these I suggest that the location stake or monument be placed as at present on the centre line and that the boundaries of the claim be marked within 10 days by two stakes or monuments only, one at either end of the longitudinal centre line. That the location stake or monument may serve for one of these, in which case this would be the point from which all measurements would originate. In case the location stake or monument is not on the end-line, then the end stakes or monuments shall be distinctly marked No. 1 and No. 2, of which No. 1 shall form the initial point for all measurements. Where, owing to timber or irregularity of surface, No. 2 cannot be seen from No. 1, a trail shall be blazed or a series of stakes or monuments erected so that the centre line may be readily traced and permanently located. Our present method of marking a claim by corner and side-line monuments is an everlasting source of confusion and uncertainty for all subsequent neighboring locators. In almost all cases the so-called boundary marks are placed too far out, with the result that there is no fixed point anywhere except the location monument, and that merely serves as a centre for the claim to revolve on to any extent within the widely spread boundaries.

12. Mr. Davis considers payment of a small tax in lieu of doing assessment work as the best of his suggested changes. I consider it incomparably the worst. While it is doubtless true that there is much evasion and wasted energy in connection with assessment work, there is also a vast amount of it useful and productive. I am convinced that the abolition of the assessment work requirement would be nothing short of disastrous to the industry. Great areas in all our mining camps would be indefinitely withdrawn from exploration, as is now the case with much patented ground, while the owners waited for the 'unearned increment' resulting from some one else's enterprise. And even if no valuable discovery had ever been known to result from assessment work, I would still be in favor of its retention in the code, since it is by far the most satisfactory present source of grubstake money for the prospector, 'busted' lessee, and impecunious claim owner.

W. F. Collins.

Battle Mountain, Nevada, June 21.

[We regret greatly that since this discussion began, hope of securing any revision of the mining law has become distinctly less. We can only hope that the next session of Congress may prove more ready to take up this important subject.—Editor.]

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

TOP SLICING the orebody of the Czar mine at Bisbee, Arizona, is under way. The ore is soft, wet, and aluminous, and square-set timbering was expensive and almost impossible.

CHURN-DRILLING at the Giroux mine, Nevada, cost $3.472 per foot during the term August 20, 1913, to April 30, 1914. This includes sampling and assaying, the distance drilled being 14,442 feet.

CAM-SHAFT BEARINGS are sometimes placed between the cams in 5-stamp batteries of heavy pattern. In most instances the system is ultimately discarded in favor of the single bearing toward the end of the shaft.

ALL HOISTS, save the Sacramento, at the Copper Queen mines, Arizona, are operated by compressed air, generated at the central power-plant, by machines having a total capacity of 21,000 cu. ft. of free air per minute.

SMALL QUANTITIES OF MATTE may be removed from cyanide bullion by using common nitre. While the bar is still hot, after pouring, dump it out of the mold, scrape off the slag and drop on the top a few ounces of nitre. It will immediately liquify and the evolution of nitrous oxide fumes will commence. Stir it around with an iron or steel rod, a long cold chisel, or some convenient tool.

LAUNDER CONSTRUCTION for gold and silver mills should increase the grade by about one-fifth around curves, as well as for some distance at the head of the launder, in order to overcome the initial inertia of the pulp until it attains its normal velocity, according to W. A. Caldecott. As a ready approximation for the conversion of degrees to percentage grade, each degree may be taken as equivalent to 1¾% grade.

DREDGING in the Klondike district, near Dawson, has always been interesting on account of the obstacles in the way of straight-forward work. During August, one of the Canadian Klondyke company's boats, No. 4, had the following log for a week's run: operating time, 159 hr. 24 min., equal to 94.9% full time; gravel handled, 102,030 cu. yd; gravel per hour, 640 yd.; power used, 115,680 kw. hours; power per yard, 1.3 kw. hours; average width of cut, 270 ft.; and average depth of bank, 24.7 feet.

IMPROVING THE QUALITY of the water-supply of Manila, Philippine Islands, is being done by adding to the water calcium hypochlorite in quantities corresponding to an addition of from 1 gram of available chlorine in 2000 litres of water to 1 gram in 1200 litres. The bacteria count of the water at San Juan bridge, about three kilometres below the new reservoir, is almost always much lower than that of the water entering the reservoir from the dam at Montalban, and harmful bacteria and organisms are generally eliminated. During the course of the tests a few complaints have been made to the effect that the water has acquired a disagreeable smell. It might be well to point out that the use of hypochlorite is entirely free from poison.

SEEDS OR PITS from peaches are valuable. At Hanford, Kings county, California, a pile of 400 tons of peach pits is stacked on the ground west of the California Fruit Canners' Association packing-house, and several hundred more tons will be shipped in. Los Angeles people, with the necessary machinery, were to have recently gone to the factory to crack the pile of pits, the 'meats' to be shipped to Germany, where they will enter into the manufacture of prussic acid and other products, including the processing of the 'meats' to be used in commerce as bitter almonds. The shells will be sold as fuel.

THE LEAD SMELTER at East Helena, Montana, has been in continuous operation for 25 years, according to Edgar L. Newhouse, and is one of the few essentially lead smelters in the United States, producing 6500 tons of metal per month. It is convenient to two railroads, electric power is obtained 12 miles away, and 450 men are employed. The ore supply is mainly from mines of the Coeur d'Alene, Idaho, and consists of crude ore, coarse and fine concentrate, middling, and slime, representing about 50% of that district's output. These products average 40% lead and 11% sulphur. Other ores come from silicious gold-silver-lead mines in Montana. In order to have a good mixture for the blast-furnaces all products are bedded carefully, the ores being sampled first. Four 42 by 264, and one 30 by 150-in. Dwight-Lloyd sintering machines make a product which is hard and porous, containing from 3.5 to 5% sulphur. The machines travel at 16 to 20 in. per minute, and they will take a very flexible charge of mixed materials. Four 48 by 136-in. blast-furnaces reduce the sintered product, lead going to the drossing plant, and matte to four Godfrey furnaces which reduce sulphur from 20 to 10%. This product is mixed with a direct converting mixture containing not over 10% sulphur, and then roasted in Huntington-Heberlein pots of 12-ton capacity each. The agglomerated mass is then melted in the blast-furnaces. A bag-house receives fume from the blast-furnaces and Dwight-Lloyd machines.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

RENO, NEVADA

NEVADA STATE MINE-RESCUE AND FIRST-AID MEET.—LABOR DAY CELEBRATION AT RENO.—BUREAU OF MINES AND UNIVERSITY AID IN WORK.—TONOPAH AND McGILL TEAMS WIN FIRST PRIZES.

A mine rescue and first aid contest was held on Mackay athletic field of the University of Nevada, at Reno, on Labor Day, September 7, 1914. The contest was held under the auspices of the engineering college of the University of Nevada with the cooperation of the United States Bureau of Mines, the American Red Cross Society, and the Nevada Industrial Safety Association. This was the first strictly metal-mining meet to be held in the United States, and the first mine-rescue meet at which a mine-rescue maneuvre was performed. The miners who participated in this meet were trained by E. Steidle, mining engineer, and George W. Riggs, first-aid instructor, both attached to Mine-Rescue Car No. 5 of the U. S. Bureau of Mines, which has been touring Nevada since July 1. Sixty-nine miners and 10 University students were trained in mine-rescue work, and 130 miners and 15 students in mine first aid. Weekend lectures in mine rescue and first aid were given by Mr. Steidle, reaching 4400 Nevada miners, and 5250 people visited the rescue car.

SCENE AT THE MACKAY FIELD CONTEST AT RENO.

Prior to the state meet, two local meets were held in Nevada, the first at Ely, July 4, when 2000 spectators watched eight teams compete, and the other at Tonopah, on August 9, where five teams competed before 1000 onlookers.

Participants in the mine rescue contest underwent physical examination at the hands of doctors at 1:15, and then marched to a position between the bleachers, where a crowd of 3000 spectators had gathered. The model drift shown was designed by E. Steidle, and was constructed of timber, laths, and tarred paper. The side toward the grandstand was left open, with the exception of one section which was filled with dangerous gases, and this was supplied with windows on the grandstand side. The drift was 6 ft. high and 260 ft. long. It consisted of 8 ft. of open drift 6 ft. high, followed by 20 ft. of drift only 3 ft. high to represent a hanging wall. Beyond this came 20 ft. more of open drift and then a gas and smoke chamber 40 ft. long. This chamber was shut off from the rest of the drift by means of swinging doors at either end, and had an inclined obstacle in the centre. At the farther side of the gas and smoke area came 20 ft. more of open drift and then 20 ft. representing a fall, in which the opening was only 3 ft. high above the fall, and finally there was 60 ft. more of open drift to the face. The mine-rescue teams in turn tested their apparatus, adjusted it, and stood a three-minute trial in the small test house, filled with gas and smoke, which was also constructed of timber, laths, and tarred paper, and stood near the entrance to the tunnel. They then entered the tunnel and rescued a miner supposed to have been overcome near the face of the tunnel. A life-line was used, and a stretcher and oxygen breathing apparatus were carried into the mine for the use of the injured man. Teams from the Tonopah Mining Co., the Veteran mine of the Consolidated Copper Co., the Tonopah Belmont Development Co., and the Goldfield Consolidated Mines Co. took part in the contest. The first prize was awarded to the Tonopah Mining Co.'s team, the other teams coming in the order given above.

In the mine first-aid contest, teams were entered representing the Nevada Consolidated Copper Co. (concentrator team), the Tonopah Mining Co., Tonopah Extension Mining Co., Goldfield Consolidated Mines Co., West End Consolidated Mining Co., Nevada Consolidated Copper Co. (Veteran mine), and Tonopah Belmont company. The mine first-aid teams worked on the following problem: Miner found in drift under fall of rock in contact with electric wire; rescue patient and re-

store breathing; patient suffering from following injuries: deep electric burn on small of back, scalp wound and left eyeball cut with severe bleeding, right collarbone fractured and simple fracture of right forearm, compound fracture of right thigh five inches from knee, severe bleeding; total time, 25 minutes.

There were also three teams of university students, two from the Mackay School of Mines and one from the electrical engineering department of the University, who contested among themselves. The first prize was won by the McGill concentrator team of the Nevada Consolidated Copper Co.; second by the Tonopah Extension; the third by the Tonopah Belmont. The fourth prize was tied between the West End Consolidated and Goldfield Consolidated teams. The shield and loving cup presented as first prizes were the gifts of the Nevada Industrial Safety Association, while the American Mine Safety Association presented medals to the individual members of the winning teams. The other prizes distributed in these contests included subscriptions to the *Mining and Scientific Press* and other technical papers, and miner's lamps donated by the manufacturers.

Details of the number of men trained and the breathing apparatus on hand in each camp are given in the following table.

Mining district.	Men trained mine rescue work.	Men trained mine first aid.	No. oxygen breathing apparatus.
Ely	10	40	6
Virginia City	10	10	7
Goldfield	10	10	6
Tonopah	24	30	13
Round Mountain	5	10	2
Blair	0	10	0
Wonder	5	10	2
Fairview	5	10	2
University of Nevada	10	15	1
Total	79	45	41

HOUGHTON, MICHIGAN

CALUMET & HECLA PASSES DIVIDEND.—THE TONNAGE TAX AND OPPOSITION OF THE COPPER COUNTRY COMMERCIAL CLUB.

"In view of the unsettled conditions of the copper market in this country, and the interruption of the Company's business with foreign customers, the directors have decided not to declare dividends at the present time." The above statement was made to stockholders September 1 by the Calumet & Hecla Mining Co. The C. & H. began paying dividends in 1871, and during the period of 43 years has paid $124,250,000 on its 100,000 shares. This amount represents 56% of the total dividends paid by all the Michigan copper companies from 1871 to September 1, 1914. During this long period only once has the C. & H. found it necessary to pass its dividend. In May, 1884, because of the low price of copper and the delays in the sale of the mine products, no dividend was paid. Since 1901 the C. & H. has paid quarterly dividends to stockholders. Two payments have thus far been made in 1914. While a few of the stockholders will probably suffer, the general feeling of the people of the copper country is that under the present conditions of reduced wages and half time, the passing of the dividend by the C. & H. was the only fair and proper thing to do.

Michigan is fortunate in having within its district the active and enthusiastic organization known as the Copper Country Commercial Club. This is an organization of 500 business men and others of Houghton and Keweenaw counties, whose purposes, among others, are to develop confidence in the business and future greatness of the locality, to develop economic conditions, and to take all possible means to promote the welfare of all of the people of the copper country. During the recent strike this body of men, through an appointed committee, conducted a most careful and unbiased investigation of the existing conditions and submitted to the governor of the state an exhaustive report setting forth the facts and truth as to wages, hours, labor, and working conditions. The Club has shown lively interest throughout the state in opposing the proposed state tonnage tax. Few people realize that a tonnage tax of one cent per pound on copper would mean a tax of about 47% on the net earnings of Michigan copper mines, and about 62½% of the amount actually received by the stockholders. How could the several companies actually operating at a loss and numerous others producing on such a low margin of profit meet this tax? It is the introduction of new and more economical methods and the most efficient management that make dividends possible at all. The very serious situation of the working people of this district has resulted in the Club appealing to the federal government for assistance, by making substantial purchases of copper at the present time. A letter has been sent by the Club's secretary to all senators from states interested in the production of copper. The letter calls attention to the critical condition of the Michigan district, and requests that the same assistance which the Government has extended to the silver mines of the West, the cotton growers of the South, the railroads and the farmers, be granted to the copper industry of America.

PLATTEVILLE, WISCONSIN

INCREASED PRICES CLEAN UP THE SURPLUS.—MINES PREPARING FOR LARGE OUTPUT.—LEAD PRODUCTION SLOW.—NEW CONSTRUCTION.

At the beginning of August prices had reached bottom quotations. The first ten days of the month they ranged from $36 to $40 per ton, 60% zinc content. August 18, producers of sheet zinc, notably the Illinois Zinc Co. and Matthiesen & Hegeler Zinc Co., gave notice that quotations would be withdrawn immediately and offered only on inquiry from bona fide purchasers. Inquiry of one of the largest spelter manufacturing concerns in the United States revealed the fact that the export demand for spelter had become emphatic and the placing of order for shipment of 25,000 tons of spelter in the closing weeks of the month, coupled with an increasing demand for home consumption, sent prices shooting skyward. The close of the month witnessed spelter at seaboard commanding $6.20 per cwt., having advanced within ten days from $4.75, while blende reached $55 per ton of premium ore. Production was slow to respond. Surplus stocks were worked off rapidly and mining companies made haste to get into shape for a maximum production. The month of September should show a decided increase in current production of blende. Buyers are numerous in this field and independent operating concerns fare better just at present than operators selling under contract arrangements. However, everyone is rejoicing in improved conditions.

Lead ore was in poor demand all month and prices were stagnant, very little ore being offered for delivery. Production of pyrite took a disastrous slump and was less than one-third that usually reported. In the northern districts, where great beds of carbonate zinc ore are ready to be drawn on, conditions remain discouragingly quiet. Producers are offering their clean-up for the season, but there is no bidding by the only buyer in the field, the Mineral Point Zinc Co., and miners are complaining.

Sales of ores for the month by districts were made as shown in the following report

Districts	Zinc, lb.	Lead, lb.	Sulphur, lb.
Benton	5,922,000	53,100	1,985,000
Galena	3,880,000	58,000	.....
Shullsburg	3,500,000	.....	.....
Livingston	3,374,000	.....	.....
Cuba	2,862,000	.....	.....
Hazel Green	2,424,000	150,900	.....
Harker	1,104,000	.....	.....
Highland	648,000	.....	.....
Linden	740,000	.....	.....
Platteville	614,000	.....	.....
Mineral Point	206,000	.....	.....
Montfort	86,000	.....	.....
Mineral Point Zinc Co.	3,149,800	.....	.....
Totals	28,509,800	262,000	1,985,000

The gross production of wet concentrate for the month amounted to 22,504,430 lb., all grades; net refined ore to smelter, 12,664,400 lb. The reserve tonnage at all points in the field at the close of the month was in excess of 3000 tons held between the Wisconsin Zinc Co. and Vinegar Hill Mining Co. About 1000 tons of lead ore was carried over. A like amount of carbonate zinc ore ready for delivery was also carried over.

The tonnage was distributed among the following buying concerns as shown. Mineral Point Zinc Co., 5713 tons; National Separating Works, 1578 tons; Illinois Zinc Co., 758 tons; M. & H. Zinc Co., 382 tons; Grasselli Chemical Co., 1044; Campbell Separating Works, 1167 tons; American Zinc Co., 250 tons; Empire Roasters, 709 tons; American Metals Co., 867 tons; and Linden Zinc Works, 210 tons.

Two new plants are nearing completion, one a concrete and steel structure at the Little Coker mine of the New Jersey Zinc Co., and one a transformed plant for the B. M. & B. Mining Co., at the Biddick mine. At Platteville the West Hill Mining Co. got into action with a new plant, and the Wisconsin Zinc Co. developed a new producer on the Sitz leasehold. By far the best showing is now being made in the New Diggings district. The Wisconsin Zinc Co. will put into commission, September 15, a plant complete handling 600 tons of mill-rock every 20 hours; the new shaft is complete; a working force of 100 men is being recruited; big bodies of ore were discovered with drill on 600 acres of land, 455 of which the Company secured in fee at $200 per acre. An electrostatic separating plant equipped with Huff machines will be added at a later date. L. V. Rice, general manager for the Fields M. & M. Co. (R. W. Hunt & Co., Engineers) announced on August 25 that the Company would at once begin the development of the Thompson quarter section, in the New Diggings district, putting down a double compartment incline shaft to a vertical depth of 230 ft., with a modern equipment capable of handling 600 tons of mill rock per day. The ore will be handled in automatic dump cars feeding into a Dunne gyratory crusher, everything being taken. The contract is to be complete in 90 days. A gas-producer plant is to be one feature of the new establishment. Three miles of macadam road has been completed from the Crawhall mine to track on the Illinois Central Railway. The first ore to go over the new roadway reached the track August 26. The new plant and mine development will involve an outlay of $100,000. During 10 months of 1913 the Crawhall mine, owned by the Fields M. & M. Co., paid monthly dividends of $30,000. The new range is an extension eastward of the Crawhall mine and mean elevations show orebodies 60 ft. in thickness.

The New Jersey Zinc Co. is completing a new power and concentrating plant on the Penna-Benton mine to go into commission some time during the month of September. The Vinegar Hill Zinc Co. has a new power and concentrating plant ready to begin operation at the Unity mine near Hazel Green. This Company gives employment to 200 men at this time. Several new properties are being developed with success. Two good producers owned by this firm have run their course, the Masbruch and Vinegar Hill, both of which have been abandoned.

McMillan Mining Co., of Milwaukee, is drawing plans for a big power and concentrating establishment on newly discovered zinc ore ranges in the Hazel Green district. The estimates call for a plant valued at $75,000.

JOPLIN, MISSOURI

NEW MILLS FOR HANFORD AND UNITED ZINC CO'S MINES.—DEVELOPMENT IN THOMS STATION DISTRICT.—REOPENING OLD CLAIMS.

A concentrating plant of 250-ton daily capacity is being constructed by the Hanford Mining Co., operating on a lease of the Mattes Bros.' land at Gordon Hollow, southwest of Joplin. The mill will replace one of smaller capacity which formerly was situated on this tract and which was destroyed by fire several months ago. J. S. Handford, of Forth Worth, Texas, is president of the Company. The mill building will be 110 ft. long by 28 ft. wide and will be equipped with cleaner and rougher jigs, sand jigs, and sludge tables. The boiler room will be 28 ft. square, and the engine-room will be 30 by 50 ft. Gas will be used for fuel. Mining operations will be conducted at a depth of 117 feet.

On a lease of the General Lead & Zinc Co.'s land in the Thoms Station district north of Joplin, J. N. Hill, W. M. Waters, Thomas Kinmouth, Charles Turner, William Brockman, and associates are sinking a shaft, where 10 years ago Mr. Hill and others undertook to get a shaft down to good ore which had been revealed in three drill-holes. At that time, however, there was little mining at Thoms Station, and consequently the problem of lowering the water was much more difficult than it is today when so many mines are at work. At that time a large pump, which in those days was considered the acme of efficiency, was used without success. Today the Company has the shaft to a greater depth than before, and yet the water is handled with a barrel bailer. A large derrick is now under course of construction and steam equipment for hoisting, and pumping also if the flow of water increases with depth, is to be installed. The lease comprises 20 acres at 10% royalty, with the option of taking an additional 20 acres if a mill is built. The shaft is now down to a depth of 125 ft., and zincblende in quantity is beginning to appear on the north side. The drill holes showed the ore to continue down to a depth of 160 feet.

Much work of real importance is being conducted in some of the old camps which for some time have been idle. The reopening of old mines that have been non-productice for some time is, in a sense, almost as important to the district's welfare as the opening of new properties, as it often transpires that the erstwhile heavy producer, long idle, can be revived and developed into a big producer. Numerous examples can be given. For instance, the Century, at Neck City, is on land that had been extensively mined, later to remain idle for years. The present production from the tract far exceeds anything previously reported. In the West Galena, Kansas, district, a dozen new companies are working on the Templar Mining Co.'s land. Ore is found at comparatively shallow depths. Small companies find this class of development inexpensive, and many of them sell their crushed rock in the rough as it comes from the ground, receiving on an average of $4 or $5 per ton for it, although an occasional rich pocket is cut which will yield $10 per ton.

Pumps have been installed on the Bob Ingersoll lease of the United Zinc Co.'s land, Chitwood camp, northwest of Jop-

lin, and will drain the old workings of this once famous zinc ore producer. Work will be conducted at a depth of 170 ft. Ore has been shown in drill holes sunk some distance in advance of the old headings. Messrs. C. H. Aldrich, of Chicago, and J. F. Jet, of Louisville, Kentucky, are operators of this mine. They contemplate the construction of a mill. Another mill is proposed on a lease of the same land, formerly operated by the Conqueror Zinc Co. Blosser and associates, of Pittsburgh, Pennsylvania, are operators of this property. Ore has been shown in several drill holes at a depth of 165 feet.

The first drilling done in recent years on the land of the Missouri Lead & Zinc Co., in the southeast part of Joplin, has been launched by two Companies, the Pedagogue Mining Co., composed chiefly of Joplin school teachers, and the J. J. Haggart Mining Co. Both companies have operated in shallow ore deposits. They intend to test the deeper ground.

The Underwriters Land Co., operating on the Connor land, west of Joplin, has begun sinking a new shaft south of its mill to open a shallow run of soft ore shown in several drill holes on this portion of the land. The Company has worked in sheet ore at a depth of 125 ft. The soft ore was cut unexpectedly at a depth of 70 ft., and the deeper sheet-ore formation was not in evidence. On the west portion of the Underwriters lease a small flotation plant is handling the sludge from the mill, and about five tons of concentrate per week is being placed in the bin.

NEW YORK

COMPANIES PAYING DIVIDENDS.—SMELTING AND RAILWAYS IN MEXICO.—COPPER REFINERIES.

Dividends declared by mining companies in September are as follows:

Company.	Per cent.	Per share.
Butte & Superior	..	$0.75
Chino	..	0.75
Crown Reserve	2	....
Grand Central	..	0.05
Hedley	3 + 2	....
Hollinger	..	0.15
Homestake	..	0.65
McKinley-Darragh	..	0.03
Nipissing	5	....
Phelps, Dodge & Co.	2½	....
Tennessee Copper	..	0.75
Utah Copper	..	0.75
Wolverine	..	2.00
Yukon Gold	..	0.075

The Chino distribution is a reduction of 50c. per share; Phelps, Dodge & Co. omitted the extra dividend; the Yukon Gold is paid from earnings, and not surplus; and Nevada Consolidated and Ray Consolidated have deferred payment for the present.

The American Smelting & Refining Co. is gradually getting its Mexican properties going again, four of the six furnaces at Chihuahua have been blown in, and a fifth will be started soon. Preparations are well advanced to blow in the plant at Aguascalientes. Chihuahua is fortunately placed in that it is not so dependent on transportation as the other smelters, the ore being just at hand. The plants which depend on railroads are less well placed, for with three year's attempts to destroy the lines, superimposed on an equal period of neglect, the lines are in a precarious condition. Now that all Europe is engaged in war, it is impossible for the Mexican railways to raise any money for repairs and reconstruction. Carranza has now taken over the National Railway system, and given it a new name.

Copper refineries are now beginning to feel the cut in output, and are beginning to curtail also. This probably means that the refineries will decrease their output and call on the mines to help carry the stocks, which are bound to accumulate as a result of the effect of the war situation. The Nichols refinery, which was fortunate enough to have a strike which interfered with its output coincide with the strike in the Lake Superior region, is similarly fortunate again, and the troubles which it is now having with its refining furnaces will automatically curtail its output.

MAIN SHAFT, POWER-HOUSE, CRUSHER PLANT, ORE-BINS, DORMITORY, AND MESS-HOUSES AT INSPIRATION.

BOSTON

NEVADA-DOUGLAS AFFAIRS.—BUTTE CENTRAL MINE.—NEWBURY MINING CO.—MONTANA RAILROAD FINANCE.—MEXICAN METALS CO.—COPPER AND ZINC.

Promoters of the Nevada-Douglas here are taking a new lease on life and claim that the leaching plant under construction at the property will give it earnings of at least $1 per share. There is no projected or pending leaching process anywhere in the country which is being quite as extravagantly presented as this one, a favorite statement being that the Company will when operating under new conditions be able to get its copper for nothing. Nevada-Douglas shares have sold as high as $7 and as low as about 70c. The property is a large and probably valuable one, but the policy of handling it has not been popular in Boston, and consequently the financing and development have been slow.

Interests here which are reorganizing the Butte Central company, at Butte, express confidence that they will be able to operate the mill at an early date. The new Company bears the name of Butte Central Mining & Milling Co., and capitalization has been reduced to $750,000, with an issue of bonds. It is proposed to run the mill in a small way on custom ores, turn over the upper levels of the mines to lessees, and sink the shaft below the 500-ft. level later on, when funds are available. The mill is a good one, both in type and construction, and represents the first application of the cyanide process to certain Butte ores.

It is understood here that negotiations have been completed by which the control and management of the Newbury Mining Co. has passed to Makeever Brothers, of Boston and Chicago. The Newbury company was organized in 1901 with a capitalization of $2,000,000. The property consists of about 50 acres and a smelter site on the Gila river, near Florence, Arizona. In the days of the old chloriders it was worked for silver, and has four veins, with silver content changing to copper at depths of 285 to 350 ft. Considerable development has been done, though but little in recent years. There is a 300-ft. adit and four shafts. Statements have been made that there were ore reserves blocked out of approximately 200,000 tons, averaging about 4% copper, $6 gold, and some silver, but it is thought these estimates have been exaggerated. Considerable stock of this Company has been distributed throughout New England, and up to the time the prop-

erty became inactive, several years ago. It was considered to be a promising project. Makeever Brothers have been operating successfully in mines for a number of years, largely in Mexico. A year or so ago they took over a property in Montana.

W. R. Allen, of Butte, has recently been spending a few days in Boston in conference with Sir Frederick W. Borden and others respecting the plans of the Boston & Montana Development Co. and the Southern Montana Railway. The directors of the former Company entered into a contract last spring with the McArthur Brothers & Perks interests, of London, New York, and Ottawa, to build the railroad, about 100 miles long, south of Butte to reach two mining districts, French Gulch and Elkhorn, controlled by the Company. Sir Robert W. Perks agreed to assume the raising of the bulk of the money needed to complete this contract, and it was arranged to float $3,000,000 of the railroad company's bonds in England. The outbreak of the war checked the program, but the English interests are confident that the plans can be carried out as soon as the Allies have won a decisive victory over the German and Austrian forces. Mr. Allen, who was a few years ago lieutenant-governor of Montana, was a director in the State Savings Bank, of Butte, which recently was placed in the hands of a receiver.

The Mexican Metals Co., which has been active in Cananea, Mexico, from September 1911 to last February, has ceased to operate, and at the annual meeting of the stockholders held in Bisbee on September 14, the question was considered favorably of acquiring 100,000 shares of the capital stock of the Cananea Mining & Development Co. It was also decided to authorize the directors to purchase new properties for the Company, according to their judgment. They were also authorized to sell or abandon such property in Mexico owned by the Company, indirectly through its ownership of the Moctezuma-Arizpe Development Co., as in their judgment may be best for the Company. The operations of the Company have been very disappointing. A geological survey of the property was made by J. M. Little, formerly with the Greene-Cananea company, who stated that a part of the extensive territory does not contain commercial ore. This survey was checked by Allen H. Rogers, of Boston, in connection with Franklin W. Smith, of Bisbee, two well known mining engineers, and their advice was to shut down operations. The principal interests in this Company are the Keiths, of Brockton, Massachusetts, large shoe manufacturers. The stock has been extensively manipulated on the Boston Curb.

The Copper Producers' Association having discontinued its monthly statements for two months, it is not likely that there will be any statement issued until the Stock Exchanges reopen. The faction which has been opposing the publication of the figures ever since they were started several years ago, is now taking advantage of the present situation to discourage the resumption of monthly reports. It is claimed by those who oppose the publication of statistics that the plan has always worked to the disadvantage of the producers, who were paying the bills.

BULAWAYO, RHODESIA

MINERAL PRODUCTION OF THE TERRITORY.—SURPLUS OF NATIVE LABOR.—SHORTAGE OF WATER AND DEVICES TO REDUCE CONSUMPTION.

Some little time ago the secretary of mines for Southern Rhodesia predicted the current year's mineral output would be worth £4,000,000. It now certainly looks as if this cheerful forecast will be very nearly, if not quite, fulfilled. The value of gold alone recovered during the period to May 31 last was £1,368,125, compared with £1,171,867 in the corresponding five months of 1913. This rate of gold production may be confidently expected to improve during the next few months. Neither the Shamva nor the Cam & Motor equipments have at the time of writing attained to normal running efficiency, and in addition to improvement that may safely be counted on from these two properties the Golden Kopje and Falcon are just commencing production. In minerals other than gold, too, the outlook for larger returns is good. Recent discoveries in the Victoria district foreshadow an increase in the chrome iron ore and asbestos outputs. The Wankie Colliery Co., having recently concluded important negotiations with the Union Minière for the supply of coal and coke to the Katanga copper mines, may be expected to record increased sales. Diamond production has been resumed in the Somabula area, and the Falcon, in addition to its gold output, will produce fair quantities of copper. Altogether then the prospect of a continued advance in Rhodesia's mineral output for some time to come is undoubtedly good.

A remarkable state of affairs in regard to native labor in Southern Rhodesia was disclosed by P. B. S. Wrey at the third annual meeting of the Rhodesian Native Labor Bureau held in Bulawayo a short time ago. The acting chairman stated that there was a surplus of natives, an extraordinary position in South Africa, a country continually crying out for more cheap colored labor. Mr. Wrey pointed out that in October last there was a surplus amounting to 1200 boys, but owing to the exertions of the mining members this was duly absorbed. Recruiting has, however, since been continued, and the position at present is that there are 2000 natives in the Salisbury compound, which the industries of the country have failed to absorb. Notwithstanding this, it was reported at the meeting that the managing director was absent in Lourenco Marquez negotiating with the Portuguese government with a view to recruiting colored laborers for the mines and farms of Southern Rhodesia, in what is known as the Tete area. It is certainly anomalous that while other industries in South Africa are handicapped on account of shortage of unskilled labor, the Rhodesian Native Labor Bureau should be put to considerable expense in maintaining surplus labor within its compounds.

That a number of mines in Southern Rhodesia have been much hampered during the past two or three years by lack of water admits, unfortunately, of no dispute. Moreover, there is a good deal of evidence to support the view that the drought has become more serious each year. Large, as well as small mines, have been hard hit during protracted dry seasons, through insufficiency of water for milling purposes, but scarcity of water has troubled the small workers more than the limited liability companies, which naturally can afford to take measures of conservation and storage, which the miniature mine-owners, because of limited capital, are unable to do. In both Matabeleland and Mashonaland numerous inventions and suggestions have recently been made with a view to water economy, and perhaps exhaust steam from non-condensing engines has received most of this attention. The latest device has been invented by T. Warwick, who has had great trouble at his mine in the Betingwe district on account of water shortage. The invention makes use of the pipe-line running to the mill. This is jacketed for a length, depending on the size of the engine, the jacket being made with two longitudinal joints so that it may be installed without breaking a joint, or in any way altering the pipe-line. The steam enters at the lower end of the jacket at a special cast iron 'T' cast in halves. As the steam travels toward the upper end it condenses and the water gravitates down the jacket to the outlet whence it enters an oil separator, from which it is passed to the boiler feed tank at a temperature of about 180°F. Among the advantages claimed for the Warwick patent condenser are that there is a condensation of 90 to 95%, giving a feed water free from dissolved matter, no upkeep costs, or delays for cleaning, simplicity both in working and erection, and a saving of about 10% in the fuel bill.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

(Telegraphic Correspondence.)—The widely published statement credited to Stephen Birch, to the effect that important discoveries of gold-bearing quartz lodes had been made at Broad Pass at the head of the Susitna, is denied at the office of the Alaska Syndicate.

New York, September 16.

Bethel

(Special Correspondence.)—Mining is progressing slowly but satisfactorily in this part of the territory. From a new discovery on Quisluk river, three men took out $3000 in 20 days' shoveling into boxes. This is the first output of any consequence from this area. A short distance from there on Eek river some men are working, but results are not known. The only drawback to the district is transport facilities, as will be seen from the fact that Mr. Hoffman, one of the larger traders on the river, who had 75 tons of supplies last year, and was short before the river broke in the spring, has not received this spring any of the goods he ordered for this summer and coming year. Chances are poor for him to get any at all this summer, and there are a number of other small traders who are in the same position. Shafer & Brown at Bethel informed me that there were things they were out of already, and no chances of getting further stocks this season. Last winter supplies were freighted in from Iditarod to Aniak river. So under these conditions the district cannot be but slowly developed. At present there are only two places where miners can get material, and they are Bethel and Takutna, 500 miles apart. The Good News Boy district can get some from Gwinhagak (Moravian Mission).

Bethel, August 1.

ARIZONA

Cochise County

Material for the 10-mile railroad from Willcox to Dos Cabezas is being unloaded at the former place. The Mascot Copper Co. is financing the work. The Dos Cabezas district is promising.

Gila County

Owing to the war in Europe, the supply of potash cartridges for Draeger mine-rescue helmets is cut off from Germany. According to Orr Woodburn, of the Old Dominion mine, these cartridges are essential for the apparatus.

Salt Lake City people, who compose the Gila Canyon Copper Co., at Chilito, are prospecting the porphyry deposits by drilling. A Keystone outfit is boring 75 ft. in two shifts, and the first hole will be 1000 ft. deep. The first 75 ft. assayed 0.6% copper. Approximately 5000 tons of 10% copper ore has already been produced and the property is earning at present about $2000 per month from shipments of first-class ore.

Mohave County

Tom Reed mine produced gold worth approximately $100,000 in August. Experiments are under way in the cyanide plant for better work.——The Gold Road continues to produce about $20,000 per week, this being taken to Kingman by George W. Ayers.——Work is being resumed at the Frisco Gold mines.——Good ore has been opened below 200 ft. in the Arabian Consolidated mine.

Yavapai County.

Over 40 men are busy panning, rocking, and sluicing gravel in the Stanton district near Congress Junction. Recent heavy rain has provided plenty of water for the work, the first time for some years.——Phelps, Dodge & Co. has taken a bond and lease on the Black Diamond mine near Jerome. The ore contains copper and silver.——At 300 ft. in the Little Jessie, at Chaparral, 30 in. of gold ore has been cut.

CALIFORNIA

Calaveras County

At the Stockton Ridge gravel mine, near Mokelumne Hill, the main adit is in 3100 ft., in which 100 ft. of the channel has been exposed. A ventilating shaft is being sunk 420 ft. to connect with the workings, the present rate at 130 ft. being 9 ft. per day. An electric locomotive is to be used to haul gravel to the mill, which contains a Price machine of 300-ton capacity per day. A good deal of equipment has been placed on the property, and $75,000 has been spent. Stephen Hughes is in charge.

Eldorado County

Collapse of timber and a fall of ground entombed W. Williams 500 ft. from the mouth of the Alderson mine adit last week. A rescue party made a small opening through 15 ft. of material and rescued him in 12 hours.

Modoc County

Ore worth up to $150 per ton has been opened at 100 ft. in the Modoc mine, 11 miles from Fort Bidwell. There are 25 men employed.

Nevada County

Officials from Rescue Car No. 5, which is at Colfax, have been giving instruction in first-aid work at the Empire, North Star, and other mines at Grass Valley.

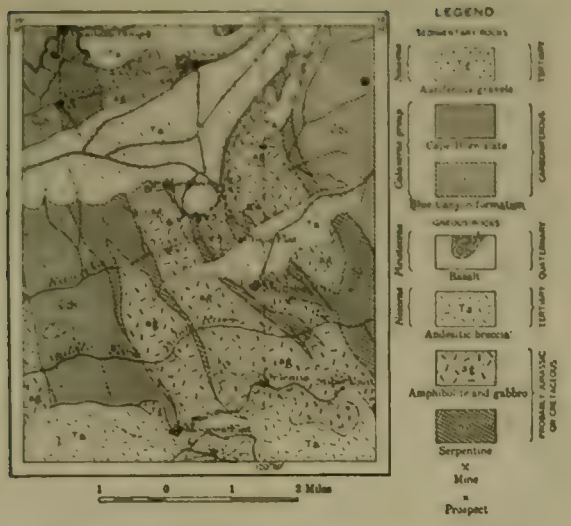
Shasta County

Owing to the improved market for spelter, the Afterthought mine, near Ingot, is to produce zinc ore.——Flume construction and other work is under way for the placer claims of C. R. Thorpe and H. C. Quirk.——James Hulme, former owner of the Gold Leaf mine near Redding, has resumed development.——At the Mammoth smelter at Kennett extensive improvments are being made to the bag-house, etc. Two furnaces out of five are in blast.

Sierra County

The lode deposits of the Alleghany district are described in *Bulletin* 580-I of the U. S. Geological Survey, by Henry G. Ferguson. He states that the area is not only interesting on account of small rich shoots of gold ore, but the problems they offer in the study of vein formation are important. Mining has been done since about 1860, and the output to date is about $5,000,000. With the finding of the Tightner vein by H. L. Johnson in 1907, the district started a new life, and since then the output to 1913 has been 51,364 tons of ore for $733,035, from 3, 8, 3, 8, and 5 mines, respectively, for the five years. The gangue is mainly quartz, and arsenopyrite the most important sulphide, the latter being rich and is an indicator of shoots of rich ore. The following mines are described briefly: Tightner, Minnie D., Osceola, Eldorado, Sixteen to One, Sherman, Kenton, Oriental Rainbow, Plumbago, Irelan, Gold Canyon, North Fork, Federal, and Kate Hardy, which are numbered on the accompanying map in this order.

Owners of the Kate Hardy have secured a bond on the southern extension of their claims and will drive north on



GEOLOGIC MAP OF THE ALLEGHANY DISTRICT.

the vein.——A new air-compressor and machine-drills have been installed at the North Fork, where the shaft is being sunk to 200 feet.

COLORADO

Clear Creek County

The Waldorf mill is working steadily and 30 tons of ore is treated per shift at present. Concentrate from the 7 tables and mine jigs assays $30 per ton.——There is now 24 in. of ore in the main drift of the Big Indian mine.——The Kane adit of the Capital mine is in 800 ft., with a similar distance to be driven before sinking is started. The main raise has been stopped and connection will be made with the adit by sinking a winze to meet the raise. Lessees in the Capital mine are as busy as usual.——Rich gold-silver ore has been cut in a raise in the Centennial.——Rich silver ore is being sacked from the Franz Joseph mine by Hugo Lendecke.

Chaffee County

The St. Elmo Mining & Milling Co. is building a custom mill at St. Elmo. The principal part of the equipment consists of one 8 by 12-in. Denver crusher, one automatic Denver feeder, one No. 2 Denver quartz mill, two 52 by 96-in. amalgamating plates, two Wilfley and one Isbell concentrating tables. The contract for the machinery has been given to the Denver Quartz Mill & Crusher Co., of Denver.

San Juan County

Ore and concentrate for the Silverton district in August amounted to 14 and 96 cars, respectively, the Gold King supplying 30, Iowa Tiger 28, and Sunnyside 21 cars of concentrate.

San Miguel County

During August the Tomboy mill treated 12,600 tons of ore yielding bullion worth $33,000 and $47,500 from concentrate shipped. The profit was $34,180.

Teller County (Cripple Creek)

Water flowing from the Roosevelt tunnel is now about 9200 gal. per minute.——Sinking is in progress at the Golden Cycle, Granite, South Burns, and Vindicator main shafts, and will be resumed at other properties later on. Developments at depth have been generally encouraging.——Lessees at the Deerhorn and blocks of the Stratton estate are mining from two to four cars of ore per week, from shoots only 35 ft. from the surface.——There are 10 sets of sub-lessees at the Midget-Bonanza mine, and Hickman, Davis & Co. have opened ounce ore near the surface. In ground southwest of the main shaft the Elkton company has opened $18 to $20 ore. The new Chilean mill at the Neville mill is at work, and the total capacity of the plant will be 60 tons per day. Owing to an accident to the crusher, the Gaylord mill has been temporarily stopped.

IDAHO

Shoshone County

Development still proceeds at the National copper mine near Mullan, and an assessment of 3c. per share on 2,500,000 shares is due October 5. The mill is still closed.——The adit at the Hector is in 4200 ft., the depth being 1600 ft., and the vein should be cut in 250 ft. Water Leyner drills are to be installed, the ground being hard. Arthur George is manager. ——Thirty feet of ore has been cut in the Silver Cable, and assays return up to 30% zinc.——The Hypotheek shaft is to be sunk from 840 to 940 ft. The ore-shoot at 700 ft. is 6 ft. wide for 540 feet.

MONTANA

Granite County

The Royal Basin Mining Co.'s mill at Maxville is nearing completion. The first unit of 250-ton capacity is about ready and the second will be in about a month. The Fields' flotation process will recover the copper minerals, a test plant having shown good results.

Silverbow County

As the result of continued trouble with the miners at Butte, on September 8 the various mining companies concerned issued a statement in which it was shown that all agreed neither to recognize the Butte Miners' Union No. 1, Western Federation of Miners, nor the Butte Mine Workers' Union. Thus Butte becomes an 'open-shop' district, it having been a union stronghold for 36 years. No changes will be made in the wage scale. Those Companies signing the statement are as follows: Anaconda Copper Mining Co., North Butte Mining Co., Butte & Superior Copper Co., Butte Ballaklava Copper Co., Elm Orlu Mining Co., Timber Butte Milling Co., Butte Alex Scott Copper Co., Pilot-Butte Mining Co., Tuolumne Copper Mining Co., East Butte Copper Mining Co., Rainbow Development Co., and Butte-Duluth Mining Co. Union men were taken by surprise, but have said or done nothing yet. The militia is destroying liquor found in saloons open in defiance of orders. Several arrests are being made.

August output of the Butte & Superior was as follows: ore treated, 30,440 tons; concentrate produced, 11,297 tons; average assay, 49.16% zinc; and recovery, 90.43 per cent.

NEVADA

Elko County

The Flaxie Mines Co., held its annual meeting at Jarbidge on August 31. Water-power rights on Bear creek have been secured. About 600 tons of $33 ore has been opened above the adit, and 60 ft. below good ore still shows. A small mill and cyanide plant is proposed. James Johns is superintendent.

Esmeralda County

Instead of sending 100 tons of ore per day to the Goldfield Consolidated mill, the Jumbo Extension company has reduced this to 45 tons, and increased shipments to smelters to about 30 tons per day. The latter ore contains copper, necessitating this change.

Humboldt County

In addition to the mill under construction, another one is proposed for the Rochester district.——After being idle for 30 years the old Moonlight mine near Unionville is to be reopened. Rich silver ore was obtained in the early days. G. D. Blood and associates, of Salt Lake City, now control the property.

(Special Correspondence.)—Important changes have taken

place in the management of one of the principal mines of Rochester. Through foreclosure proceedings and sale, the Mexican company, operating on the Comstock, has secured 500,000 of the 650,000 issued shares of the Rochester Weaver Mining Co. In the first week in September two of the three directors resigned, their places being filled by the election of Whitman Symmes, general manager, and Mr. Jacobsen, superintendent, of the Mexican company, and the office and books were removed to the office of this company at Virginia City. Joseph F. Nenzel, former owner of the stock acquired by the Mexican, retains the position of president of the Company, and is the third director. The Rochester Weaver has an authorized capital stock of 1,000,000 shares, and ore reserves estimated at 15,000 tons developed by tributers. Besides the Rochester Weaver stock the Mexican company has acquired 150,000 shares of the Rochester Mines Co., of which Company Mr. Nenzel was formerly president, having recently been succeeded by John F. Cowan, of Salt Lake City, after a prolonged fight in the courts of Nevada. The Rochester Mines and Rochester Weaver stock referred to was pledged to the Mexican company by Mr. Nenzel about a year ago, to secure the payment of a loan of $45,000. The Rochester Mines Co. has an authorized capital stock of $1,250,000, represented by 1,250,000 shares of stock, of which 870,000 shares are issued.

Rochester, September 14.

The new vein in the Codd lease of the Rochester Hills Co. has been cut in the Big Four claim, proving the vein to extend through four leases. In the Codd lease is 10 ft. of rich ore at a depth of 600 ft. In the Four J lease adjoining, has been opened a wide iode of $18 ore. A total length of about 1000 ft. of mill ore has now been proved in the four leases.

Lincoln County

The Prince Consolidated company, at Pioche, has acquired control of the Virginia Louise company. The latter's property is opened by a 465-ft. shaft, and a large orebody has been proved. M. C. Godbe is manager of the Prince Consolidated.——In August the Gold Chief mine, near Caliente, treated about 40 tons per day yielding between $5000 and $6000. H. W. Rand, of Portland, Oregon, is manager.——A heavy flow of water was met with on No. 14 level of the Amalgamated Pioche on September 3. No. 12 level stope is producing up to 100 tons of zinc ore per week. Flotation is said to be suitable for this ore.

Lyon County

The Nevada-Douglas mine produced 1843 tons of dry ore, yielding 243,211 lb. copper in August.

Mineral County

The Aurora mill is now treating 200 tons of ore per day yielding $3.40 per ton. The Company employs 150 men on the property.

In the 4000-ft. adit of the Lucky Boy mine, near Hawthorne, 24 to 36 in. of rich silver-lead ore has been opened in limestone. Twenty men under Morris Gallagher are driving the adit 8 ft. per day in hard ground, according to G. W. Ingalls of Reno.

Nye County

(Special Correspondence.)—The Round Mountain company has started sinking the main incline shaft from the 700 to the 900 ft. level, and will hasten the work in order to make connections with the Sphinx mine working at 800 ft. The Sphinx was acquired on August 1 by the payment of $20,000 and $175,000 in shares of Round Mountain stock. At the time the deal was consummated the Sphinx dismissed its suit against the Round Mountain company, and Wm. Forman of Tonopah, its attorney, was elected a director for that company. The Round Mountain company has discovered a good body of ore in the Sphinx since assuming charge of that mine, a faulted segment of the vein which was missed by the Sphinx management. The lease which the hydraulic company held on Round Mountain placer ground expires May 1, 1915, and the Company is making arrangements to work its own placer. The water-rights of Jett cañon, eight miles distant across Smoky valley, have been purchased, and a pipe-line is to be constructed this year, to provide water for hydraulicking next year, and to insure an ample supply for the mill should enlargement of its capacity be found advisable. The plant has a capacity of 5000 tons per month. During the past four months the Round Mountain company has earned $40,000 net, and now has $75,000 in its treasury. Of the capital stock of $1,500,000 shares, 1,087,519 are issued. The last dividend, of 4c. per share, was paid in August, 1913.

Round Mountain, September 5.

It is reported that the Manhattan Consolidated Mining & Milling Co. has taken a bond and option on all the important properties in the western portion of Manhattan, including the Mustang, Big Pine, Mayflower, Big Four, Jumping Jack, Indian Camp, and Stray Dog mines. Ore from the different mines is being tested at the War Eagle mill, and holes will be drilled to a depth exceeding 2000 ft. below the workings.

The Belmont district, 47 miles north of Tonopah, which has been practically deserted for 30 years, is to have a new lease of life. Nelson Bros., who own several claims there, have arranged with the Nevada-California Power Co. to extend its power line from Manhattan, 14 miles away. A large production of silver was made in the camp from 1864 to 1885, but it cost up to $40 per ton to mine and treat ore. The company controlled by Nelson Bros. is called the Monitor Belmont Mining Co., and a mill is being constructed.

Mines at Tonopah produced 9425 tons of ore worth $196,540 last week.——At the Labor Day sports at Reno, teams from Tonopah mines won four prizes in first-aid and mine-rescue contests.——At 900 ft. in the Desert Queen workings of the Belmont, 9 ft. of $70 to $100, and 3 ft. of rich ore has been cut in trachyte formation.——Stopes on the Macdonald, Martha, and Triangle veins of the Montana mine continue to furnish plenty of ore for the mill.

White Pine County

Safety First, the monthly bulletin of the Nevada Consolidated company, states that August was an unfortunate month for accidents. At Copper Flat, five men were killed and three seriously injured on August 4, by the punching and striking with a hardwood tamper, some dynamite lodged on a rock which had by accident become jammed in the barrel of a blast-hole. At the Veteran mine, concentrator, and smelter there were several more or less serious accidents. A team from the concentrator captured first prize for first-aid at Reno on Labor Day.

NEW MEXICO

Grant County

At the Chino company's mine, mill, power-plant, and residences a total of 600,000,000 gal. of water is required per month. But 83% of this is recovered, and the balance, about 100,000,000 gal., is lost. This amount must be replenished each month, and as the supply has been difficult to obtain at times, seven spring and dam sites capable of delivering 196,000,000 gal. per month have been obtained. There is now stored 375,000,000 gal. above the three tailing ponds below the mill at Hurley.

SOUTH DAKOTA

Lawrence County

(Special Correspondence.)—At the annual meeting of the Golden Reward Consolidated Gold Mining & Milling Co., held at Deadwood, the following directors were elected: C. C. Tegethoff, O. H. Kahn, Harris Franklin, Robert W. Goelet, H. W. DeForest, W. B. Devereux, Walter Luttgen, E. C. DeWitt, and W. A. Harriman, all of New York. The officers are:

C. C. Tegethoff, president, Harris Franklin, vice-president; W. J. Johnson, secretary, and N. E. Franklin, assistant secretary.——The regular monthly dividend of 1c. per share was declared by the directors of the Wasp No. 2 Mining Co. on August 15. Everything about the plant is running smoothly.——Permission having been given the Heidelberg Mining Co. by the South Dakota 'blue-sky' commission, to sell treasury stock, sinking has commenced with the funds raised, and a shaft will be put down below the present deepest level, and, simultaneously, a raise made to the surface, a distance of 100 ft., directly over the shaft, to be connected with it, and thus give exit to the surface. A windlass will be used in sinking until such time as a steam plant can be erected on the surface and connections made.——S. T. Cochran was elected president, J. N. Andrews vice-president and secretary, and Banks Stewart treasurer and general manager, of the Hidden Treasure Gold Mining Co. at a meeting held in Deadwood. These officers and a number of stockholders visited the property at the time of the meeting, and discussed plans for future development. It is probable the shaft, now 200 ft. deep, will be continued. It is equipped with a gasoline plant.

Since the establishment of an assay office and the employment of an assayer at the Titanic property, the workings and surface outcrops are being systematically and thoroughly sampled. The work is well in hand, but will probably require the balance of the summer to complete. The company recently purchased the Albe fraction from Mrs. Ellen Holmes, the owner. This was a small acreage, but was situated at what might be called a strategic point.

Deadwood, August 20.

UTAH

Juab County

Zinc ore, containing 35% metal, is being shipped from the Lower Mammoth mine.——On the 600-ft. level of the old Mammoth mine, a new shoot has been cut which assays from 3 to 19% copper, 1 oz. gold, 150 oz. silver, and 18 to 35% bismuth.

Salt Lake County

The South Utah mines at Newhouse have been shut down. The mill was stopped in April, and some high-grade ore was sent to the Tooele smelter in May and June, yielding 120,921 lb. copper, 2197 oz. silver, and 29 oz. gold. In the first four months the yield was 1,290,063 lb. copper.——A 50-ton flotation plant is to be tried at the Ohio mill at Lark.

On September 7 fire destroyed part of the mill and the transformer station of the Wasatch Mines Co. at Alta. The loss is estimated at $40,000, but the plant will be rebuilt.——On September 9 fire destroyed about $90,000 of apparatus of the Dykes Universal Concentrator Manufacturing Co. of Salt Lake City. The Company was engaged in distilling, concentrating, and solidifying wood alcohol, which was placed on the market in the form of small cubes and packed in tin cans. H. K. Clover, chemist of the Company, stated that the apparatus in the laboratory was imported from Germany, Belgium, and Bohemia, and could not be replaced until after the war. All tanks, stills, and pipes in the laboratory were of pure copper and brass, some of them alloyed with platinum, and one large still was about 75% silver. The carboys, test tubes, and graduates were of finest Bohemian glass. In addition to the apparatus, the loss included wood alcohol in tanks and a supply of valuable chemicals, and furniture, cans, and bottles used in packing the product.

The South Hecla Mining Co., of Alta, held its annual meeting last week. The daily output is now 30 tons of ore, but during the summer it was 100 tons per day.

Summit County

Shipments of Park City products in August totaled 4355 tons, of which the Silver King Coalition contributed 2455 tons; Silver King Consolidated, 1157 tons; Daly-Judge, 476 tons, and Daly West, 170 tons. Good progress is being made with the new Daly West mill.

Bournonite, a sulphide of lead, copper, and antimony; jamesonite, a sulphide of lead and antimony; and calamine, a silicate of zinc, occur in certain mines at Park City, according to Frank Robertson Van Horn in the August *Bulletin* of the A. I. M. E. The failure to recognize bournonite is due to its similarity to tetrahedrite. It is a rare mineral, and has been found in the Silver King Coalition and Daly West mines, from the 1300 and 1000 to 1200-ft. levels. Jamesonite is also rare, and occurs in the Silver King Coalition and Daly-Judge mines. Calamine has never been reported from Park City before, where it was identified on a dump at the Quincy mine, associated with a brownish manganese oxide resembling wad.

CANADA

Ontario

(Special Correspondence.)—The Ontario government has issued an 'order-in-council' granting an extension of time for three months for the performance of assessment work on mining claims, in view of high prices and the difficulty of obtaining money.

Toronto, September 1.

It is reported that all of the silver bullion in the wrecked steamer *Empress of Ireland* has been recovered by divers.——After three weeks of work at one-third capacity, the Casey-Cobalt company will bring this up to about 70%, and 10 drills will be at work in the mine.

The Nipissing Mines Co. has taken an option on 1,501,000 shares of the McIntyre company, of Porcupine, at 40c. per share, or $600,400. The Company has 60 days from September 7 to examine the property and decide on its acquisition.——The Vipond mill at Schumacher is in full operation.——The Rea mine at South Porcupine produced 1000 oz. gold in July, and is employing from 35 to 40 men.——During the period ended August 12 the Hollinger mill treated 16,456 tons of ore averaging $15.46 per ton, with 94.4% recovery. Total costs of mining, treatment, etc., were $4.17 per ton, and the profit was $171,976. The net surplus is now $481,135. The mine continues to show good results. A winze is being sunk below the 675-ft. level. On this level the vein is 20 ft. wide, assaying $10.90 per ton.

Mineral production of this province for the first half of 1914 is as follows:

Product.	Quantity.	Value.	First half 1913.
Gold, ounces	99,869	$2,011,069	2,171,147
Silver, ounces	13,379,044	7,053,418	7,693,713
Copper, tons	8,357	1,197,059	832,645
Nickel, tons	13,105	2,872,843	2,514,414
Iron ore, tons	47,160	118,119	141,324
Pig iron, tons	343,408	4,429,664	5,051,840
Cobalt, tons	129	22,581	7,374
Cobalt and nickel oxide, lb.	757,268	379,152	186,317

Yukon

The eighteenth anniversary of the discovery of gold on Bonanza creek was celebrated at Dawson on August 17. Rain somewhat interfered with the program. With the estimate of $5,400,000 for the current season, the total gold shipments from the Klondike since 1885 amount to $179,853,908. The Klondike gold today comes chiefly from Bonanza, Eldorado, Hunker, Dominion, Gold Run, Last Chance, Quartz and Sulphur creeks, and benches along some of the streams. The Fortymile, Sixtymile, Stewart, Scroggie, Livingstone, Nansen and other districts contribute a share. There were 5310 placer claims in good standing in the Yukon Territory at the end of March 1914, of which 4428 were in the Dawson district. There were also 908 quartz claims, 554 being at Dawson, 152 at Duncan, 25 at Whitehorse, and 81 at Conrad.

PERSONAL

T. J. Hoover is in New York.

L. D. Ricketts has gone to Arizona.

Donald F. Irvin has gone to New York.

F. G. Cottrell has returned from Denver.

D. T. Day was in San Francisco this week.

W. Y. Westerfelt was in San Francisco Thursday.

E. H. Leslie has gone to Salt Lake City and Denver.

Frank Dennis is in New York, returning from London.

W. R. Calvert was in San Francisco returning from Calgary.

Ralph Arnold will leave New York shortly for Venezuela.

Colin Fraser has been examining properties in New Guinea.

Edwin J. Collins, mining engineer of Duluth, was in Los Angeles on business last week.

Walter Harvey Weed, mining geologist, was recently in Boise, Idaho, on professional business, en route home from Alaska. He was expected in New York on September 15.

W. E. Colby addressed a joint meeting of the San Francisco sections of the A. I. M. E. and the M. & M. Soc. Amer., at the Engineers' Club, Monday evening, on the Argonaut-Kennedy Extension litigation.

Olof Zetterlund, general manager for El Arco Mines Co., San Bartiolo, Copala, Sinaloa, Mexico, was in San Francisco this week on his way to New York. He plans to purchase additional equipment for a cyanide plant.

Archer W. Hendrick, of Portland, Oregon, has been elected president of the University of Nevada to succeed the late J. E. Stubbs. Mr. Hendrick was formerly dean and professor of English at Whitman College, Walla Walla, Washington.

J. B. Tyrrell, of Toronto, has recently been making an examination of the lower part of the valley of the Fraser river in British Columbia with the object of determining the question of the existence or non-existence of oil in commercial quantities.

Charles H. Lee, consulting engineer for Los Angeles, has been engaged by the ground water division, water resources branch, of the U. S. Geological Survey, to carry on comprehensive investigations of ground water supply throughout the Pacific slope of San Diego county. Mr. Lee will maintain his engineering offices in the Central building, Los Angeles, where he will continue his consulting engineering practice

Obituary

H. C. Gerber died at Los Angeles on August 9, after a long illness. He was a well known mining man and at the time of his death was vice-president and general manager for the Yaqui River Smelting & Refining Co. His death will be regretted by his many friends.

Henry Beatnober, who died at Livermore, California, September 13, was born 65 years ago in Prussia. He was educated in that country, but came to the United States before the Civil War, in which he served with distinction among the Northern troops. He was one of the pioneer mining men of the West, being especially connected with the influx of British capital in Western metal mines that marked the eighties. His judgment and his word ranked high in London, and he was the responsible agent in the selection of many of the best properties bought by the English. Later he turned his attention to Alaska, in which he was much interested at the time of his death. He was an active worker to the last, and an indefatigable traveler who went at the first hint of a discovery, to see things for himself. It was characteristic that he should have been interested in the Chisana, a district that is only being proved this year. A big, jovial, friendly man, a hard worker, and an excellent judge of mines and prospects, he will be much missed.

James B. Haggin is another of the pioneer mining men of America whose death has just been announced. His name is so closely interwoven with big mining, both in North and South America, that it is difficult to decide where to begin in describing his activities. He was born in Kentucky in 1827 and educated for the legal profession. In fact he practised law at St. Joseph, Missouri, and Natchez, Mississippi, until 1849, when he joined the throng moving to California. Here he did well, and both in California and Nevada he became a power. Later, in Montana, with Daly he founded what has become the Anaconda Mining Co., just as elsewhere with Hearst he started great enterprises. In recent years his greatest work has been in connection with the Cerro de Pasco, that great Peruvian enterprise to which he devoted so much time, money, and energy. To the general public he was best known as the owner and breeder of race horses, and in this as in mining he scored a success worthy of his Kentucky ancestry. However, Haggin was no man to be dominated even by a pleasure, and he suddenly sold all his turf holdings when he found them taking too large a part in his life. Right to his death he was active, and in the troublesome days of the money panic in 1907, as we recorded at the time, his eighty years did not prevent his daily attendance at the conferences of the capitalists who stopped the panic. He was a vigorous, keen witted, far seeing pioneer—the sort that marked the old generation, but the like of which present conditions do not conspicuously develop. Under his care big enterprises grew and many men worked because of his faith in the future.

The death of Albert Grothe, better known to his numerous Mexican confrères as Don Alberto, on August 19, at the age of 73 years, in the American hospital at Mexico City, marks the passing from Mexico's mining circle of its 'grand old man.' Everyone familiar with the modern development of the metallurgy of silver in Mexico, which may be said to have commenced with the introduction of the cyanide process, will associate this advance with Mr. Grothe's work; and those of us who have known him and sat at the tea table in his offices and enjoyed his congenial companionship for a half-hour during the balmy afternoons of the Mexican winter, feel the loss of a true friend.

As a mill builder and metallurgist, whose work in Mexico was largely responsible for the introduction of the Pachuca tank and other standard equipment in the present metallurgical practice, Mr. Grothe, despite his advancing years, has always been in the forefront. In addition to his professional duties and his representation of the Cyanide Plant Supply Co. of London and the Don Machinery Co., Mr. Grothe found time to devote to the establishment and upbuilding of the Mexican Institute of Mining and Metallurgy. As its first president, to which office he was repeatedly elected, Mr. Grothe was the corner-stone upon which this organization was built.

During the last few years of his life, Mr. Grothe devoted considerable time, in coöperation with the Department de Fomento in the preparation of a monograph on Mexico's mineral resources. Several installments of this work have been published by the Mexican government, and those who have read these detailed descriptions, written in the Spanish language, will appreciate what was to have been the monumental character of this work. We trust that this series, which was so well begun, may be completed. Mr. Grothe's many contributions to scientific societies and the technical press will be recalled as important and timely.

Of German parentage, his years spent in Mexico, his masterful command of Spanish, his intimate knowledge of the Mexican people, his broad technical experience, and his lovable personality gained for him the confidence and esteem of all those with whom he came in contact in that cosmopolitan country.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, September 17.

Antimony	15 —15¾
Electrolytic copper	14 —14¼
Pig lead	4.15— 5.10
Quicksilver (flask)	$75
Tin	36 —37½
Spelter	6½— 6¾
Zinc dust, 100-kg. zinc-lined cases	15

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, September 17.—The copper situation is unchanged, and lead and spelter are quiet at 3.85 and 5.25c. per pound respectively. Antimony ranges from 10 to 13c.; three shipments have arrived. Ferro-manganese is $85 to $100 per ton. Platinum, $48 to $50 for soft, and $52 to $54 for hard metal. As stated last week, the general feeling in copper is much better, despite failure of negotiations for a pool. Consumption both at home and in England has held up better than was anticipated.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

In New York and London, prices have been around 55c. and 24 to 25d. per ounce respectively. The market is stronger now, and the increase in supplies in New York seems to be met by the purchases for coinage in various countries. Practically all sales are on a cash basis, and there has been no business for future delivery. Owing to a favorable season and low stocks at Bombay, resumption of silver shipments to India from London is likely soon.

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per pound more. Prices are in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

Transactions in this metal have been few, and quotes of 12.15 to 12.60c. per pound are the same as last week. Copper production of the Braden mine in August was 4,532,000 lb., a record, from 80,895 tons of ore with 72.70% recovery, against 1,332,000 lb. in July, and 662,000 lb. in June. A clean-up in August gave the large return. The Old Dominion yielded 2,236,000 lb., against 2,962,000 lb. in July; Shannon, 1,960,000 lb., against 1,084,000 lb.; and Granby, 2,714,089 lb. in July. Output of the Sulitjelma mine, Norway, increases, that for August being 1100 tons of concentrate.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Sept. 10	3.85	Aug. 5	3.85
" 11	3.85	" 12	3.85
" 12	3.85	" 19	3.88
" 13 Sunday		" 26	3.87
" 14	3.85	Sept. 2	3.90
" 15	3.85	" 9	3.85
" 16	3.85	" 16	3.85

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

Lead ore prices at Joplin, Missouri, are dull at $46 per ton, basis of 80% metal.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending		Sept. 3	75.00-85.00
Aug. 20	No quotes	" 10	75.00
" 27	80.00	" 17	75.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

Advice from London states that the British government has secured all supplies of quicksilver in England for war purposes. It is allowing a certain amount to be sent to some South African mines. Indications are that prices are likely to appreciate instead of declining. New York quotes are $75 per flask.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Sept. 10	5.25	Aug. 5	4.75
" 11	5.25	" 12	5.25
" 12	5.25	" 19	5.60
" 13 Sunday		" 26	5.77
" 14	5.25	Sept. 2	5.75
" 15	5.25	" 9	5.50
" 16	5.25	" 16	5.25

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

At Joplin a month ago blende of 60% metallic zinc was selling for $38 to $40 per ton. After a smart rise to $50, basis, which figure was paid for virtually the entire production of an entire week, or approximately 5000 tons, bids for ore dropped quickly, declining to $45, at which figure the market is fairly steady. The decline after the unnatural advance was to be expected. An increase of $10 per ton was recorded during a period of two weeks, this being the sharpest gain in the history of the local industry. The strength was purely speculative; future strength will doubtless be based upon something more substantial, and there seems little doubt that an ultimate advance may be looked for. Zinc metal, which reached $6 at East St. Louis, declined to $5.75 per 100 lb. at the close of August. For the corresponding week of 1913 blende brought $46 to $48 per ton, basis, with premium lots commanding as high as $51. Spelter was quoted at $5.75.

ZINC DUST

There have been sales as low as 15c. per pound, while other dealers quote from 17½ to 25c. A small shipment reached San Francisco during the week, but was immediately sent away to Central America. Another lot is expected within a month.

TIN

Nominal prices are now about 32c. per pound. A shipment of 725 tons is due in New York next week, which surprised the trade. Tin-plate scrap is accumulating, as Germany used to absorb the most of it.

COMPANY REPORTS

The following companies operate at Reefton, on the west coast of the South Island of New Zealand, and the reports cover the year 1913. A. Winter Evans is general manager for the whole group.

BLACKWATER MINES, LIMITED

Development consisted of 1648 ft. of driving at $13.04 per foot, 314 ft. of cross-cutting at $7.56 per foot, and 1768 ft. of raising at $14 per foot. Crediting ore won during this work, the net average cost was $10.02 per foot. Driving 918 ft. on the lode averaged $10.84 per ton over 17 in. Of this, 420 ft. exposed $14.35 ore over 24 in., and 498 ft. $4.23 ore over 11 in. Raising 1188 ft. showed 22 in. of $12.56 ore, of which 812 ft. opened 25 in. of $14.83 ore, and 376 ft. 15 in. of $4.37 ore. Stoping was done on No. 1 to 5 levels, inclusive, but No. 1 to 3 are about exhausted. Ore reserves are estimated as 104,727 tons averaging $9.89 per ton over a stoping width of 31.98 in., a small increase over 1912. Prospecting was carried out on several other claims. Geological work covered the correlating various strike and dip faults frequently found in the mine, to avoid unnecessary work being done. The main shaft must be sunk farther. The mill treated 45,053 tons of ore for £75,072 by amalgamation, £7152 by cyanidation, and £4841 from 462 tons of concentrate, equal to a total of $9.28 per ton. Total recovery was 84.19%. More Wilfley tables have been since installed to save more concentrate and increase the recovery. Costs were as follows: mining, $350 (high on account of narrow lode and other factors); transport and treatment, 85c.; general, 62c.; and bullion charges, 12c., a total of $5.09 per ton. The gross revenue was £83,239; gross profit, £34,982; and net profit £21,526, of which £12,500 paid No. 6 dividend.

CONSOLIDATED GOLD FIELDS OF NEW ZEALAND, LTD.

This Company operates the Wealth of Nations mine, and has large interests in the Blackwater and Progress mines in the same district. Development in the Company's mine totaled 2579 ft., at an average net cost of $8.94 per foot. Driving on the lode showed 35 in. of $10.59 ore for 133 ft., and 37 in. of $3.98 ore for 131 ft. In raising, 258 ft. showed 49 in. of $11.98 ore, and 142 ft. of $2.16 ore over 31 in. Stoping cost $2.02 per ton. Ore reserves are 25,764 tons assaying $10.41 per ton; but the peculiarities of the lode and gold content make estimates difficult. Geological work was limited on account of extra work in the survey department. The mill treated 23,661 tons for £28,355 by amalgamation, £8730 by cyanidation, and £681 from 152 tons of concentrate, total recovery being 78.89%. But this will be increased to 87.75% on complete slime treatment. Treatment costs were $1.14 per ton, and total costs $4.62 per ton. Total revenue for the year was £43,801; gross profit, £18,457; and net profit, £6056.

PROGRESS MINES OF NEW ZEALAND, LTD.

The area of this Company's property is 816 acres, five miles from Reefton. Underground work in 1913 totaled 4055 ft., at an average net cost of $8.60 per foot, of which 633 was diamond-drilling, costing $3.38 per foot. In driving 42 ft. there was exposed 58 in. of $15.07 ore, and 51 in. of $1.87 ore for 538 ft. In raising 428 ft. the lode was worth $2.17 over 59 in. Cross-cutting showed 169 in. of $15.63 ore for 16 ft., and 182 in. of $1.21 ore for 104 ft. Reserves cannot be estimated, but stopes on levels No. 6, 9, 10, and 11 should yield from 42,000 to 60,000 tons. Prospecting was done on outside claims, and some geological work was done in the main mine. Mining cost $3.06 per ton. The mill treated 34,996 tons yielding £26,878; £10,217 from sand, and £4619 from concentrate.

MINERAL STATISTICS

The following for 1913 is from the U. S. Geological Survey: Georgia ranked second among all the states in 1913 in the production of barytes, bauxite, fuller's earth, natural mineral paints, and paper clay, and was the only state reporting a production of asbestos. The total value of the mineral products of Georgia in 1913 was $6,525,792, a fair increase over 1912, nearly 80% of which was from its clay pits and quarries. Clay products were valued at $2,692,619; granite and marble, $2,105,366; coal, 255,626 tons, worth $361,319; ochre, 11,869 tons, worth $123,616.

Coal mined in Illinois in 1913 amounted to 61,618,744 short tons, valued at $70,313,605, according to figures compiled by E. W. Parker, in coöperation with the Illinois State Geological Survey. The coal-mining industry presented some interesting and contradictory features. In the first place, the diminished supply of natural gas in Kansas caused an increased demand for Illinois coal in the territory which is naturally tributary to the Illinois coalfields but which for a few years had been supplied by gas, and during the last three months of the year the strike in the coalfields of Colorado caused a movement of Illinois coal to more western markets in order to supply the deficiency created by the strike. On the other hand, exceptionally mild weather in the early winter had a depressing influence on the domestic trade and the water-power developed by the Keokuk dam seriously affected the demand for and prices of steam coal within a radius of 250 miles from the power-plant. It is estimated that the power furnished by the dam displaces about 3000 tons of coal per day. The resultant effect of all these influences was an increase in the quantity of coal produced from 59,885,226 short tons in 1912 to 61,618,744 tons in 1913, a gain of 1,733,518 tons, whereas the value showed an increase of only $19,267, the average value per ton declining from $1.17 in 1912 to $1.14 in 1913.

Texas, the largest of all the states in area and fifth in the number of inhabitants, ranks nineteenth in the value of its mineral production. In each of the last two years Texas advanced two numbers in the rank of mineral-producing states. In the percentage of its increase in 1913 over 1912, Texas was exceeded by only one other state, its northern neighbor, Oklahoma, which, on account of the sharp advance in the price of petroleum, showed a gain in value of mineral products of nearly 50%, while Texas showed an increase in value of 38.9%—from $22,797,015 in 1912 to $31,666,910 in 1913. Texas ranks second in the production of asphalt and third in the production of quicksilver. Since the great strike at Beaumont in 1901, petroleum has had first place in the mineral products of the state, and Texas now ranks fourth in the quantity of petroleum produced and seventh with respect to the value of the product. The production increased from 11,735,057 bbl. valued at $8,852,713, in 1912, to 15,099,478 bbl. valued at $14,675,593, in 1913. The possibilities for oil development are widely scattered over Texas, and the chances for further extension are therefore excellent. Second in importance among the mineral products of Texas, reckoned by the value of output, is coal, including lignite or brown coal, the combined production of which amounted in 1913 to 2,429,144 short tons valued at $4,288,920, against 2,188,612 short tons valued at $3,655,744 in 1912. Texas is the only state in the Union that produces considerable quantities of both bituminous coal and true lignite or brown coal. The only other mineral products of Texas which contribute as much as $1,000,000 to the total value are asphalt, cement, clay, and natural gas, cement being $2,663,063, and natural gas $2,073,823, against $2,064,124 and $1,405,077 in 1912, respectively.

RECENT PUBLICATIONS

Coal-Mining Practice in District II. By S. O. Andros. *Bulletin* 7. University of Illinois. P. 22, illustrated. Urbana, 1914.

Pre-Cambrian Geology of Southeastern Ontario. By Willet G. Miller and Cyril W. Knight. P. 151. Ill., maps, charts, index. Bureau of Mines, Toronto, 1914.

Safety Bulletin No. 13 of the National Founders' Association. P. 9, illustrated. Chicago, June 1914. Contains some useful hints on the use of hoisting accessories.

The Ohio Coal Supply and Its Exhaustion. By Frank A. Ray. *Bulletin* 12. Ohio State University. P. 46, ill., maps, plans, charts, index. Estimates of the coal supply vary from 48 to 688 years, depending on weight given unknown factors.

Western Electric Poles. P. 12, illustrated. Western Electric Co., New York, 1914. A well prepared booklet with all details of cutting poles, inspecting them, and specifications of suitable poles for line work.

Statistical Report of Highway Work in North Carolina during 1912. Compiled by Joseph Hyde Pratt and Miss H. M. Berry. *Economic Paper* 36. North Carolina Geological and Economic Survey. P. 127. Illustrated. Raleigh, 1914.

The Broad-Top Coal Field of Huntingdon, Bedford, and Fulton Counties of Pennsylvania. By James H. Gardner. *Report* No. 10. Topographic and Geologic Survey of Pennsylvania. P. 81, ill., index. Also case with 11 maps and charts, and table of coal analyses. Harrisburg, 1913.

Building and Ornamental Stones of Canada. Volume II. Maritime provinces. By Wm. A. Parks. P. 264. Ill., map, 45 halftones and colored plates, index. Department of Mines, Ottawa, 1914. A valuable contribution on an important subject, and should be obtained by architects, builders, contractors, and others.

The Young Man and the Electrical Industry. By James H. Collins. P. 24, illustrated. The little book deals with the opportunities afforded a young man in this industry, and the different lines in which he may direct his activities, as exemplified by the works of the Westinghouse Electric Co., of East Pittsburgh.

United States Geological Survey publications, Washington, D. C., 1914:

Production of Magnesite. By Charles G. Yale and Hoyt S. Gale. P. 14.

Gold, Silver, and Copper in Alaska in 1913. Mines report by Alfred H. Brooks. P. 13.

Silver, Copper, Lead, and Zinc in the Central States in 1913. Mines report. By B. S. Butler and J. P. Dunlop. P. 93.

Marble Resources of the Juneau, Skagway, and Sitka Districts, Alaska. By Ernest F. Burchard. *Bulletin* 592-C. P. 13, map.

A Barite Deposit near Wrangell, Alaska. By Ernest F. Burchard. *Bulletin* 592-D. P. 9, ill. This was reprinted in the *Press* of September 5.

Ore Deposits of Northeastern Washington. By Howland Bancroft. Including a chapter on 'The Republic Mining District,' by Waldemar Lindgren and Howland Bancroft. *Bulletin* 550. P. 215, ill., maps, plans, index. An abstract of this work appeared in 'The Mining Summary' of September 12.

Contributions to *Economic Geology*:

Some Deposits of Mica in the United States. By Douglas B. Sterrett. *Bulletin* 580-F. P. 61, illustrated.

Gold Placers of Wind and Big Horn Rivers, Wyoming. By Frank C. Schrader. *Bulletin* 580-G. P 19, illustrated.

BOOK REVIEWS

Unit Construction Costs. By E. Horton Jones. P. 152. Illustrated. McGraw-Hill Book Co., Inc., New York, 1914. For sale by the *Mining and Scientific Press*. Price $2.

This valuable compilation was originally prepared for and presented at the Salt Lake meeting of the American Institute of Mining Engineers, held in August, and has already appeared in the July *Bulletin* of the society. An abstract with line drawing was published in the 'Concentrates' of the *Press* of August 8. The costs given are probably the most detailed of any yet published on construction of a plant, and represent expenditure on the new smelter of the Arizona Copper Co., Ltd., operating at Clifton, Arizona. The data covers the period from February 1912 to February 1914, and the total cost was $2,105,020. This volume will be found extremely useful to constructing engineers.

Quantitative Chemical Analysis. Introductory notes on. By Charles William Foulk. P. 250. Illustrated, index. McGraw-Hill Book Co., Inc., New York, 1914. For sale by the *Mining and Scientific Press*. Price $2.

This is the third enlarged and revised edition of the little work first appearing in 1898, and again in 1910. No claim of originality is made for the aim of the work, namely, the presentation of beginning work in quantitative analysis in such a way that a student will be led to think more of the general aspects of the subject, than of learning merely to carry out a succession of methods. Part I starts with advice to students, then notes on chemical apparatus, weighing, gravimetric analysis, samples, precipitation, filtration, volumetric analysis, normal solutions, and titration. And Part II covers the preparation and standardization of volumetric solutions, and various determinations. Everything is given in a practical manner, and students and others should find the volume of general value.

The Diamond Fields of Southern Africa. By Percy Albert Wagner. P. 347. Ill., map, plans. *The Transvaal Leader*, Johannesburg, Transvaal, 1914. For sale by the *Mining and Scientific Press*. Price $8.

Although diamonds are a luxury, and are of little use save for personal adornment, yet their recovery, cutting, and destination is of considerable interest. The estimated production of this form of carbon in 1913 was worth £14,815,400, of which the Union of South Africa yielded £11,246,200; German Southwest Africa, £2,953,500; Rhodesia, £3200; Belgian Congo, £12,500; and other countries, £600,000. The British Empire produces 76% of the total. The author of this volume has for years personally studied the whole subject of diamonds. The geology of diamond deposits, and the origin of the stones, is not settled, and it is doubtful whether a general accepted theory will be found. In an editorial paragraph of the *Press* on April 4, 1914, was given in abstract the views of Gardner F. Williams, so long at Kimberley. Mr. Wagner discusses the kimberlite and other occurrences. The diamond 'pipes' are of peculiar shape, but contain all the stones within their respective areas. Early and present systems of mining are described at Kimberley, the Premier, and other properties of less note. Also crushing, concentrating the 'blue' and 'yellow' ground, and saving the diamonds on grease tables. Alluvial mines are also described, and a few remarks on the economics of the industry. The book is well illustrated, has a good bibliography, but lacks an index. It is a valuable addition to the literature on all pertaining to these gems.

RECENT PATENTS

1,100,972.—Electrical Furnace for the Reduction of Copper and Other Ores. William H. Hampton, New York, assignor to the Conley Electric Furnace Co., Inc., Wilmington, Delaware, a corporation of Delaware.

A copper reduction furnace comprising a plurality of shafts having electrical resistance heaters in their walls, an upper shaft portion common to said shafts, and electrical resistance heaters in the walls of said common shafts portion.

1,100,582.—Process of Crushing and Grinding Calcium Carbide. Walter S. Landis, Niagara Falls, Ontario, Canada, assignor to American Cyanamid Co., Nashville, Tennessee, a corporation of Maine.

Preventing explosions as well as lessening the weathering of calcium carbide and the losses incident thereto during the process of grinding said carbide which consists in carrying out the grinding operations in an atmosphere of substantially chemically pure nitrogen, substantially as described.

1,106,332.—Percussive Drill. John George Leyner. Denver, Colorado.

In a fluid operated drill, a drill cylinder and a piston therein having a drill rod projecting forwardly thereof, said drill rod having a fluid conveying bore, a front head on said drill cylinder, a fluid pump cylinder, secured to the front head, a piston in said fluid pump having a rod secured to said drill rod, and fluid connections for conveying fluid from said pump to said drill rod bore.

1,106,836.—Process and Apparatus for the Extraction of Pregnant Cyanide Solutions from Pulp. Edson S. Pettis, San Francisco, California.

Combination of a tank, means for introducing and distributing pulp into the top portion of the tank, means for simultaneously introducing into the tank a counter underflow of barren solution, yet allowing the solids to gravitate continuously and thicken in the solution underflow, and means for recovering the pregnant solution, mixed solution, and thickened pulp separately, substantially as described.

1,107,240.—Process of Treating Ore. Niels C. Christensen, Jr., and Theodore P. Holt, Salt Lake City, Utah, said Christensen, assignor to George H. Dern, Salt Lake City, Utah.

A process of treating ore, consisting in preliminarily finely dividing the ore and bringing finely divided fuel into intimate mixture therewith and adding chemicals to the mixture of fuel and ore according to the results desired from the subsequent treatment of the ore, igniting the fuel carried by a charge of the preliminarily prepared ore and roasting the charge by internal combustion thereof, and thereafter extracting the useful metals from the roasted ore by lixiviation with a suitable solvent.

1,106,333.—Gyratory Crusher. John McInrue, Chicago Heights, Illinois, assignor to Chalmers & Williams, Inc., Chicago Heights, Illinois, a corporation of Illinois.

The combination of a gyratory shaft and a crusher head, said shaft and head being provided with engaging tapered surfaces, and means for securing and maintaining the bearing on said head in strong frictional engagement with the bearing on said shaft, said means comprising right-hand and left-hand nuts threaded to said shaft, both of which bear upon the upper end of said crusher head, and means for connecting said nuts to said head whereby angular movement of said head on the crusher shaft will be imparted to said nuts, substantially as described.

INDUSTRIAL PROGRESS

Pan Motion Concentration

The application of the miner's pan motion to modern concentrating machinery is marked by the presentation of the Senn concentrating machine. Pan motion has been experimented with by the inventor of this new mechanical motion for a number of years, and the present machine is claimed to have overcome all the early mechanical difficulties and a machine has been perfected which embodies this motion.

The motion is the result of two eccentrics operating at right angles and connected by a ball and socket joint. The perfect circular pan motion can be varied to an elliptical motion by changing the position of the eccentrics. The machine has a double cone belt drive, belt tightener, shifter, and feed clutch connected to a worm gear by means of a telescope knuckle shaft. This permits the operator to change the belt travel instantly by either the hand wheel or lever.

In the construction of the machine all bearings are babbitted, pins in all drum-heads are standard cold rolled shafting and interchangeable on short notice. The stationary frame supporting the whole machine consists of four massive columns or pedestals, which are bolted to two heavy timbers. The columns on their upper ends are braced firmly together both side and endwise by heavy pipes and rods. The main drive shaft rests in large bearings at the base of the columns, which eliminates vibration from the machine. The machine has been designed for heavy use and large tonnage. The idea of the pan has been carried out in the construction of the belts, which has molded into it thousands of small disc shaped indentations. Whether the material treated is coarse or fine, classified or unclassified, it is claimed that due to the uniform pan motion, the mineral settles almost immediately and the gangue is held in suspension and carried in successive half circular steps down the incline of the belt and discharged as tailing.

A careful test on low-grade copper ores of Arizona, continued through several months, resulted in favor of the pan motion concentrator. The concentrator is manufactured by the Senn Concentrating Co., of San Francisco, California, which company also maintains an ore-testing laboratory in Oakland, California, for the demonstration of its machine.

Commercial Paragraphs

The Swedish Metal Preserver Co., M. W. Putnam, Pacific building, San Francisco, agent, has issued a pamphlet on its metal preserver.

The Holt Manufacturing Co., Stockton, California, in the August number of the *Caterpillar Times* discusses with illustrations some of the many uses to which the caterpillar type of tractor is adapted.

The Chas. C. Moore & Co., Engineers, San Francisco, report the sale of a 6½ by 15 Platt triplex pump direct connected to 150-hp. motor, and two 6-in. 5-stage Platt pumps direct connected to 125-hp. motor, to Goldfields Merger Co. The triplex pump operates against 1525-ft. head and is the first centrifugal mine pump to be used in that district.

The Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, Missouri, will be pleased to distribute to those who are interested a reprint of an address by Dr. Diesel before the American Society of Mechanical Engineers on 'The Present Status of the Diesel Engine in Europe,' and a few reminiscences of the pioneer work in America. The Pacific coast sales division of this Company is in the Rialto building, San Francisco, California.

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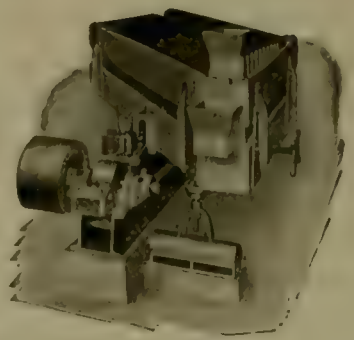

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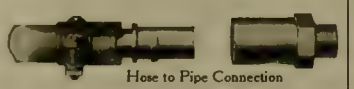

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By E. J. Vallentine 473
The F. M. S. produce 50,000 tons of tin per year and furnish the bulk of the world's supply. Most of the mining has been in the hands of the Chinese and has been done by hand. A change is taking place, Australians and British have introduced hydraulicking and dredging, and a fine field is apparently open for builders of bucket-dredges. Mr. Vallentine gives details as to costs.

The Nassau Zinc Works at Depue, Illinois.
By E. H. Leslie 475
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Mr. Abbott presents a cheerful picture of the rejuvenation of one of Nevada's famous pioneer mining districts.

Progress and Working Costs, Tanganyika Copper Mines.
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This address, delivered at the annual meeting of the Tanganyika stockholders, includes interesting extracts from letters written at the inception of the enterprise, but only now made public, and a statement by M. Jadot of results to date. The output for 1914 was estimated (before outbreak of the war) at 12,000 tons costing 7½c. per lb. in Europe.

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EDITORIAL

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DEATH of T. J. Grier, manager for the Homestake Gold Mining Company, is announced. Mr. Grier passed away suddenly after a pleasant evening with Mr. Edward H. Clark at Los Angeles. We shall speak later of his services to the industry; now we mourn the passing of a friend. It is a pleasure to have recorded recently the fine tribute paid to him by the Commission on Industrial Relations at its hearing at Lead.

CYANIDE conditions in the United States and Mexico are likely to improve rapidly, thanks in large part to the persistent efforts of Mr. Charles Butters, who has been bringing pressure to bear at Berlin to secure a lifting of the embargo on shipments. On Wednesday this week he received the following wire from the acting secretary of state, Mr. Robert Lansing: "Advices from Berlin state that the American minister was informed on the 16th instant by the director of the Gold and Silber Scheide Anstalt that export of cyanide is now permitted for America and Mexico. Imperative that no cyanide be re-exported." This means that shipments must be for *bona fide* use in this country and Mexico. Since the German ports are still open to neutral ships and the routes through Holland and Denmark are open, there is no reason why direct importations should not be resumed. In addition, three of the fourteen sets of machinery ordered in Germany before the war for use in converting cyanamid into cyanide, are reported ready and can be gotten out. There is furthermore a large shipment of cyanide from Germany to the United States that had got as far as Antwerp when the trouble began. This may become available at any time, though it may also be diverted or destroyed. If, therefore, users will but be patient and accommodate each other a little with loans, there need be no real hardship.

REPORTS of rich gold discoveries in Alaska are made from time to time, but rarely is any more heard of them, and mining men wonder from what sources the reports emanate. Such wild exaggerations have greatly held back the development of this promising territory. The recently widely published news that a goldfield of enormous extent and possibilities had been discovered in the Broad Pass district of Alaska, and credited as coming from Mr. Stephen Birch, is a report without any foundation whatever, as we noted in our news columns last week. The details are given in our New York letter. A spirit of over enterprise led some of our contemporaries to spread the news ridiculously beyond what proved to be its deserts. The real responsibility, however, rests with the one starting the report. People who give out news of this sort should be apprehended and taught a lesson, as they cause a rush to the alleged district, and subsequent disappointment to miners who have enough hardships in Alaska. It might be as well to point out that great deposits such as at Juneau and at other great lode mines, are not developed in a few days, but after many years of skilful work; so that when a report is heralded that a goldfield equal or larger than some other one which has been a long period in coming to production is discovered, caution should be exercised in accepting the statement, at least among technical men.

PROGRESS IN ZINC SMELTING

In closing the series of articles on modern zinc smelters in the Middle West, by Mr. Leslie, with the description of the Nassau plant of the Mineral Point Zinc Company, we take advantage of the occasion to contradict the often expressed opinion, especially by those whose endeavors have been confined to other fields of metallurgical practice, that zinc smelting has been marking time for the past thirty years. A study of the situation presents ample evidence to the contrary. The opinion is generally based upon the fact that no really successful substitute in the form of a blast-furnace has been found for the present retort furnaces. It has been tried innumerable times, and a review of the literature on the subject and the files of the Patent Office will show that no little effort by most capable scientists has been directed toward producing a substitute for the present retort method of zinc distillation, all of which efforts to date have been failures in a greater or less degree. When mixed with a large percentage of the products of combustion and air, an inherent difficulty in blast-furnace practice, zinc will not condense to fluid metal, an oxidizing of the vapor taking place with the formation of zinc oxide and a fine metallic powder. A solution for this and other difficulties has been sought, and is being sought, but with little hope of success for the moment. Electric smelting of zinc at present occupies the attention of the zinc metallurgist, but it remains to be demonstrated just what the pos-

sibilities of electricity as applied to zinc smelting are. While the thermal efficiency of zinc smelting continues low, and fuel costs are high, this is true also of railway locomotives and steamships. In fact wherever it is necessary to burn coal, oil, or gas under boilers or in furnaces for whatsoever purpose it may be, high thermal efficiencies are impossible. Recognizing the impossibility of this situation and that heat will go up the chimney, radiate, and migrate uselessly, the tendency in all of the industries has been to conserve it as much as possible and reduce operating costs by increased mechanical efficiency. Zinc smelting has been no exception, and improvements in this industry are keeping pace with the advances in thermology in the other industries. In time, perhaps direct smelting will prove possible, but in the meanwhile it must be evident to anyone who has attentively read these articles, that rapid progress is being made in many other phases of the work and that the total efficiency, which after all is the significant measure, has increased enormously in the past decade and is still increasing. It is only to the outsider that zinc smelting looks backward.

TIN IN THE UNITED STATES

The tin consumption of the United States is large, over a hundred million pounds, worth about forty cents per pound, being imported yearly. Most of this is used in the making of tin plate, which is chiefly used to make cans for holding oil and preserved vegetables and meats. Many years ago the tin plate was imported, but most engineers remember the part which tin plate played in national politics a quarter century ago, and how, with the aid of a protective tariff, the making of tin plate has been transferred to this country, only the pig tin being imported. All efforts to secure supplies of tin within this country have been uniformly unsuccessful, for although the metal is found in many places, at none does it occur in sufficient amounts to be capable of being worked at a profit. The Harney's Peak fiasco is well known to most engineers. In Alaska some tin has been recovered by dredging, and the industry has there developed local importance, but it is actually inconsiderable, the annual yield being less than one-tenth of one per cent of the total imports. Some years ago the Standard Oil Company, one of the largest users of tin cans, thought to provide itself with an independent supply of tin and thereby obtain better rates from the plate manufacturers. The sources of ore supply were therefore investigated, and it was found that tin concentrate from the Malay States could be carried to New York at a low rate by the Standard Oil steamers, which ordinarily returned empty from those waters. A tin-smelting plant was therefore built near the refinery at Bayonne, on New York bay, at a cost of about $300,000, and work was started. The local smelters in the Malay States were naturally disturbed by this interference with their business and made representations to the local government, with such success that a prohibitive export tax was laid on shipments of tin concentrate. This unexpected blow made it impossible to smelt concentrate at New York in competition with the Orient and England. Since that period, Bolivia has become a considerable shipper of tin concentrate, which goes to Europe for smelting, but the result of the Standard Oil venture seems to have effectually deterred anyone else from embarking in the tin-smelting business in this country.

Since the useful life of tin cans is exceedingly short, it would seem that it should be possible to recover the tin from old cans and re-use it. This would at first appear true from the fact that the production of secondary tin from tin-bearing material in this country usually amounts to a little over one-fourth of the yearly imports. On closer inquiry, however, it is seen that this secondary tin is chiefly derived from tin scrap made in the manufacture of tin cans, from tin foil, and from old tin pipe. Most of the tin in empty cans is a total loss, as but a small part of the total yearly output of cans is ever reworked. The reason for this is that the cost of recovering the tin from tin scrap is so high that there is but little profit in the business, and it is not possible to go to much expense in collecting old tins and preparing them for detinning. The discovery of a cheap process for the recovery of tin from scrap would add a good deal to the wealth of this country by giving more employment to domestic labor and freeing us from the necessity of buying so much tin abroad.

Since the war in Europe has cut off shipments of tin to the United States and caused the price of the metal to increase rapidly, much interest has been exhibited in the proposal to divert the shipments of Bolivian concentrate to this country for smelting. The situation has materially changed since the unfortunate venture mentioned above. At that time the tin output of Bolivia was small: now it is valued at about $25,000,000 annually, or about two-thirds of our yearly imports. The concentrate is now being shipped from the port of Mollendo to Hamburg or Liverpool *via* Magellan, a distance of about 10,000 miles, for smelting. Now that the Panama canal is open, shipments can make the short cut, reducing the distance to 7000 miles. The distance to New York is, however, only 4000 miles, and as smelting costs here should closely approximate those in Europe, it should be perfectly feasible to transfer the industry to the vicinity of New York or Baltimore. The tin deposits of Bolivia are peculiar in that the cassiterite occurs in veins, instead of in placer deposits. The deposits occur between Lake Titicaca and Lake Poopo, the richest deposits being 30 miles south of Oruro. The veins are narrow and have not yet been worked to any great depth, the deepest mine being less than 700 feet. The tin content averages about 3 per cent, and the ore is concentrated to 60 per cent before shipping. Nearly one-half of the total output is derived from the mines owned by Don Simón Patiño, though the Compañia Estañifera de Llallagua, which, by the way, is under

direction of an American technical staff produces about 15,000 quintals per month, and is one of the most important tin lode mines in the world.

The following figures, of which we were unable to determine the original source, showing the charges which a ton of 60 per cent tin concentrate must bear, will be of interest in this connection:

Mining	$ 4.78
Sorting	0.48
Melting	1.51
General expense	0.36
Freight, mine to Guiguí	35.88
" Guiguí to Mollendo	10.14
" Mollendo to Europe	7.80
Export duty	15.60
Commissions, insurance	10.92
Total	$87.47

It will be seen from these that the margin in favor of the United States is not so great as might at first appear, for a freight rate of $7.80 per ton to Europe *via* Magellan affords no great leeway for a cheaper rate to New York. Assuming the same rate per thousand miles this would correspond to $5.88 per ton to Hamburg *via* Panama, and $4.42 to New York, assuming that the American ships also have to pay $1.20 per ton canal dues. This gives New York an advantage of $1.46 per ton of concentrate, or $2.40 per ton of tin, which offers possibilities, assuming that smelting costs here will not exceed those abroad. It is also quite possible that the next Republican congress could be persuaded to place an import duty on pig tin if any appreciable domestic smelting industry develops in the meanwhile. All in all, it seems quite probable that one effect of this war will be to develop a domestic tin smelting industry, though the fact that the tin mines in Bolivia are largely financed with European capital is likely to have a good deal of bearing on the matter.

WAR EFFECTS IN AUSTRALASIA

Mail advices from Australasia indicate that up to the last week of August the effect of the war had not been so great as was expected. All of the gold mines are working. Broken Hill, the great centre of lead, silver, and zinc production, employing over 9000 men with 42,000 people directly dependent on them, has been hit the hardest. Some of the smaller mines were closed, others are working half, and some full time. Production of zinc concentrate by flotation has been largely curtailed. Mt. Morgan in Queensland, and Mt. Lyell in Tasmania, continue their full copper production, but Wallaroo and Moonta and others have shut down. At the Great Cobar work was already temporarily reduced, so there was less change. In Tasmania, the government proposes to advance certain sums for tin, copper, lead, and zinc ores, the balance to be paid later, but the terms are not everywhere acceptable. New Zealand yields few metals of importance save gold and silver.

In Australia the population of approximately 5,000,000 people produces much more of minerals, metals, and agricultural material than it consumes. The country also has not many metal industries, so markets are widely scattered in Africa, Asia, England, Europe, and the United States, but mainly in England and Europe. The war has shut off the greater part of these outlets for products, consequently Australia and New Zealand are suffering. Exports and imports of all materials from the Commonwealth are about balanced at £79,000,000 each per year, and on a total debt of about £300,000,000, the annual interest charge is nearly £10,000,000. Exports of gold and silver amount to £11,000,000 per year, depending on the trade balance. New Zealand's trade is £22,000,000 of exports. The mineral output of Australia is valued at £25,000,000 per year, to which gold contributes £10,000,000; silver, £1,750,000; copper, £3,250,000; lead, £2,000,000; zinc, £2,000,000; tin, £650,000; and many rare ores, also a large tonnage of coal.

Regarding the effect of the war on the metal output, it may be said that the mints at Perth, Melbourne, and Sydney can easily handle the output of precious metals, of both Australia and New Zealand. Copper is exported to England and Europe, and a good deal is returned in the shape of manufactured goods, as is also true of other metals. A larger tonnage of lead is sold in China and Japan than most people think. Zinc ore and concentrate is mostly sent to Belgium and Germany. It amounts to over 500,000 tons per year, and contains up to 45 per cent metal. The export of spelter to other than England is prohibited now. Tin eventually goes to England and the United States. As for rare ores, the destination of which is generally Europe, there is no market.

It would seem that after the metal companies accumulate considerable stocks, paying operating charges meanwhile, they will begin to feel embarrassed, unless exports can be made regularly to the allied countries now fighting. There is little use in sending copper and lead to the United States, as these metals are produced far in excess of consumption here already. Fortunately Australia has one large pig-iron plant working, and another under construction. No quicksilver is produced, and as its exportation from England is prohibited, the gold mines will be short. Zinc dust is not used, and the rolling of sheet zinc is still an infant industry. Cyanide is imported from Glasgow, but the Scotch people have stated that they can take care of Africa and Australia. The wool shearing season is now on, and Germany takes 20 per cent of the clip in normal times. The finances of the country are sound, though stock exchanges are closed as elsewhere. There is considerable patriotic feeling over the war, and as a result of its record and its defence scheme, which made Australia prepared for the war, the Labor party defeated the Liberals by large majorities in the election for the House and Senate of the federal parliament on September 5. The Labor party, let it be noted, is a much more responsible party than in the United States and comes into office with experience as well as authority.

As War Looks in London*

By T. A. RICKARD

Speaking of naturalization, I learn that the ordinary naturalization of a German or Austrian in England is in effect only a sort of declaration of intention, for he does not cease to be a subject of the Kaiser or the Emperor unless he obtains a formal release of allegiance, which is reluctantly accorded. If of an age proper for military service, he would be treated as a deserter, for his failure to respond to the call to arms, whenever he returned to the country of his nativity. On the English passport given to a German who has been 'naturalized' here in the ordinary (and incomplete) way, it is stated that the passport is granted "with the qualification, that he shall not, when within the limits of the foreign state of which he was a subject previously to his obtaining his certificate of naturalization, be deemed to be a British subject unless he has ceased to be a subject of that state in pursuance thereof or in pursuance of a treaty to that effect." If one of your people takes out his papers of naturalization, your government relinquishes him, and you metaphorically spit at him, don't you? This question comes round to the old one: Can a leopard change his spots? Only by going from one spot to the other, or, to speak seriously, by imbibing the ideas of his new country. The ability to speak the language is, to my mind, the best proof of assimilation. But it is not a complete proof, for a good linguist may learn quickly and still retain the 'spots,' while a man who speaks with a strong guttural accent may be perfectly loyal to the country of his adoption.

That reminds me. The Krupp machinery firm gave an Ullrich separator to the Bessemer Memorial laboratory at the Royal School of Mines. The same firm made a contract with the Dunderland Iron Ore Co., a British company operating in Norway, to deliver a number of these machines—and obtained a payment in advance. A couple of days ago Charles McDermid, the secretary of the Institution of Mining and Metallurgy, received a telephone call asking that the separator at South Kensington might be loaned to Krupp's agent in London, in order to copy it or make drawings suitable for such a purpose. He referred his caller to the authorities at South Kensington. The Rector of the Imperial College and Royal School of Mines, Sir Alfred Keogh, is at the front, being a Medical Corps reservist. It is not likely that the request will be granted, but unpleasant remarks have been made. The Krupp machinery works at Magdeburg are separate from the Krupp armament establishment at Essen, but both belong to the same great firm, and the armament firms have been largely instrumental in exciting military aggression. My point is this: the Krupp machinery (not armament) agent in London is W. Stamm. He is an Englishman by naturalization; more than this, his son fought and died for the Union Jack in South Africa. That is good enough for me; the man that gives his son's life or his own for the country of his adoption is naturalized indeed.

London, August 28.

"Business as usual pending alterations to the map of Europe." That is the motto of all who still have something to do. We are sending a circular to all the advertisers in *The Mining Magazine*, urging them that this is their chance to win new business and to get even with the German firms whose undercutting has been the feature of recent competition. I hear of seven or eight big machinery orders that were placed in Germany and are now canceled by the war, and of a general campaign to take the business lost to the enemy by the stifling of his commerce. That silent victory has been won by our fleet. During the last few days our papers have been full of data concerning various industries directly affected by the war. Among the matters under discussion is the manufacture of cyanide and the smelting of zinc. You will be glad to learn that arrangements have been made in England for all the cyanide required in the Transvaal, and that the greatest goldfield is assured also of all the other supplies needed to continue regular operations.

London, August 29.

In an earlier letter I mentioned that an Englishman, John Cockerill, founded an important steel industry at Liége. I note that it is now reported that the Prussians have taken hold of the gun factory at Cockerill, at Seraing, close to Liége, and are using it for the manufacture of war material. The Belgian artisans have been offered a 50% increase in wages and work under the threat of being shot for any bungling, such as patriotism might reasonably suggest.

London, September 9.

*In this series of war letters, the *Press* will print extracts from Mr. Rickard's personal letters from London, believing that an account of the war as seen by a mining man in that great centre will be of interest to mining men everywhere. Mr. Rickard is an Englishman who was born in Italy, passed his early boyhood in Russia, managed mines in France and Australia, and lived in the United States more than twenty years. His sympathies are naturally with the Allies, but he will endeavor to be as impartial as he may. We add this week an extract from a friend in Russia, and we hope later to pass on to our readers comment from friends in other countries concerned in the fighting.

HOW IT AFFECTS A SIBERIAN MINE

C. W. Purington writes us from Nadezhdinsky, in the Bodaibo region of Siberia, where he is looking after the interests of the Lena Goldfields: "Just now the question is, will we ever get back. They drew off 1800 men here yesterday (August 2) out of 8000 for the Army mobilization, and although we do not have the pleasure of getting the veracious news disseminated by the *Chronicle* and other papers, it seems there must be something doing. The war is some distance from here, but it may last some time, and cause a low period in Russian mining activities."

Tin Mining in the Federated Malay States

By E. J. VALLENTINE

With a steady annual output of from 40,000 to 50,000 tons of the most valuable of the base metals, the Federated Malay States maintains its place at the head of the tin-producing countries of the world. However, it is only within the past few years that the general public has begun to realize the wealth of this far-off British protectorate. It is curious to reflect that the rubber boom of 1910 did far more to advertise the country than the production, year after year, of half the world's tin.

The reason for this is not far to seek. Most of the cassiterite is won from extensive alluvial deposits lying at comparatively shallow depths from the surface, which can be exploited without much capital outlay. These ideal conditions for the poor man gradually attracted a large number of Chinese miners, and they were well established in the country before the advent of British protection over 30 years ago. Under a beneficent government the industry has since grown and flourished, but it has remained almost entirely in Chinese hands, and it is only of late years that European and Australian mining capital has been largely introduced.

The output for 1913 was 50,127 tons of metallic tin, of which the Chinese produced over 42,000 tons or 85%, leaving 15%, or under 8000 tons, to the credit of the European or Australian owned mines. The following table gives the F. M. S. outputs for the past 14 years:

Year.	Tons, metal.	Year.	Tons, metal.
1900	42,444	1907	48,431
1901	46,145	1908	50,837
1902	46,480	1909	48,743
1903	49,978	1910	43,863
1904	50,960	1911	44,149
1905	50,992	1912	48,421
1906	48,618	1913	50,127

In the early days, transport and other difficulties combined to restrict mining to the high-grade parts of the known deposits; but as time went on these difficulties gradually lessened, operating costs came down, the price of the metal rose, and so more and more ground became available for profitable exploitation. Alarmist rumors have been current of late that the principal deposits are rapidly becoming worked out, and this is certainly true of the high-grade portions of the known fields, while it is also the case that the chance of discovering a new alluvial field of any considerable extent is very remote. Many lodes may still be found, but lode mining will never produce on a scale sufficient to offset a serious decline in alluvial mining. Deep leads of tin-bearing gravel occur in several localities under 'false bottoms' of what seemed to the earlier miners to be 'kong' or 'bedrock,' and they are now being discovered from time to time by drilling, but they do not seem to be sufficiently numerous or extensive to make much difference to the total output.

The 'Gondwana' beds of the Kinta valley said by the government geologists to be of glacial origin,* are of considerable economic importance, and should yield large returns for many years. However, there is apparently little doubt that the tin-mining future of the F. M. S. chiefly depends on the extensive areas of alluvium carrying one pound or less of cassiterite per cubic yard, which are so situated that they can only be worked on a large scale, with a suitable choice of modern methods, and which, as yet, have received comparatively little attention. Owing to the heavy initial expenditure necessary for the development of these areas, one may assume that their exploitation will rest more in European than in Chinese hands.

Introducing Machinery

The Chinese are gradually becoming more willing to employ machinery, or water under pressure due to natural head, in cases where the advantages are very obvious, but they are conservative to the core and very distrustful of any innovation. Unfortunately, the record of European mining in the F. M. S. is not a list of unbroken successes. Several elaborate plants, hurriedly selected and erected in the full conviction that they would eclipse Chinese methods, have been shut down after a few months' run, and these failures have done much to foster the Asiatic distrust of our modern mining appliances. However, small steam boilers with pulsometer pumps or portable engines driving centrifugal pumps are in common use in Chinese mines, while, within the past year or two, small gravel pumps of the Kershaw type have come into favor, the 8-in. being the usual size. Steam winches are used for hauling cars out of many of the larger open-cast mines, and power-driven puddlers are often employed where the tin ore is found in stiff clay.

The European and Australian owned mines show many different methods of working. Several companies are operating lodes on fairly conventional lines, at costs ranging from 7s. to over 23s. per ton milled. A few large open-cast mines are operating alluvial beds much after the style affected by the Chinese, their working costs running from about 1s.3d. per cubic yard upward. The heavy rainfall makes pumping a considerable item of expenditure and more especially at limestone and granite contacts where a mine forms a sump for a large drainage area.

A number of hydraulic mines are operating ground with a general slope sufficient to carry off the tailing cut from the bank by the monitors. Some of them claim to work at under 2d. per cubic yard and to win their black

*Quart. Jour. Geol. Surv., Vol. LXVIII, p. 140, 'The Goperg Beds of Kinta,' by J. B. Scrivenor.

tin for £20 per ton. Where the tailing has to be raised, other hydraulic concerns are using monitors in conjunction with elevators. Although the mechanical efficiency of these hydraulic elevators is very low, they prove most economical where a good supply of water under natural pressure is obtainable, the operating cost in some instances being under 4d. per cubic yard. They have so widened the scope of hydraulic mining that practically all the available streams within reasonable distance have been, or are being, harnessed.

Where the supply of water under natural pressure is limited and the tailing has to be elevated, a monitor may be operated in conjunction with a power-driven gravel pump. The operating cost, which depends largely on the height the gravel has to be lifted, may be in the neighborhood of 5d. per cubic yard. This brings us to what is often called a suction plant, where power is used both to pump water through a monitor and to operate a gravel pump. Assemble this plant on a pontoon, and we have the suction dredge, which has been boomed as the ideal equipment for working alluvium resting on bedrock of limestone. A hard crystalline limestone underlies large areas of the tinfields and gives a most irregular bottom, high pinnacles alternating with deep pockets. However, none of the mines operating these dredges have as yet proved very successful. It is claimed that under favorable conditions the working cost is about 6d. per cubic yard, but the more usual cost in the F. M. S. would seem to be nearer double that figure. One company is operating at a profit in a limestone bottom with a large bucket dredge which is provided with a gravel pump for cleaning out the pockets; but owing to the depth of water in the pond it is difficult to say whether the pump does its work thoroughly.

The Opportunity for Bucket Dredges

It is only recently that the possibilities of bucket dredging in the F. M. S. have received serious attention. A great future for this method of mining, which should show to best advantage in the large areas of swamp land known to contain tin, but hitherto classed as unprofitable, may be predicted. In a deposit of a free gravelly nature, resting on a level soft bottom, an operating cost (including administration, head office, and general expense) of 4½d. per cubic yard may be quoted. For several large bucket dredges now being built for service in the F. M. S., an engineer with considerable local and Australian experience estimates the operating cost under 5d. per cubic yard. The cost of a dredge, afloat in the pond and ready to work, is given as £20,000, the duty as over 80,000 cu. yd. per month, and the life of the plant as 20 to 25 years.

With regard to the operating costs quoted in this article, one must state that they do not include the tin duty, which is deducted direct from the selling price of the output. Most of the tin ore won in the F. M. S. is sold locally to representatives of one or other of the smelting companies, who deduct the duty when buying, and pay it to the Customs when they export the ore to their smelting works at the coast. It is calculated on a sliding scale based on the ruling price in local currency and there is a fairly heavy tax, as the following table will serve to show:

Price per ton metal.	Duty per ton metal.			Duty per ton ore.*			Ratio of duty to value.
£	£	s.	d.	£	s.	d.	Per cent.
140	16	13	2½	11	13	3	11.90
150	18	5	10½	12	16	1¼	12.20
160	19	18	6½	13	18	11¾	12.46
170	21	11	2½	15	1	10	12.68
180	23	3	10½	16	4	8½	12.89
190	24	16	6½	17	7	7	13.07
200	26	15	8¾	18	15	0¼	13.39
210	28	8	4¾	19	17	10½	13.53
220	30	1	0¾	21	0	9	13.66
230	31	13	8¾	22	3	7¼	13.78

*Assessed for duty as containing 70% metallic tin.

The duty collected on the output for 1913 was £1,238,326. In the case of a mine recovering one pound of cassiterite per cubic yard, with tin at £180 per ton, it amounts to 1¾d. per cubic yard.

Prices and Production

As regards the future scale of production from the F. M. S., it is hardly necessary to say that it depends more on the price of tin than on any other factor. The high prices which have ruled for the past three years have encouraged miners to work low-grade ground and re-wash old dumps, the result being these increased annual outputs which would seem to give the lie to any suspicion of rapid exhaustion of the fields. But what would happen if the price were to fall to £140 per ton?

It is not so long ago that £140 was considered a good price, and, in 1908 or 1909, no one would have dreamed of opening up a mine that did not promise to produce at a profit on that basis; but many of the mines now in operation require to market their tin at £160 or £170 in order to pay their way. The principal Chinese mine owners (and one must not forget that 85% of the total output is won by Chinese) are agreed that should the price drop to £140 per ton and remain at that level for several months, the result would be the biggest slump ever known in local mining. As far as can be gathered, there is no reason to fear that the price will come down so low, but it is instructive to learn the margin on which much of the Chinese mining is being conducted. The F. M. S. produces nearly half the world's tin, and it would therefore seem reasonable to suppose that, if over production should ever cause a glut of tin in the market and a serious fall in price, the decline in output from the Chinese mines alone should soon reduce the world's stock sufficiently to bring the price back to, say, £160 per ton.

In the Federated Malay States is an attractive field for the mining investor, and, should the numerous dredging and other recently floated companies have anything like the success they anticipate, a substantial influx of European and Australian capital can be expected. It is to be regretted that the enormous profits won from the tinfields of a British protectorate have been going mostly into Chinese pockets for so many years.

GENERAL VIEW OF NASSAU PLANT, CONCRETE STORAGE BINS IN FOREGROUND.

The Nassau Zinc Works at Depue, Illinois

By E. H. LESLIE

Northern Illinois has long been identified with the zinc smelting industry, and by reason of its central situation with relation to mines, market, and fuel, bids fair to be a district productive of spelter for many years to come. The Illinois coalfields have for many years been identified with the zinc industry and in that it has been the history of the industry that zinc concentrate has been shipped to the fuel rather than the fuel being shipped to the concentrate, the coalfields of Illinois will continue to be the centre of spelter production as long as coal is mined and zinc concentrate produced in the Middle West. The Nassau plant at Depue is the most modern of that series of northern Illinois zinc smelters which include the classic Matthiessen & Hegeler plant at La Salle, which was the scene of so many developments and improvements in the metallurgy of zinc, and the Illinois Zinc Co.'s smelter at Peru. The Matthiessen & Hegeler Zinc Co. is operating 5256 retorts, with a new block under construction, and the Illinois Zinc Co. has 4640 retorts. Both of these plants employ the chamber process of sulphuric acid manufacture and the smelting equipment is supplemented in both cases with sheet-zinc mills, in which a large part of the spelter output is rolled into various forms for different industrial purposes.

The Nassau works, at Depue, Illinois, is the most modern of this group and the largest American zinc smelter. The contact process of sulphuric acid manufacture is a distinctive feature of the works, and the general practice is representative of the most modern work in the smelting of zinc concentrates. The mechanical efficiency of the plant has been carefully studied, with the result that the handling of supplies and products and the movement of concentrate through the plant has been made as nearly automatic as modern equipment permits.

The smelter site is a level tract of land covering approximately 80 acres which is adjacent to the main right-of-way of the Rock Island railway, 110 miles west

RELATIONS OF ZINC SMELTERS IN THE NORTHERN ILLINOIS COALFIELD TO WISCONSIN ZINC MINES AND TO TRANSPORTATION. DEPUE IS IN THE LA SALLE DISTRICT.

DRYING AND CRUSHING DEPARTMENT; CONCRETE STORAGE BINS AT THE LEFT; 'HIGH LINE' RAILWAY BETWEEN BUILDINGS.

of Chicago and about 150 miles from Platteville and the Wisconsin zinc district. Its advantage in position with relation to ores, fuel, and market is readily recognized and where freight rates on raw materials is an important item the influence of position on economic smelter practice is a most important item. The lay-out of the smelter site, position of buildings, and tramways has resulted in a plant of excellent distances for the economic conduct of smelting operations. The accompanying illustrations present an idea as to the character of the smelter construction. The structural steel, concrete, brick, and corrugated iron structural materials are evidence of a construction which is not dependent upon an uncertain fuel supply, but has that stamp of permanency which marks the new producer-gas smelters.

Construction work on the Nassau plant was begun in the autumn of 1904, the original plant consisting of the three distillation furnaces in the concrete furnace building and two roasting furnaces, with the accompanying acid plant, and the pottery, mix house, crusher, power plant, office, and laboratory. This plant was put into operation in the summer of 1906 and subsequently the capacity was gradually increased until in 1910 it was double that of the original plant. About two years ago construction was started on a large addition which again doubled the capacity of the plant and brought it up to its present size.

The concentrates from the Wisconsin mines which form a large part of the material treated, together with concentrates from Missouri, Colorado, and other western states, are brought over a turn-out from the main line to the smelter and delivered at the drying and crushing plant. The sulphide and carbonate ores as received at the plant are handled separately, each being stored in a separate unit of the drying and storage department. The sulphides after being received are unloaded by a mechanical unloader, elevated and fed through a rotary dryer. Here the moisture is reduced to 0.3% and the dried product is passed through a pair of rolls and thence to a ¼-in. trommel, the oversize being passed through a second set of rolls and returned to the screen. The undersize as discharged from the screen falls upon a belt-conveyor and is elevated to the circular concrete storage bins. There are 10 of these bins, which have a large capacity, with additional steel hopper bins of about one-half the concrete bins capacity.

The carbonate ore as received at the smelter is unloaded by a mechanical unloader and crushed to ¼ inch in a Farrell jaw crusher and elevated to a feed-bin over a rotary, which has a capacity of 150 tons per 10 hours. After being dried, during which the moisture in the concentrate is reduced to below one per cent, the dried concentrate is recrushed in a pair of 36 by 16-in. rolls and elevated to a ¼-in. trommel screen, the oversize from which is returned to a pair of 27 by 14-in. rolls and subsequently returned to the trommel. The undersize from the trommel is conducted by a system of three conveyor-belts to the circular concrete storage bins, previously mentioned, and elevated in bucket-elevators to the bins. The drying and crushing department of the plant is not in continuous operation, being only used as occasion demands. The entire drying and crushing department is driven by one motor of 75 horse-power.

The dried concentrate is drawn from the bottom of the circular concrete storage bins, previously mentioned, and removed by a belt conveyor to the hoppers which

GAS PRODUCER PLANT FOR DISTILLATION FURNACES.

DISTILLATION FURNACES, SHOWING FRAME FOR RETORTS.

load the industrial cars for delivery to the roasting furnaces. As filled, the cars are distributed over elevated tracks, locally known as the 'high-line.' A gasoline locomotive is used on the 'high-line' railway for pulling cars to the different roasting houses, where they are automatically dumped into the feed hoppers of the roasting furnaces.

The roasting of the sulphide ores at this smelter, as at others where the furnace gases are utilized in the manufacture of sulphuric acid, is conducted in modified Matthiessen & Hegeler roasting furnaces. There are seven of these furnaces in operation at the Nassau works, four of which are arranged in one series and three in the other. The furnaces are separately housed in buildings of structural steel and corrugated iron.

The Hegeler roasting furnaces have seven super-imposed muffled hearths, which are 6 ft. wide and 80 ft. long, and of the same general type discussed in previous articles. The fuel, which is producer gas, is admitted under the lower three hearths. Heavy 'I' beam buck stays are used for bracing. The producer gas fuel for six of the furnaces is generated at one central producer plant which is equipped with 12 hand-poked producers and the gas generated is conducted through separate concrete underground conduits to the different roasting furnaces. Samples of the gas are taken every hour and analyzed for CO and CO_2. The southern Illinois coal which is used in the producers is delivered at the plant in standard hopper-bottom gondola cars and unloaded by gravity into bins on a level with the working.

The ore enters at opposite ends of the top hearths of the roasting furnaces and is drawn through the furnaces

DISTILLATION FURNACES WITH DRAW-CAR IN PLACE.

by means of the characteristic Hegeler rabbling mechanism, which has been described in a previous article. The concentrate, as charged into the roasting furnaces, contains 34% sulphur. Its passage through the furnace requires 60 hours, during which time the sulphur content is reduced to about one-half of one per cent. The temperature of the hearths varies from 1000°C. in the lower hearths to 850°C. in the upper. The furnaces have chisel platforms on either side which are fitted with a motor for elevating and lowering them, but are moved over tracks at the sides of the furnaces by hand. The 'chiseling' of the different hearths, or the removal of agglomerated ore, is done about every three weeks by men standing upon the platform and working through the ports at the sides of the different hearths. The furnaces have been in operation for several years and are still in a good state of preservation, the hearths having in but few instances shown signs of weakening. The furnaces are rabbled and drawn every hour. The roasted ore as discharged from the furnace falls over 1-inch grizzlys by which means any agglomerated lumps are removed. The roasted product is then elevated by a chain and bucket-elevator to hoppers on the level of the 'high-line' railway. It is then discharged into industrial cars and removed to the steel storage bins at the mix-house. These bins are 'W' bottomed and have a storage capacity of 9000 tons.

The anthracite coal for use in the retorts is elevated from the cars by means of a Peck carrier to a screen placed above the bins. The fine is discharged into the bins, which are of the catenary design, and the coarse is crushed and returned. The coal from these bins, which have a capacity of 250 tons, is drawn into industrial cars and removed to the mixing house. The cars of roasted sulphide, carbonate, and coal as they enter the mixing house pass over scales where they are weighed and the ore dumped into a Ransom concrete mixer. As the material is discharged from the mixer it falls into the boot of a bucket-elevator and is elevated to hoppers which discharge into the furnace charge cars, which have a capacity of 15,000 lb. each.

Distillation Furnaces

The retort or distillation furnaces are housed in four buildings, three of which are corrugated iron and one of reinforced concrete. The concrete building was the first to be built and this type of construction has since been abandoned. There are three blocks of furnaces, arranged in series in each of the four furnace buildings, making 12 blocks of furnaces in all. Each block of furnaces contains 750 retorts, giving the smelter a capacity of 9000 retorts. At present there are but 7500 retorts in operation. The furnace buildings are of the elevated floor type, the working floor being 22 ft. above the ground-level. This type of structure has come to be standard construction and adopted by all the modern smelters. In this furnace, which is of the Neureuther regenerative type, the gas and air are discharged through ports at three different levels in the centre wall. In this type of furnace, owing to the position of the ports, it has been necessary to construct a thicker centre wall than in the old Siemens furnace. The Neureuther type of regenerative furnace has come to be generally adopted in the more modern zinc smelters, the advantages claimed for it by the inventor being that by introducing the gas and air at different elevations in the centre wall a more uniform heating effect is obtained, an additional row of retorts may be installed, and a corresponding increase in capacity is possible. The air and gas enter through the checker-work under the floor of the combustion chamber and pass through the ports into the combustion chamber on one side of the centre wall, over the centre wall and out through the corresponding ports on the opposite side of the centre wall, thence through the checker-work on that side and on to the stack. The flow of air and gas is reversed regularly about every 20 minutes, causing the hot gases to heat the checker-work on the opposite side. The checker-work thus acting as a pre-heater of the gases conserves to a certain extent the heat losses and thereby increases the thermal efficiency of the furnace. While the principle of regenerative furnaces like the Hegeler muffle furnace is the same in every instance, the details of construction vary and each smelter superintendent and furnace man has original ideas as to what should be the proper construction.

Retorts Charged by Hand

The retorts are charged by hand, the charge mixture being brought to the furnace floor in the 15,000-lb. charge cars, from which it is shoveled into the retorts. The temperature of the distillation furnace is gradually raised from about 800°C. at the beginning to 1400° C. at the end of the shift. The draw-car used for drawing the retorts is hand propelled and the ladle operated by a hand winch. The retorts are drawn three times during the course of 24 hours, and scraped out with scrapers after the last draw. Water and steam are not used for the discharging of retorts. The plant treats about 200 tons of roasted ore per day.

The residue removed from the retorts falls into chutes, in the floor and immediately in front of the furnace, which connect with hoppers underneath and empty into large industrial cars of 6½ tons capacity. Two cars are used on each block, and the residue is removed by these cars to the dump. As the residue from the ores treated here is of no value, no effort is made to conserve it. Possibly at some time in the future a method will be devolved whereby the high carbon content of retort residue may be profitably reclaimed for its fuel value, but for the present most of the residue is dumped or used for railroad ballast.

There are two large batteries of gas producers for supplying fuel to the distillation furnaces. These batteries, of which one is made up of 14 mechanical producers and the other of 24 hand-poked producers, are placed between the furnace buildings. By this arrangement it is possible to have one battery of producers for

each two furnace buildings with their 6 blocks of furnaces.

The fuel used in the producers is southern Illinois coal, which is delivered at the plant in standard gondola cars and dumped into concrete bins situated under the tracks. From these bins the coal is elevated by means of a bucket-elevator, into a steel catenary bin, which is supported on structural steel columns from which the coal is subsequently drawn into an electric larry car and delivered to the bins of the producers. There is also stored a large quantity of coal on the storage piles. Locomotive cranes are used in handling this coal. The Brown hoist system of grab-buckets is used for unloading cars direct. The buckets travel suspended from a rail to the producer bins, where they are discharged. A 25-hp. motor is used for the operation of this crane.

Pottery

The clay or adobe used for pottery purposes is ground to ¼ inch in a gyratory crusher, from which it is removed to dry pans, a form of Chilean mill, where it is further reduced. As discharged from the dry pans, the crushed material is elevated to a wire cloth trommel, the undersize from which is discharged into the storage bins, while the oversize is returned and given a regrinding in the dry pan.

The clay or adobe used for pottery purposes is bins and given a weathering out of doors for six months at least, after which it is brought into the pottery and given a preliminary pugging in a Mehler pugging machine. It is then cut into a convenient size for handling as it comes from the pug-mill and again weathered for 15 days. The material is then removed from the stock piles and given a second pugging and elevated to the retort press floor. Here the material is placed in a Schlag machine and compressed into balls for the retort presses. The power for these machines is supplied by three individual 35-hp. motors.

The retorts are molded in Mehler hydraulic presses, there being two of these machines in the pottery department, one being held in reserve and to meet any increase in demand for retorts. The plant has a capacity of about 325 retorts per day at the present time. These retorts are 8½ in. inside diameter and from 48 to 56 in. long, according to their position in the furnace. As removed from the press, where they are molded under a pressure of 1000 lb. per square inch, the retorts are removed on trucks to the dry-rooms and stored for 60 days. The dry-rooms are arranged on 4 floors of the pottery building, there being 10 rooms on each floor with a storage capacity of 25,000 retorts. The rooms have both floors and ceilings of hollow tile and are kept at a temperature of about 60°C. by the exhaust steam from the power plant. The upper and lower floors are the finishing floors and the retorts are given their final drying here. A Vanetta machine is used for the manufacture of condensers. A 15-hp. motor is used to drive the condenser and ball machines. The material used for the manufacture of condensers consists of a mixture of one-half clay and the other a combination of ground retorts, old brick, and adobes. The condensers not being subjected to the intense heat of the furnace, do not require as good a grade of material or as much care in manufacture as the retorts. As removed from the augur machine they are allowed to stand for a day on the floor, then crimped and removed to the dry rooms, where they are stored for 15 days and subsequently removed to the tempering kilns for use in the furnaces. In removing the products of the pottery to the furnaces they are loaded on flat cars and drawn by a donkey engine over a track on the same level as furnace floors. The life of the retorts is about 35 days and the condensers 15 days.

GENERAL VIEW OF NASSAU PLANT; ACID STORAGE TANKS IN THE FOREGROUND.

Power Plant

The boiler plant consists of 8 boilers, 6 of which are of return tubular and 2 of water tube type. All the boilers are fitted with Green mechanical stokers. The principal power units consist of two Allis-Chalmers compound steam-engines direct connected to two 500-kw. Bullock generators. A third unit consists of a Nordberg compound engine driving a 500-kw. Westinghouse generator. The other engine-room equipment consists of condenser pumps, 3 service pumps, 2 high-pressure pumps for the retort presses, Ingersoll-Rand Imperial type air-compressor, and a Pawling and Harnischfeger

overhead electric crane. A Westinghouse panel switchboard with the regular meter and switch equipment is included.

The machine-shop, which is in the same building with the boiler and engine rooms, is fully equipped for performing all of the ordinary work in the operation of the smelter. All machinery is individual motor driven and includes 3 lathes, a planer, shaper, 2 drill-presses, 3 threading machines, Thermit welding outfit, and accessory equipment. The overhead electric crane is used for work in both the engine and machine shops. The blacksmith equipment includes 7 forges with accessories. The main smelter water-supply is obtained from the Illinois river, about one-half mile distant, by means of a 3500-gal. per minute centrifugal pump direct connected to a 150-hp. motor. The drinking water-supply is obtained from artesian wells.

The Acid Plant

The catalytic sulphuric acid plant for the utilization of roasting furnace gases at the Nassau smelter is unique and one of the features of the practice. It is to be regretted, however, that owing to the present status of the United States patent laws, that in many instances are more productive of litigation than protection, it is not possible to publish details regarding the operation of this process. I may say that the Grillo-Schroeder contact process is used. In this process the roaster gas, consisting of the sulphur dioxide resulting from the combustion of the sulphur from the ore, with the nitrogen and residual oxygen from the air, is carefully purified by the removal of both physical and chemical impurities. This is necessary to prevent deterioration of the contact mass. The purified gas is heated and passed through the converters, in which it comes in contact with the contact mass consisting of finely divided platinum distributed through a mass of granular, anhydrous magnesium sulphate. The catalytic action of the platinum causes the sulphur dioxide to combine with an additional atom of oxygen forming sulphur trioxide, or sulphuric anhydride. This is then absorbed in 98% sulphuric acid, the free water in the acid combining with the sulphur trioxide and forming sulphuric acid.

The principle of catalytic sulphuric acid manufacture is an old one, and is based upon the combination of sulphurous anhydride with oxygen in the formation of sulphuric anhydride which is easily absorbed in water, forming sulphuric acid. Finely divided platinum in the form of platinized magnesium sulphate has that faculty of condensing oxygen and facilitating the union of SO_2 with O into SO_3. By catalysis a decomposition and new combination is effected by reason of the presence of the platinum which does not enter into the reaction itself. It is believed by some that platinum does take part in the reaction, but is restored constantly to its original condition and as such in the cycle of operations no loss takes place. The temperature of the sulphurous anhydride at which it impinges upon the catalytic agent is important, as a complete oxidation with its corresponding high extraction is only possible within certain limits, about 375 to 425°C., at which temperatures a conversion of from 98 to 99° of the sulphurous to sulphuric anhydride is possible. Above this, decomposition takes place and the conversion is greatly decreased.

This process originated in Germany and has been developed in this country into a very efficient and satisfactory process. It has one great advantage over the older or chamber process, which is that it will, in one operation or by simple dilution with water, yield any grade of acid desired.

A great deal of attention is paid at this plant to accurate and scientific control of all operations. All ores, coal, and other raw materials are sampled by the most approved methods, and analyzed in a well equipped laboratory. In addition to the main laboratory, there are small departmental laboratories in connection with the spelter furnaces, roasting kilns, and acid plant in which intermediate and final products are analyzed as checks on the operation of the plant. The handling of materials, which is one of the principal features in operation of an efficient zinc smelter, has been given particular attention, with the result that the movement of supplies and products has been made as nearly automatic as modern equipment permits. For the comfort of the men the Company has supplied sanitary wash-rooms with lockers, mess-rooms, artesian wells, and other conveniences. The plant belongs to the more modern group of zinc smelters, and no little credit is due to the management for its most successful practice at America's largest zinc smelter.

In concluding the present series of articles on American zinc smelters, there is one suggestion which I would venture, and that is a closer coöperation of the zinc metallurgists.

There is no great secret about zinc smelting, and no one smelter, group of metallurgists, or any individual has a monopoly of all that is good practice in the industry, so why this unwillingness to give one's neighbor the benefit of one's experience and coöperate in every way possible for the good of the common cause? There are reasons, no doubt, for secrecy, but there are greater reasons for coöperation and publicity. It is a pleasure to note that among the most progressive and modern of the present-day operators this feeling of aversion to helping one's neighbor is disappearing and friendly relationships are being established. I would take occasion here to express my thanks to those whose assistance has made possible this series, and, while it is impossible to mention all, I recall with especial pleasure courtesies extended by Messrs. Archibald Jones, W. H. Gill, E. G. Godshalk, H. A. Grine, J. N. Houser, Elias S. Gatch, J. D. Martin, W. F. Rossman, F. H. Ives, Joe Brennemann, M. F. Chase, and W. M. Kelsey, who, in addition to being conspicuously identified with modern zinc metallurgy, are representative of the growing sentiment for coöperation and progress.

Sulpho-Cyanides in Cyanidation

By HARAI R. LAYNG

The action of these compounds in cyanide work, judging from the little discussion they have received in the technical papers, has been but slightly understood by those engaged in ore treatment. The importance of this action was not realized by myself until about three years ago, when in attempting to work out a regeneration process, now nearly perfected, I was obliged through encountering many obstacles to realize that sulpho-cyanides were of more importance than text-books and other publications had led me to believe.

Sulpho-cyanides are to be found in all cyanide solutions which have been in contact with ores containing sulphur, or compounds of that element. Cyanide has but little effect on sulphur in the cold, but when sulphur is treated with warm cyanide solutions of appreciable strength, a reaction occurs between the two which results in the formation of a sulpho-cyanide according to the following equation:

$$KCN + S = KCNS$$

Sulpho-cyanides are rarely formed during cyanidation by means of the direct action of cyanide on free sulphur, but they are readily formed through the action of cyanide on thiosulphates resulting from the action of caustic alkalis on sulphur, as is shown by the following:

$$6NaOH + 4S = Na_2S_2O_3 + Na_2S + H_2O$$
$$Na_2S_2O_3 + KCN = Na_2SO_3 + KCNS$$

Sulpho-cyanides are also formed through the action of cyanide on electro-negative or soluble sulphur, which results from the decomposition of sulphur compounds like Na_2S.

Alkaline sulphides do not react directly with cyanide to form sulphur-cyanide. They must first be broken down to soluble sulphur before their sulphur contents will react with cyanide to form sulpho-cyanides, and as solutions usually contain zinc, and possibly traces of lead, it is doubtful whether they would have a chance to break down into soluble sulphur, and then combine with the cyanide to form sulpho-cyanides, before they would combine with the metals to form insoluble sulphides. Therefore, they do not cause the formation of sulpho-cyanides in cyanide solutions to any considerable extent.

Lead acetate does not prevent the formation of sulpho-cyanides to any greater degree than that due to its combining with alkaline sulphides, before the alkaline sulphides have had a chance to break down to soluble sulphur. A number of tests which I made on Goldfield Consolidated ore show that the amount of sulpho-cyanide formed when lead acetate was added at the rate of 0.25 lb. per ton of ore, was only 2/100 lb. greater than that which was formed when one pound of acetate per ton of ore was used in otherwise parallel tests.

Lead acetate does not precipitate sulpho-cyanide from solutions which have sufficient protective alkalinity, but it precipitates the sulpho-cyanide as lead sulpho-cyanide, $Pb(CNS)_2$, from solutions which have no protective alkalinity. The following test shows the action of lead acetate on sulpho-cyanides:

Test No. 1.	KCN, lb.	Pro alk., CaO, lb	KCNS, lb
A—Solution before adding acetate	2.38	0.41	0.984
B—Solution after adding 1½ lb. acetate per ton	2.26	0.30	0.984
Test No. 2.			
C—Solution before adding acetate	1.00	0.05	0.699
D—Solution after adding 1½ lb. acetate per ton	0.64	none	0.616

Sulpho-cyanides of the alkalies, when treated with acids, form hydro-sulpho-cyanic acid, according to the following equation:

$$2KCNS + H_2SO_4 = 2HCNS + K_2SO_4$$

Sulpho-cyanic acid is non-volatile in the cold, in which one respect it differs from hydrocyanic acid. It has a greater affinity for metals like silver and copper than has hydrocyanic acid. This is proved by the fact that it will replace the cyanogen contained in silver cyanide according to the following equation, which is based on the results of actual experiment:

$$AgCN + HCNS = AgCNS + HCN$$

Its affinity for silver is even greater than that of chlorine, as I have proved by tests that silver sulpho-cyanide will precipitate in preference to silver chloride from a dilute mixture of sulpho-cyanic acid and hydrochloric acid, when silver nitrate is added to such a mixture. Its affinity for gold is great, as is proved by the fact that gold is not completely precipitated from acidified solutions containing HCNS by means of reducing agents, other than those which result in the formation of nascent hydrogen even when after all of the HCN has been removed from the solution, until all of the HCNS has been precipitated from the solution.

Oxygen in the molecular form has no appreciable oxidizing effect on sulpho-cyanides, whether they exist in acid or alkaline solutions. Ozone in a dilute form, and nascent oxygen, will oxidize sulpho-cyanides to a corresponding cyanide, according to the following equation:

$$HCNS + O_3 + H_2O = HCN + H_2SO_4$$

Powerful oxidizers such as strong nitric acid, hydrogen peroxide, undiluted ozone, and others, have a tendency completely to convert the cyanogen contained in the sulpho-cyanide to ammonia. Electrolysis converts sulpho-cyanides to a yellow compound. Strong, or moderately strong acids, such as sulphuric even in a dilute state, will convert sulpho-cyanides to ammonia compounds and carbon oxysulphide, as is shown by the following equation:

$$KCNS + 2H_2SO_4 + H_2O = KHSO_4 + NH_4 + HSO_4 + COS$$

Sulpho-cyanides have but little or no solvent action

on metals like silver and copper, according to tests which I have made; but when an ore is treated with a sulpho-cyanide solution in the presence of lime, by means of air agitation, some silver extraction will be observed. Silver sulpho-cyanide is somewhat soluble in alkaline sulpho-cyanides, and it is quite possible that silver chloride in the ore would be dissolved by alkaline sulpho-cyanides according to the reaction:

$$AgCl + 2KCNS = AgCNS{\cdot}KCNS + KCl$$

In some cases I have noted that free sulpho-cyanide had no harmful effects on the extraction power of a cyanide solution. I have not noticed any reverse to this. It is quite probable that some bad effects on the extraction would be noticed in cases where solutions were loaded with free sulpho-cyanide, but this would be the effect of the inactive salts.

Judging from the evidence shown by the foregoing reactions and facts, it appears that free sulpho-cyanide is not a reducing agent in the sense as reducing agents are classified in the art of cyanidation. I have found that copper from sulphide ores invariably goes into solution as cuprous sulpho-cyanide dissolved in cyanide, as is expressed in the following final equations:

$$2CuS + 8KCN + 2H_2O = Cu_2(CNS)_2{\cdot}6KCN + 2KOH + H_2$$

$$Cu_2S + 8KCN + S + 2H_2O = Cu_2(CNS)_2{\cdot}6KCN + 2KOH + H_2$$

According to these, 1.52 lb. CNS in terms of KCNS would be formed, and 4.09 lb. KCN would be consumed per pound of copper dissolved. To prove the value of these equations, a test was made with 1 gm. of $Cu_2(CNS)_2$ and cyanide. In this the titrations with silver nitrate and potassium iodide indicator showed a consumption of 1.63 gm. of KCN. This agrees closely with the above equations, which would indicate a consumption of 1.606 gm. of KCN per gm. of $Cu_2(CNS)_2$. Further proof of the value of these equations is shown by results of tests made on sulphide ore from the Headlight mine in Trinity county, California. In this test titrations indicated a consumption of 65.16 lb. KCN per ton of ore with the solution of 13.494 lb. Cu, the formation of 21.18 lb. CNS in terms of KCNS, and 9.31 lb. $K_4Fe(CN)_6$, which is equivalent to 9.96 lb. KCN. The cyanide consumed per pound of copper, after allowing for the cyanide equivalent of the $K_4Fe(CN)_6$, was 4.1 lb. KCN, while the sulpho-cyanide was formed at the rate of 1.57 lb. KCNS per pound of copper.

These equations, representing the form in which copper exists in solutions, differ greatly from those given by Will H. Coghill in the *Press* of August 17, 1912. Mr. Coghill mentions a compound having the formula $Cu(CNS)_2$. I may mention that I have failed to find any evidence of its existence in cyanide solutions.

Silver usually enters the solutions in the form of a sulpho-cyanide dissolved in cyanide, excepting in the case of oxidized ores. The silver is usually in the form of AgCNS·KCN. It is because both silver and copper exist in many solutions as sulpho-cyanides, that a number of operators have been misled about the regeneration of cyanide due to zinc precipitation. Some of these operators have been accustomed, in conducting tests, to allow for a regeneration of cyanide in zinc precipitation from the compound of silver existing in the solution which they presumed to be $KAg(CN)_2$. The reactions upon which they based their regeneration figures may be expressed as follows:

$$KAg(CN)_2 + Zn + 2KCN + H_2O = K_2Zn(CN)_4 + Ag + H + KOH$$

$$K_2Zn(CN)_4 + 4KOH = 4KCN + Zn(OK)_2 + 2H_2O$$

According to these, 1.207 lb. of KCN would be regenerated by zinc precipitation, from each pound of silver precipitated. The regeneration of cyanide as shown by the second equation only occurs when solutions have a high protective alkalinity. My experience has been that the regeneration usually occurs when solutions have over 1 lb. CaO protective alkalinity. That the regeneration as shown above is wrong in cases of sulphide ores is clearly proved by the fact that the silver exists in solution not as $KAg(CN)_2$, but as AgCNS·KCN. The regeneration in zinc precipitation from such a compound may be expressed by the equation:

$$AgCNS{\cdot}KCN + 3KCN + Zn + H_2O = K_2Zn(CN)_4 + Ag + H + KCNS + KOH$$

$$K_2Zn(CN)_4 + 4KOH = 4KCN + Zn(OK)_2 + 2H_2O$$

Here the regeneration of cyanide in high alkaline solution would only amount to 0.603 lb. KCN per pound of silver precipitated. While in the case of low alkaline solutions a higher consumption of cyanide would take place according to the above reaction, when precipitating the solutions resulting from the treatment of sulphide ores, than would occur when precipitating solutions resulting from the treatment of oxidized ores.

I have not as yet found any evidence of the existence of a compound of zinc and sulpho-cyanide; therefore, I have presumed that zinc does not exist in solutions as a sulpho-cyanide of zinc dissolved in cyanide.

That free alkaline sulpho-cyanides are regenerated during zinc precipitation is shown by the following typical test which I made at the Belmont mill at Tonopah. In this test the solution entering the precipitation plant for 24 hours contained 2.1692 lb. free KCNS and 2.66 oz. Ag, while the solution leaving the plant during the same period contained 2.47 lb. KCNS and 0.02 oz. Ag. Here 0.3008 lb. KCNS was regenerated. Of this amount, 0.164 lb. was due to the silver precipitated, while the remainder was due to the copper precipitated. Analyses of a head solution taken from the Belmont mill at Millers shows 4.24 lb. KCNS (free) and 1.62 lb. (KCNS terms) of combined CNS. In the case of a test on Jim Butler ore, with fresh solution 1.98 lb. combined KCNS (terms) were formed. The 0.24 lb. of copper dissolved would account for 0.3648 lb. KCNS, and the 25.2 oz. Ag or 1.727 lb. Ag dissolved, would account for 1.554 lb. KCNS; making a total of 1.918 lb. KCNS, against 1.98 lb. KCNS found by titration, only a trace of which was free KCNS.

Present Conditions at Pioche, Nevada

By JAMES W. ABBOTT

The leading banker of Pioche remarked today: "We are right now on the most substantial footing since we came here." This statement accurately represents the universal confidence here among the mining and business men. After passing through various phases of re-grouping and reorganization, the old Utah-Nevada and Meadow Valley properties on the hill south of town are now owned by the Amalgamated Pioche Mines & Smelters Corporation, with head offices in New York City. W. J. Palmer is president and H. R. van Wagenen is manager. The Company is operating through the old Nevada-Utah No. 1 shaft. It has revised the plant, the principal part of which is now new installation. The boiler capacity now is 500 hp. A new boiler-house has been erected and capacious coal-bins excavated. The narrow-gage railroad, up which the coal is hauled from the railroad station, has a new track above the coal-bins. There is a new double-drum steam hoist, housed in a new building. A counter-balance operates in the ladder way. There is a pump station at the 650-ft. level, and another on the 1200, which is the water line. The shaft has been sunk to the 14th level, where another pump has just been placed with a deep sump below. The water is carried through a 5-in. water column to the surface, and then runs down the main street of the town through a waste pipe. There is a new cable 2000 ft. long, a new change room with shower baths, cement floors in front of the boilers, and telephones in the mine connecting with the foreman's office.

Deep-Level Development

The Company ran a cross-cut 135 ft. long from the bottom of the shaft to the old Raymond & Ely 12th level, above which there is a considerable body of zinc ore. Another cross-cut was run from the 1400-ft. station and cut the Raymond & Ely fissure where 18 in. wide. A drift has been run to the westward on the fissure, and it is expected that that drift will cut the old Raymond & Ely Black Ledge within 600 ft. from the cross-cut. No reliable maps of those old deep workings are known to exist, and it has been necessary to make provision for the water collected in the winze which was sunk in the early days on the Black Ledge. As a protection against that water, a very long drill-hole has been carried ahead of the face of the drift, and a cement bulkhead, with heavy rail-reinforced door, placed just back of the station, with a valve, so that in case of emergency the water flow can be controlled. As the drift approaches nearer and nearer to the old winze, the flow of water somewhat increases. It has been carried down to the 1400-ft. pump station, from whence it is lifted to the 1200-ft. level and carried off through old workings. On the 12th level a narrow vein of silicious ore has been opened which sampled 1.34 oz. gold. The drift on the 1400-ft. level has opened a body of mineralized material, 7 ft. wide, some of which carries much native silver in lead and zinc sulphide. This body of ore is believed to indicate the approach to the famous old Black Ledge. Six men are working in the stope above the 1200-ft. level.

At present the Pioche Amalgamated is shipping at the rate of about 300 tons per month, but when the Black Ledge is reached and the ore-house on the surface completed, it is the intention to increase the shipments. Much of the ore now mined will not be taken to the smelters, but will be held for treatment in a mill to be erected later. The Company has given several leases.

MAP SHOWING SITUATION OF PIOCHE.

One covers the upper 600 ft. of the Raymond & Ely fissure, in ground connected with shaft No. 1. The most important of these leases is to a company of which A. Y. Smith is president, B. L. Smith, manager, and H. L. Parker, formerly of Prince Consolidated, is superintendent. This is known as the Yuba Leasing Co. The lease is to run for five years, and covers all the Company's property on the Yuba dike, and 1000 ft. of the old Meadow Valley fissure. This Company now has a 40-hp. Fairbanks-Morse hoist, with a new head-frame, at the old No. 3 Meadow Valley shaft, through which the larger part of the rich ore of the old Meadow Valley mine was hoisted. This shaft has been dismantled, but the new Company, said to have been financed in New York, is preparing to reëquip it thoroughly. It has already erected a blacksmith-shop, engine-room, and large ore-bins, and is about to install an air-compressor. It has done considerable exploratory work, all the drilling being done by hand. A long shoot of ore, running high in gold, with some silver and lead, was found on the 900-ft. level; also several shoots in the old Yuba

ELY VALLEY MINING & MILLING COMPANY.

dike workings, which were opened by a cross-cut from the 900-ft. level, 362 ft. south. A cross-cut is being run on the 6th level from the old No. 5 shaft of the Yuba dike. When the dike is struck, drifts will be run in each direction. The one to the east will in a short distance enter an old stope in Yuba workings. This leasing company has negotiated with the old Boston & Pioche for the privilege of using its workings to gain entrance to the old Yuba, known in the early Pioche days as the American Flag. This property, on the Yuba dike, has already produced millions, and the late William Lloyd, who was in charge of mining on the Yuba nearly 25 years ago, always said they left a very large amount of choice ore when the Yuba was forced to close down because the old Phoenix Reduction Co.'s smelter, down on the flat, went out of commission. In a winze from the 900-ft. level on the Yuba dike the leasing company found ore running 160 oz. in silver and ¾ oz. gold per ton. The finding of these rich bodies of ore so far from the surface, both in the old Meadow Valley and Raymond & Ely, is exceedingly encouraging.

As the result of a complicated series of negotiations, the Amalgamated Pioche Mines & Smelters Corporation now controls the old Ohio-Kentucky, which included the Greenwood. Lessees have recently shipped some high-grade gold ore from the Greenwood mine. The ore-shoot in the part of the mine from which this gold ore was taken is doubtless an extension of the old Panaca vein of the Raymond & Ely.

Several years ago the old Day mine, which, as the Jack Rabbit, in 1877 produced a vast amount of phenomenally rich ore, and the old Bristol Consolidated properties on the Bristol side of the range, were consolidated into a corporation which was known as the Day-Bristol Mining Co. The Day mine has not been worked for a long time, but the Bristol side of the range has been quite active. Mining operations on that side were conducted at great handicap because of very expensive wagon haul, averaging probably $6 or over per ton, from the mine to the Pioche-Pacific railroad at Jack Rabbit. To obviate this wagon haul, the Day-Bristol last year contracted with the F. C. Richmond Machinery Co. of Salt Lake to build an aerial tramway, to cost upward of $40,000, to be settled for with the Company's notes for $5000 per month, first payment to be made within 30 days after completion of the tramway. This tramway is now nearing completion. The properties of the Day-Bristol Consolidated have for a year or more been operated entirely by lessees. Nearly all of those worked have been entirely without equipment, and mining operations were conducted mostly by Mexican methods, but the ore is so valuable that, notwithstanding all these obstacles, it is said that all the lessees have made money.

A Little High Finance

The methods of the Day-Bristol have been so very peculiar as to suggest the doings disclosed by the former president of the New York, New Haven & Hartford railroad. The receipts were not very judiciously applied to covering the obligations of the Company, and some months ago H. E. Freudenthal was appointed receiver of the Day-Bristol Consolidated Mining Co. About three months ago the receiver filed his first report in the District Court. It showed a total indebtedness of $93,040, including cost of the tramway. Many well informed mining men regard the Bristol property as worth $1,000,000, but as there is no cash in the treasury at present, it is not easy to see how the property can be saved from disintegration. If sufficient capital were available to connect the various mines, and operate them through a single shaft at the Bristol terminus of the tramway, doubtless one of the most valuable mining properties in Nevada would be developed, but, as it is, the immediate future of the Day-Bristol is clouded with doubt. The different properties on the Bristol side, which have been operated by lessees, are the Hillside, Tempest, Iron Mine, National, Vesuvius, and Geyser.

The Mendha-Nevada, whose history goes back to the very beginning of time in the Pioche district, last year built a concentrator to treat its second-class ores. The Company has been shipping about two cars of concentrate per week. The property has recently been care-

fully examined by experts, and it is generally understood that a deal is pending.

The old Half Moon mine, about three miles on a straight line southwest from Pioche, has recently been worked on a lease by A. T. Godbe, who has shipped not only many cars of tailing, but also several cars of ore yielding more than ½ oz. gold, in addition to silver and lead. The Half Moon is a bedded vein, which was worked during the early years of this century, and the ore treated at the old Phoenix smelter. It was regarded then as a very valuable piece of property if the ore could be locally treated. A concentrator was erected on the premises and a large quantity of concentrate was made and locally treated, but the enterprise did not pay, and was abandoned, the property being acquired by the Nevada-Utah. Recently the mill building and contents, including crushers and concentrating table, were hauled away from the Half Moon to the Gold Chief property in the Chief district about 25 miles easterly. The Gold Chief ore contains principally gold. Several years ago a cyanide plant was erected at the Gold Chief mine, which was idle for a long time. It has recently been in operation, and about 500 tons of ore has been treated, with an average extraction of about $6, leaving from 80c. to $1 per ton in the tailing. The mine is now being worked and the outlook is very encouraging.

Another enterprise of promise to the Pioche district is the Alps Mining Co., organized under the laws of Oregon by a syndicate composed of Charles S. Shea and associates, of Portland. The Alps, in the closing days of Pioche's first period, was a mine of great promise. It had already produced several hundred thousand dollars under the conditions then existing. It had, in addition to the principal vein, of which the value was mostly in silver, another which produced the most beautiful free gold ever sent from that district. The old Alps owned the Floral mill, situated between the present centre of Pioche and the railroad depot. Lessees have recently shipped the tailing from this old Floral mill and have done well. The new company is going to explore for that rich free gold shoot which was finally lost in the early days.

The Pioche Pacific railroad, 14 miles in length, from Pioche to the Day mine at Jack Rabbit, was in the hands of H. E. Freudenthal, receiver, for considerably over a year. Last October it was released from the receivership, and has managed to exist from the receipts of ore hauled from the various leases on the Day Bristol and vicinity.

Prince Consolidated a Heavy Shipper

The most active mine in this district today, and the one at present of most promise for the future, is the group owned and operated by the Prince Consolidated Mining Co., situated about three miles southeasterly from Pioche. The ore in the upper 300 ft. consists of an argentiferous iron manganese, carrying a little lead, the orebody being a replacement in limestone. Below are found numerous beds of shale, and cutting the formation are two approximately vertical veins of ore high in silver and lead. The Company owns a standard-gage railroad about nine miles long, from the Pioche depot on the Salt Lake line to the mine, over which more than 100,000 tons of ore has already been shipped, the present production being from 200 to 300 tons of ore per day. This production can be maintained for many months without additional development. In addition to the mine, the Company owns tailing dumps at Bullionville and Dry Valley, which it is estimated are good for $400,000 when the Company is ready to dispose of them. It was from the tailing at Bullionville that the money was obtained to build the railroad. The mine is at present operated through an incline shaft to a little below the 500-ft. station, which is about water-level. The Company plans soon to exploit the sulphide zones below water level, already disclosed by diamond drills. A commodious vertical shaft, properly placed best to serve the property, is also among the plans for the future. At present the equipment consists of a 50-hp. gasoline hoist, an auxiliary 50-hp. hoist for emergencies, and a 100-hp. gasoline engine to run the air-compressor. The ore, when mined, is dropped to the 400-ft. level and from there hoisted to the surface. James Quirk, for many years foreman at the Mercur mine, is superintendent of

THE MENDHA AT HIGHLAND, EIGHT MILES NORTHWEST OF PIOCHE.

the Prince. M. C. Godbe is manager. Every attention is paid to the comfort and welfare of employees, and it is often asserted that few mine boarding houses in the United States have equalled its high standard of service. During the entire history of the operation and development of the Prince, only one fatal accident has occurred, and that was due absolutely to the victim's own carelessness. This is interesting, in view of the fact that no timbering is required in the mine.

The Virginia-Louise Mining Co., an Oregon corporation, is developing the Virginia-Louise mine which covers the extension of the Prince on the south. From the 321-ft. level a drift was driven in ore the course of the supposed strike, toward the southeast 100 ft., at which point a cross-cut was driven about 40 ft. westerly and 120 ft. easterly, where the walls were found respectively, indicating the strike of the ore-shoot to be almost at right angles to the cross-cut. This entire cross-cut from wall to wall is in ore. The main drift was then extended another 50 ft. and a second cross-cut run to the limestone on the east. The orebody was first cut in the shaft at a depth of 150 ft., with a uniform dip of about 17° to the southeast, the bottom of the drift on the 321-ft. level being a few feet above the foot-wall. Above the main bed in the shaft another bed of ore 20 ft. thick was found, with a 10-ft. bed of limestone between the two ore beds. The assay value shown by a careful sampling of this entire main bed of ore is 3% lead, 3 oz. silver, and 30% excess iron, manganese, and lime; constituting practically, at present market quotations, a $7 ore. The shaft was continued, and at the 381-ft. level another orebody was found, 18 ft. thick, with ore of a trifle higher grade. From the bottom of this deposit the shaft was sunk another 45 ft., where it entered a fissure vein with about 18 in. of silver-lead ore, averaging practically $50 per ton. That the orebodies in the Virginia-Louise are identical with those in the Prince has been demonstrated by a study of the position, thickness, and other phases of the beds. At a depth of about 250 ft. on the Prince a connection was made with the Virginia-Louise, insuring perfect ventilation for both properties, and vastly increased conditions of safety.

The Silver Park District

The pecuniary difficulties of the old Ely Valley and Horn Silver mines, which were due to the illness of George Weddell, president, have been adjusted. The Atlanta Consolidated, a company composed principally of Los Angeles capitalists, including E. M. Bray, W. T. Hook, and J. J. Giroux, owns a large group of patented claims in the old Silver Park district, 45 miles northerly from Pioche. This has been sampled by shafts, drifts, and cross-cuts to develop a sufficiently large body of low-grade free milling ore to supply a thousand-ton mill which the Company is planning to erect soon. The property is equipped with a steam hoist and necessary machinery, water system, electric light plant, blacksmith shop, store houses, assay offices, barn, boarding house, offices, and houses for a large force.

The rocks of the Silver Park district were originally sedimentaries, limestone, and sandstone, cut by an immense dike of porphyry, and later by an intrusion of rhyolite, which appears to have been the source of the mineral-bearing solutions, and in or adjacent to this intrusion orebodies were found. Much of the mineral-bearing material was a more or less complete replacement in the limerock shattered by the intrusion. The ore contains both gold and silver in commercial value, gold prevailing. In the old days, Silver Park had a daily six-horse Concord coach, connecting with the outside world at Palisade, on the Southern Pacific. It had two mills, and when the Pioche mines were producing more ore than could be handled at Bullionville and Dry Valley, a large tonnage was hauled to Silver Park, and reduced to bullion, with a treatment charge higher than the total value of the ore now produced in any of the big mines of the United States. E. M. Bray, manager, and J. J. Stubenbord, superintendent, are in charge of active exploitation now in progress.

Development of Farming near Pioche

It will be of interest to those familiar with the old Pioche as a mining camp pure and simple, to know that Pioche now seems likely to become the commercial metropolis of a very thriving agricultural area. About thirty miles from Pioche is the largest dry-farming enterprise in Nevada. W. M. Jardine, of the Agricultural College of Kansas, a recognized authority on dry farming, reported on the enterprise, and declared that he knew of no region anywhere holding out such promise for successful dry farming.

The Valley View Farming Co., a local enterprise of Pioche business men, has acquired sufficient water to mature a crop on 1000 acres by irrigation. The Association owns livestock, implements, and machinery, has a large farmhouse, barns, machinery shed, granary, etc., acquired at an expense of $25,000. About 80 cars of grain was harvested last year, with an estimated value of crop of $5000. The Company has a large tractor and plows, and hopes to have 1000 acres more broken by the autumn of 1914. Revenue for operations and equipment was obtained by monthly assessments upon each member of the Association. It is expected that the enterprise will be on a paying basis this year. Each member has taken up a half-section of land. Lake valley, in which this Association is operating, contains about 300,000 acres, nearly all open for settlement, with the choicest kind of soil. At the upper end of the valley underground waters come to the surface in the form of geysers, spouting at regular intervals, leading to the belief that artesian water can be developed, although sinking for it has not been tried.

Galvanized iron making in England is important, and exports in 1913 to Argentina, Australia, Canada, India, Japan, New Zealand, and South Africa amounted to 762,244 tons. This material is used largely in the construction of houses.

Progress and Working Costs, Tanganyika Copper Mines

By ROBERT WILLIAMS

*In order that you may clearly understand the remarks I am about to make, particularly with regard to Benguella Railway finance, I will begin by giving some extracts from a letter I wrote November 4, 1902, to the Minister of Finance of the Congo State, at his request, to show to the late King Leopold, who at that date, just twelve years ago, adopted the general policy for Katanga development laid down in this letter. I have never been able to make this letter public before, but now certain developments have made it possible and necessary that I should do so: "In accordance with your request, I now place in writing the views I gave you when last in Brussels. The reports which have come to hand from my engineer, J. H. Farrell, now place beyond all doubt that we have discovered in the Kambove No. 2 and Likasye mines the richest copper mines in the world, both as regards magnitude and value per ton of ore. These, taken together with the other large mines we have discovered, will place your group and mine practically in control of the copper supply of the world when we have connected our mines by rail to the nearest point on the seacoast. Like the other great discoveries in Africa—namely, the Rand goldfields and the Kimberley diamond fields—this great copper mine is unique in that it is of such magnitude and in such form that, although far removed from the sea, the conditions of mining it, together with the high percentage of copper, will be so favorable that the saving in the mining alone will more than compensate for the cost of transport by rail to the sea, and the cost of smelting by imported coke, should no coal deposits be found, or should a pig-headed policy still decline to push forward the Southern Cape railway to connect our mines with the great Wankies coalfields near the Victoria falls on the Zambesi river. The profit that these mines will yield per ton of copper will therefore almost entirely depend on two factors: first, the cost of transport to the coast and to England; second, the cost of smelting the ore. Now both the cost of transport to England and the cost of smelting depends upon the building of a railway to export our copper and import our coal and other mining requisites at the nearest point on the coast to England. The nearest point is Benguella, and I am on the verge of signing a concession with the Portuguese Government to build a railway to connect our mines in Katanga with this port, subject, of course, to your approval, coöperation, and a guarantee of assistance, without which such a railway would be useless. The points we must agree upon are as follows: First, that you coöperate with us commercially, not as a state, in the actual cost of the railway" that means it is not a political but an economic railway; "second, that you allow me to extend my line through your country to the mines; third, that you agree not to charge a greater rate on your railway section than is fixed on ours; fourth, that your import and export duties are agreed upon; fifth, that no duty is charged on machinery, coals, gold, copper, or other metals.

*This address, delivered at the annual meeting of the Tanganyika Concessions, Ltd., London, July 22, and reported in the *Financial News*, is of so much interest that we reprint it almost in full.

Comparison with the Rand

"The comparison between our discovery and, say, the Rand goldfields is that we are ready when the railway is finished to produce ore in value that would on the narrow 3-ft. average Rand bed take several millions to develop in deep-level shafts, tunnels, and extensive and costly mining plant, and the public is being invited, and, indeed, has readily subscribed to such mining propositions, being content to wait for upward of five, eight, and ten years until these can possibly produce dividends. Now, our proposition is at least open to the eye; it is above ground, so to speak, and can be inspected by all and sundry of the mining experts of the world who will take the trouble to look, and our only requirement in place of deep-level shafts, tunnels, and mining plant is our own railway, and we can get this built with an absolute certainty that such a railway will yield handsome dividends in at least as short a time as they can get down to some of the deep-level Rand mines." This letter then proceeded to show that the country could produce 1000 tons of copper per day, and gave details of probable costs with imported European coke, and further stated that by using Wankie coke and the Benguella Railway route for transport to the seacoast, copper could be landed in Europe at £24 per ton (5¼c. per pound). The letter then proceeded as follows: "It is also reasonable to expect in a sandstone formation that coal will be found not far distant from our copper, and, certainly, every endeavor will be made by us to find it by boring and otherwise; but in any case it is safe to say that the Rhodesia Railway Co. will find it imperative to connect with our Benguella railway in order to make its own system pay—indeed, the very mines in Northern Rhodesia which they had calculated on to make their line pay will be served by our railway at several pounds per ton cheaper than by their own line. By such an arrangement we will secure cheap coal and coke from Wankies, which will effect an immediate saving of at least £7 per ton of copper on 20% yield and £15 per ton on 10% yield, and the Rhodesian railway system will secure the only traffic that can make that system pay. By such an arrangement, which must come sooner or later, I shall have guided the Cape-to-Cairo railway through your

state, and thereby carried out my guarantee to the late Mr. Rhodes that I would 'see it through.' Such is the plan we should work on, and if my Portuguese railway concession was signed I would place the whole scheme before Mr. Chamberlain"—who was then Colonial Secretary—"and with his keen business insight I think I would have little difficulty in showing him: first, that our copper industry is to be one of the greatest, if not the greatest industry in Africa; second, that such an industry is bound to have a great bearing on the future politics of Africa as a whole; third, that if he works with me now in this railway business and assists me to get a connection with Wankies coalfields and the Rand he will greatly assist the commercial development of South and Central Africa as a whole, and will assist both your state and Portuguese Angoliland as well as our Empire, and thereby seal a friendship which is bound to have a lasting influence on the general welfare of all."

Fulfillment of the Program

The entire program laid down in that letter was agreed to by the late King Leopold twelve years ago. At that date the terminus of the Cape-to-Cairo railway was many miles away from Katanga, and the Benguella railway did not exist. There is hardly one thing predicted in that letter that has not been either entirely carried out or is rapidly being carried out. I was able to negotiate and finance the extension of the Cape-to-Cairo railway to the Congo frontier through the able assistance of Jean Jadot on the Belgian side and Sir Starr Jameson on the Chartered Company's side, with the result that we have not only secured cheap Wankie coal, but discovered coal of our own at Luana, which will be useful when developed. The quantities of copper we are producing are increasing steadily, and the costs are as steadily falling, and I see no reason why, with the advent of the Benguella railway, in two or three years' time the quantities should not be largely increased and the costs either largely reduced, or, what is equally important, large quantities of low-grade ore made profitable, which can never pay without the railway. The only item in the program I laid down in 1902 which has not yet been completed, and which might have been completed some years ago if the Belgian Colonial Minister had been as energetic as the late King Leopold in these matters, is the Benguella railway. However, colonial expansion is new to the Belgians, and they have to learn, like we did ourselves, and so we have had to be patient, and I am glad to say they have now awakened to the fact that, if they are to make the minerals and railways of Katanga a success, they must have the Benguella railway, and that quickly.

M. Jadot's Recent Speech

I will deal with my finance negotiations for that line later on, and meantime will quote a few remarks from the able speech of Jean Jadot, chairman of the Union Minière du Haut Katanga, in which this Company is so largely interested, and made a few days ago in Brussels. This speech reads as follows: "With regard to the mines, I have very little to add to the information contained in the directors' report. The two steam-shovels, with a capacity of 200 tons per 10 hours of work, which started working at the Star mine in January, are giving entire satisfaction. At the Kambove mine we shall start working in a few months' time—at the end of January, perhaps—with two steam-shovels with a capacity of from 500 to 600 tons, these being much more powerful machines than those at the Star. The results of the prospecting carried out during the last financial year and during the last few months very largely confirm, both as to quality and quantity, the early estimates, of which shareholders had been reminded in a previous communication. The data collected in proportion as our mines were developed very largely confirmed what was known on the subject of their richness. There are still only three mines working; the others will be developed in proportion with our resources in labor and with the progress of the work.

"Concerning the tin mines, we have made some experiments in working at Busanga. In order to develop them and to arrive at normal working, it is necessary for the railway to arrive near to these mines; in a few months it will be as far as these mines—that is to say, at a distance only of 60 kilometres, which is a very little matter compared with the distances dealt with when we were prospecting. It is also necessary for the labor from the north of the Bukama district to be able to arrive by railway to the mines. Therefore, prospecting has specially been carried on, and the result of these missions confirms previous estimates concerning Busanga from the point of view of richness and tonnage, which were formed as a result of the first investigations. The following will indicate the progress of our metallurgical work: Production of copper, from January 1 to June 30, 1914, 42 days' work with one furnace; 122 days' work with two furnaces; three days' work with three furnaces, which corresponds to 295 days' work with one furnace. The production for this period was 4520 tons of bars, containing on an average from 96 to 97% of copper, and 100 tons of matte containing 65%. The average production per day furnace was 15½ tons. Note—Since that date (June 30) the three furnaces have been working well and uninterruptedly.

Cost of Copper Production

"The average cost of production in 1913 of the ton of copper on truck at the works was 800 francs—that is £32 (7.18c. per lb.). The average cost for the first six months of 1914 was 778 francs (7c. per lb.). This price was found to obtain during a period when work was comparatively reduced, if it be compared with that registered since three furnaces had been working. We had anticipated an average cost of 700 francs per ton (6¼c. per lb.). This cost will certainly not be exceeded by the average cost for the financial year 1914 now in progress, because during the second six months the production will be higher than that of the first six

months and will be recorded under more economical conditions. The probable production for 1914—we say probable because we must always take into account occurrences of every kind—will be from 10,000 to 12,000 tons of copper instead of the 7000 tons in 1913. To the above-mentioned cost of production calculated on truck at the works must be added the cost of transport from Elisabethville to Antwerp, cost of handling, sale, etc., which gives as the probable cost of production at Antwerp for 1914, in round figures, about £40 per ton (9c. per lb.). Please note that this price does not include general European expenses carried to the profit and loss account, which amounted in 1913 to £18,000.

Progress at the Mines

"We are engaged in realizing a vast program of enlargement of our metallurgical works at the Lubumbashi, especially by the addition to the three existing furnaces of four new furnaces, which we hope to see working about June or July, 1915. If this hope be realized, our production for 1915 may be from 20,000 to 24,000 tons of copper. Naturally, this increase in production will have a very favorable effect upon the cost of production; the more the production increases the more the cost of production diminishes. We do not lose sight of the question of the mechanical preparation plant about which I have spoken to you previously. The question of the mechanical preparation and concentration of our ores is a very important one. We have decided upon the construction of a small experimental works built to prepare 50 tons of ore per day; further, this plant will be equipped for the investigation of different new processes which have been suggested to us for the treatment of the ores. This plant is ordered and is on the way to Africa, where it will be erected in a few months' time. The question which is of equal importance to us is the question of fuel. We have not ceased to give it our attention. The two batteries, each of 22 coke ovens, were fired, the first in December 1913 and the second in March 1914. Their capacity for production is 3000 tons per month. They ensure the working of two water-jacket furnaces, and fulfill our expectations.

With a view to obtaining all the coke required to supply the new plant, we have entered into a very satisfactory agreement with the Wankie colliery. We have obtained a notable reduction on the transport rates for fuel on the Rhodesian railways. The question appears, therefore, to be settled on excellent terms. The year 1914, during which we shall have working coke ovens, three water-jacket furnaces, and a mechanical preparation plant, and during which we shall have commenced the construction of the new smelting plant, including four new blast-furnaces, shows signs of being one of importance in the history of the Union Minière du Haut Katanga. We pay a tribute here to our staff, both in Africa and Europe, which has not failed to show us its devotion. In order to ensure under the best possible conditions the carrying out of our vast mining and metallurgical program, we have obtained the services of a consulting engineer, A. E. Wheeler, a man of great experience, who left a very exalted position in the copper industry in the United States in order to collaborate with us in the realization of the great work we have undertaken. Mr. Wheeler at the present time is making a thorough study on the spot of our mines and works; in fact, we can confirm what we told you in December last. The principal difficulties encountered since the beginning of our undertaking are today overcome. One, however, still remains, and one which is not the least serious, which you know has had our attention for a long time; it is the question of native labor."

M. Jadot, in finishing his speech, made the following significant statement with regard to railways: "The Benguella-Katanga railway, the construction of which is being pushed on in Angola, is to connect this territory with the mining regions of the colony, and is included in the Belgian program of the Colonial Minister. It would thus be a powerful element in the industrial development of Katanga, ensuring with the Katanga railway and the Bas-Congo Katanga railway—in complete accord with those two lines—the enormous transport which will result from the development of the great mining wealth of the southern part of the Congo."

The Future

Last year the copper output was 7000 tons. Now I am going to predict to you the future output of copper, cost of same, and profits. I believe, from all the statistics I have read, and given fair conditions of labor—and at present these look promising—that the copper output and costs of the Union Minière company will be about as follows: For 1914, 12,000 tons at £38 (7⅓c. per lb.) landed at home; for 1915, 25,000 tons at £30 to £32 landed at home; for 1916, 40,000 tons at about £30 (6½c.). The profits on these outputs will, of course, depend on the price of copper, but there is no indication that it will fall below present prices. Now, if copper prices are maintained, then the Union Minière company must earn something in the neighborhood of £1,800,000 to £2,000,000 sterling in profits in the next three years, of which we are entitled to about 40% after allowing for depreciation and other deductions.

I may further tell you that if the negotiations I am now carrying on are signed in their present form this Company and the Zambesia company will receive debenture interest at once from the earnings of the railway, as about £390,000 will be earned within two and a half years in carrying construction material alone, according to Pauling & Co.'s contract. If people ask you how we are financing or are likely to finance, just quote these figures to them and tell them that although our assets figure as stated in the report at £3,545,831, one of them, which is given at a cost of £392,000 in the above figure, is worth today on the market about £3,000,000 sterling, which is equal to your whole share and debenture capital.

The Taisho National Exposition at Tokyo

By WARREN D. SMITH

On my way home from the Philippines recently (June 1914), I stopped off at Tokyo for a few days, and while there called on my old friend, B. Koto, professor of geology in the Imperial University of Tokyo and dean of Japanese geologists. After we had chatted for a while about our geological experiences he proposed to take us to the big exposition which was then being held in Ueno Park nearby. We spent all that afternoon there and I went back Monday and spent the day. I was particularly interested in this exposition because it comprised in the main the exhibits which will later be sent to the Panama-Pacific, and I can say that Japan will have no reason to feel ashamed of her part in the big fair in 1915. I cannot even attempt a description of all that I saw, nor would it interest the readers of this paper sufficiently to warrant.

Plan of the Exhibition

The general arrangement of buildings is essentially like that at any big exposition, with lagoons, fountains, escalators, and casinos. The buildings, much to my disappointment, were not in the Japanese style, but this was partly redeemed by the Formosa building, which was in the Chinese style as found in that island.

Readers of this paper would naturally go first to the mining exhibits, and so did I. I was greatly impressed by the mineral production of Japan as shown by what I saw displayed in this building. The Japanese have an especial aptitude for anything requiring manual dexterity, and the wonderful display of mine models demonstrated this beyond question. The coal and copper industries were very fully represented by complete models of several of the largest plants, samples and maps, and exhibits illustrating working methods. I noticed one pile of ingots of the reddest looking copper I had ever seen. Mr. Koto told me that it was characteristic of the copper from that particular mine. Not being a copper expert, I was unable to say whether it was unusual or not. The ore is chalcopyrite.

The Petroleum Exhibit

Perhaps the exhibit which interested me most was that of petroleum and one of the first things to meet my eyes was a huge model of a California derrick with complete rotary equipment. It was about 20 ft. high. Full credit was given to California oil men for the present great success of that type of rig in Japan. What heightened the interest of everyone in this exhibit was the fact that almost simultaneously with the opening of the exposition a great gusher was struck in the north of Japan in the Prefecture of Akita, due to the use of the new (to them) type of rig. I have been told since that the production of the Echigo field (the principal one) has been doubled since the advent of the rotary. The Japanese oil men feel very grateful to Californians for what they have done to help them in this most important industry, and if I mistake not, they applied first to the *Mining and Scientific Press* for advice. I swelled, too, with pride when I saw a great spire of cubes diminishing in size from the one at the bottom (labeled 'oil production of U. S.') about two feet on a side to a wee tiny one on top about one inch on a side labeled 'all other countries.' Of course, there were some fairly respectable sized blocks in between, standing for Russia, Roumania, etc., but Uncle Sam's topped as well as bottomed them all. I believe the feeling of the Japanese oil men toward California is typical of the feeling of most of the good people of Japan. They certainly want to be friendly, and it will not be their fault if they can't be. Not once in all the places I visited in Japan, and I traveled from Nagasaki to Tokyo by rail, did I see the slightest sign of any ill-feeling toward an American. But this is getting too far away from the subject.

The Imperial Geological Survey had a small but well selected exhibit consisting of useful minerals and maps, and anyone who has ever given these maps more than a passing glance must acknowledge their excellence in point of draftsmanship, and if their geologists are anything like Mr. Koto, who, as it happens, trained most of them, they must also be very accurate.

Formosa and the Head Hunters

In another part of the ground there was one feature which served both for amusement and for educational purposes, namely, a great artificial landscape containing the ramifications of a mine with small mine cars and everything complete. The galleries were just large enough for a person of average height to walk through comfortably. From this we went across the lagoon to the Formosa building. In the centre of this large pavilion was a relief map of the island nearly a hundred feet long. All the cultural features were indicated and explained. My attention was particularly drawn to a large area on the eastern slopes of Mt. Sylvia marked off by a white line. Mr. Koto translated the label and I was able to verify what I had heard about Japan's method of dealing with the intractable hill people. The label explained that this white line marked the position of an electrically charged wire or set of wires (over 300 miles long) placed there to keep the headhunters confined. Surrounding this enclosure troops are stationed. If the people try to break through they usually come to grief, but if they come quietly begging for salt they are given a chance to come out and settle in one of the peaceful villages. You will say, many of you, how barbarous! But the Japanese believe in getting through with a painful operation quickly and they don't believe

in having to perform the operation more than once.

It is to be admitted that in Formosa, at least, they are getting results. Formosa is not as large as Luzon, is geologically very similar, and the Japanese have had control there only three years longer than we have been in the Philippines, and yet the mineral production of the former last year amounted to about $20,000,000, as against $3,000,000 for the whole Philippine group. This ought to settle for once and all those wild charges emanating from that enlightened circle of anti-Imperialists near the 'Hub of the Universe' to the effect that we Americans in the Philippines have been exploiting the poor Filipino.

Who Are the Japanese?

In that same building were many exhibits from the schools showing that the Japanese are not neglecting that side of the people's interests. There was also the Aino building, which was very interesting, particularly as the Aino is one of the parent stocks of the present composite race we call Japanese. You may not know it, but Griffis, who spent many years in the East, has said that the Japanese race is made up of Malay, Mongolian, Semitic, and Aino elements. I can account for all but the Jew. How and when he got in I don't know. There were also a Bonin islanders exhibit and a Polynesian section, all of which threw considerable light on questions which had come to mind in traveling among the less civilized groups in the Philippines.

We had dinner early in a nice hotel in a high part of Ueno Park not far from a great Pagoda. The head waitress here spoke excellent English and had lived a long time in Berkeley, California. She told me that English was now required in all the government schools in Japan.

Sayonari

As Mr. Koto and I made our way to the Shimbashi station we talked about many phases of the new Japan, and I said, "Koto, Tokyo looks very much like one of our cities. Are you going to take over the Occident entire?" "No," he said; "this is largely superficial, it won't go much deeper," and hesitating a little, but with fine courtesy, "I don't think we ought to take any more." He did not mean to be rude, and I did not so take it, for I had to admit that there was much in our Western civilization it would do no people good to adopt. I found him always ready to give praise, as for instance when we were discussing ore deposits, "You Americans now lead the world in the science of ore deposits."

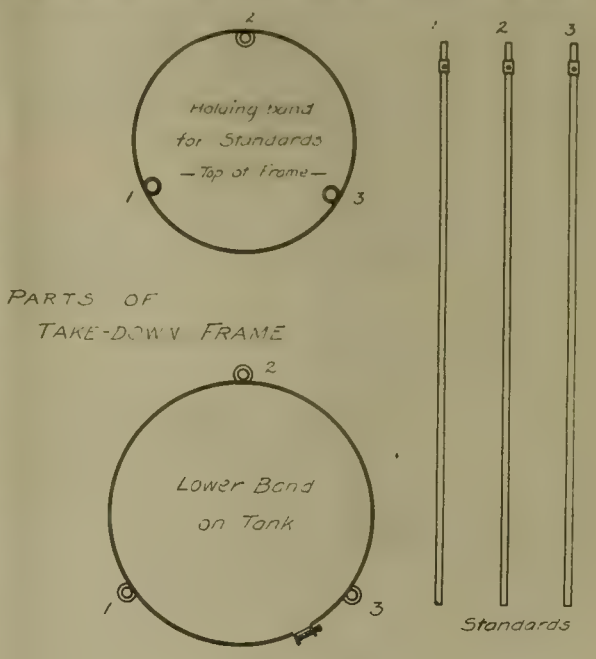
As I looked out of the train window at the fine old gray head bent forward in a bow such as only the Japanese can make, I thought "there is one of the modern Samurai of Japan," and I took away the thought that there is too much of value in Japan for us of the Occident ever to permit ourselves to become unfriendly toward them. I urge all visitors at the great fair next year not to neglect Japan's part of it, for she will be there with an exhibit well worthy of a visit and of which any nation might well be proud.

Portable Assay Outfit

By THEO. A. CLACK

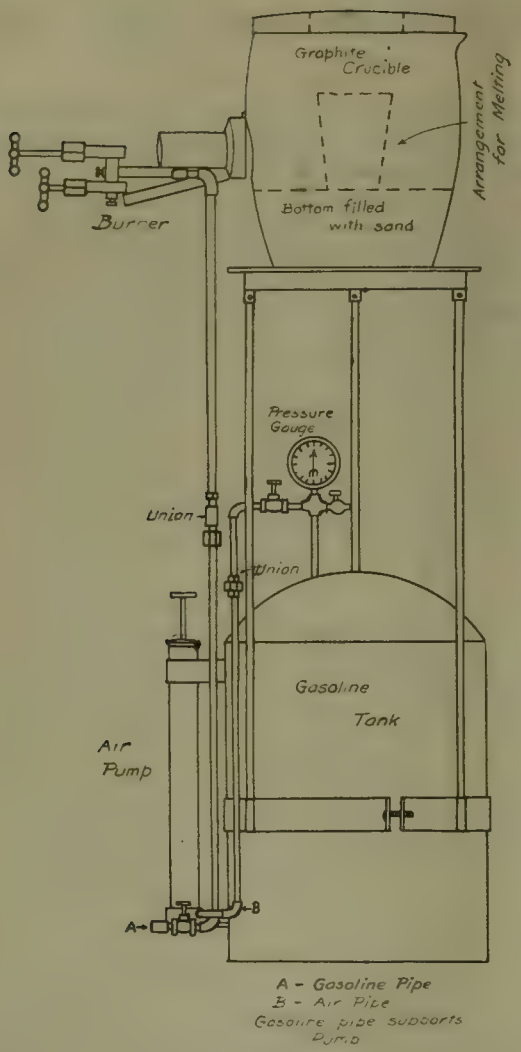
The accompanying sketch shows a portable assay outfit designed and built at the Heald's Engineering School, under my supervision in the department of mines, metallurgy, and chemistry. It is considerably lighter and cheaper than outfits sold for field work, and may with a little skill be built by most any one engaged in prospecting. It has been used in field work and has given excellent results.

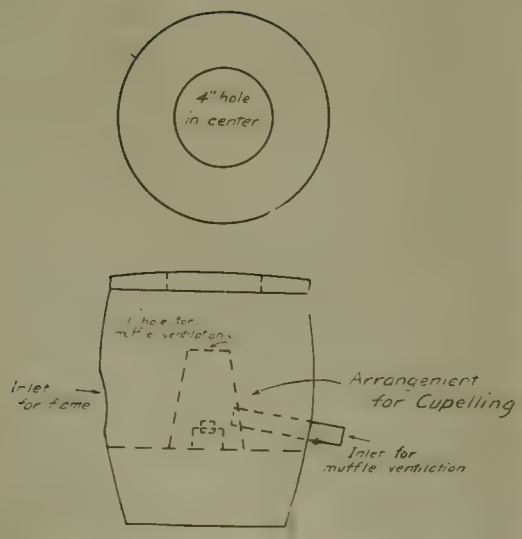
The outfit consists of an 8 by 11-in. graphite crucible, 1-in. gasoline burner, pump, and tank with the necessary



crucible support and piping. The piping, if arranged as indicated, may be taken down by unscrewing two unions. The take-down frame support for the crucible may be removed by pulling out the standards which fit into openings provided in the band about the gasoline tank and into the rest for the crucible. With this arrangement the outfit may be set up and taken down with dispatch and can be packed in a comparatively small space.

The large graphite crucible constitutes the furnace. It may be replaced easily when worn out or broken and gives sufficient heat insulation to produce a melting temperature within 15 minutes. This furnace crucible is covered with an ordinary crucible top having a 4-in. hole in the centre as indicated in the diagram. The burner is placed in front of the opening in the side of the crucible in a slanting position so that the flame may have a twirling motion within the furnace. The flame may be regulated in this way so that the hottest part of the flame envelopes the crucible or crucibles carrying the assays.





CLACK PORTABLE ASSAY FURNACE.

Cupellations may be conducted in the same furnace crucible by a slightly different arrangement. There is a 1-in. hole lower than the hole admitting the flame and on the opposite side of furnace crucible which allows the entrance of a porcelain electric wire insulator. This insulator supplies air to the inverted 30-gram clay crucible shown in sketch in which the cupellation takes place. This improvision will permit good cupellation conditions. The movement of the flame around this muffle crucible creates a sort of whirlwind action above the muffle crucible, and in this way seems to aid the circulation of air within. A porcelain insulator was used above the muffle crucible which resulted in an excessive supply of air and was consequently discarded. Under those conditions feather litharge formed about the cupel until it was covered completely.

With the exercise of judgment and the acquisition of experience, satisfactory results may be obtained with a home-made outfit of this character, which is, as far as we know, considerably lighter, cheaper, and more convenient than the usual portable outfit.

Ore Contracts and the Smelter

By HERBERT LANG

Contracts for sale and delivery of ore generally run for a term of months or years or relate to a specific quantity to be delivered at the smelter yards, or sometimes at sampling plants controlled by a third party. They contain stipulations concerning the time of delivery, time and rate of payment, method and place of sampling, and the handling of the assays on which the sale is to be based. They invariably specify the percentage of the assay value to be paid, which infers the amount of deduction on each of the several metals. The contract is frequently put in the form of letters, one from the buyer to the seller offering to purchase on stated terms and in set quantities, and the reply from the seller accepting the proposal. The contract, while sufficiently rigid to be of legal value, is not very formal in tone or phrase, partly because the smelters have found that such contracts are not too stringently adhered to by the sellers. In fact, their violation is not improbable. Legal measures to compel their observance are not unheard of; but the smelters, as a rule, have not found it profitable to attempt to hold recalcitrant parties to strict account, allowing a pretty wide latitude rather than spend much money in the uncertain pastime of the law. The percentage paid varies in different localities and under different conditions. A deduction of 5% on the silver is now usually made, but I have been able in former days to buy on a 15% deduction, the recovery having averaged about 96%. A transaction like this would be held nowadays to be a robbing game, but I cannot yet see why it is not perfectly justifiable, and I wish I might do it again. By basing the treatment charge on wet weights, I made a very pretty profit. I recall that one lot of ore containing 60,000 oz. of silver yielded us $20,000 net.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Kalgoorlie Geology

The Editor:

Sir—In view of the recent voluminous discussion concerning the geology of Kalgoorlie goldfield, perhaps a few remarks, from a practical standpoint, may not be out of place.

As far as geology assists the mining engineer to find ore material carrying precious metals in quantities sufficient to pay for mining, treatment, and dividends—and to cheapen its development, it is of value, but no further, except as a scientific study. Mr. Maclaren, while on his recent visit to this field, stated that it was the physical characteristics of the country rock traversed by the lodes which chiefly determined the deposition of gold in the latter, and experience has proved the truth of this statement.

Mr. Larcombe, while dealing with felsite, a rock which has a detrimental effect on those Kalgoorlie lodes which are enclosed in it, said (*Mining and Scientific Press*, Vol. 108, p. 700) * * * "at deep levels the edges of the felsite are often 'aphanite;' the recognition of this fact has considerably reduced the thickness of the felsite."

Let us use for the time being this new term 'aphanite,' merely for the sake of reference to Mr. Larcombe's remarks. The 'aphanite' is probably, then, contemporaneous with the felsite. It is obvious that this felsite is older than the orebodies, since it is penetrated by them, so both this felsite and the 'aphanite' along its edges are older than the orebodies. The physical characteristics of felsite and this 'aphanite' of Mr. Larcombe are practically identical. Indeed Mr. Larcombe admits this: "This rock (aphanite) at deeper levels is indistinguishable from the felsite (albite porphyry)" and apparently differences are only observable under the microscope. Therefore these rocks must have had a precisely similar effect on the deposition of gold in the lodes and from the point of view of the mining engineer may be regarded as one and the same. Mr. Larcombe is then merely making confusion worse confounded by introducing a new, and as I have attempted to show, an unnecessary name into a geological situation already sufficiently complicated.

A little further on in the same paragraph, is the following: "A study of the Horse-Shoe plans shows the importance of this rock as an indicator in boring * * *" Certainly, in places there is a considerable amount, up to 30 ft., of material which is readily "separated from quartz-dolerite in cores" on either side of the Golden Horse-Shoe lodes. This is bleached and carbonated rock, resulting from the action of the lode-bearing solutions on the original quartz-dolerite, through which the lode fissure passed. The Geological Surveyors for the state of Western Australia called this 'carbonated diabase.' The term 'bleached dolerite' describes it equally well. Why then, in the name of all that is logical, do we require the name 'aphanite' for this rock, either for its schistose or its pink (through oxidations of ferrous carbonates) varieties?

J. L. Connor.

Kalgoorlie, June 22, 1914.

[A more detailed account of the district in question, prepared by Mr. Larcombe for the *Press*, will be printed later.—Editor.]

Valuation of Dredging Ground

The Editor:

Sir—To elaborate on the article by L. A. Decoto in the *Mining and Scientific Press* of May 9, 1914, I submit a mathematical demonstration of the principles involved in estimating the value of ground and then show their applications to the theoretical example given by him.

The following nomenclature will be used. The product of yard value by depth in feet will be called 'valence' and designated by the letter v. The depth of the prospect hole in feet will be designated by d.

Starting with the simplest geometrical figure, a triangle, A, B, C, Fig. 1, at the corners of which drill holes

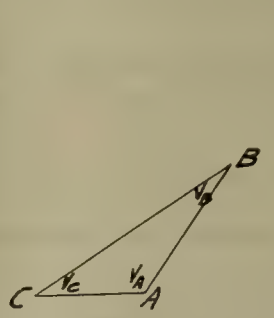


Fig. 1.

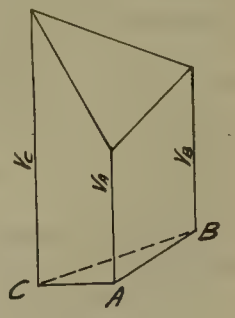


Fig. 2.

have been sunk, giving the valences v_a, v_b, v_c. The valence of the entire triangle can be shown graphically by the volume of a prism, the base of which is equal to the triangle A, B, C, while the vertical sides may be represented by some convenient scale equal to the corresponding valences. This has been done in Fig. 2.

It is assumed in this figure that $v_c > v_b > v_a$, and that the area of the triangle A, B, C is unity, also that the valences increase uniformly along the lines AC, AB, and BC. While this last assumption is not borne out by actual experience, it is a safe one to make, provided the differences in yard values are not excessive and that the distance between individual prospect holes is not a great one.

The volume of the prism $= \frac{v_a + v_b + v_c}{3} \times$ area of triangle A, B, C, and as this area has been assumed as unity: $= \frac{v_a + v_b + v_c}{3}$. That is, the average valence for a triangular piece of ground is the arithmetical mean of the valences at its corners.

Similarly we get for the cubic contents of the prism, as existing on the ground, for a triangle of area of unity: $\frac{d_a + d_b + d_c}{3}$ and for the mean yard value, $\frac{\frac{v_a + v_b + v_c}{3}}{\frac{d_a + d_b + d_c}{3}}$ or $\frac{v_a + v_b + v_c}{d_a + d_b + d_c}$.

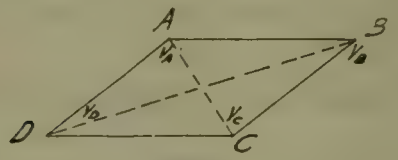


FIG. 3.

Taking now the case of a parallelogram, Fig. 3, we can divide it into two triangles by either one of the diagonals AC or BD. Using AC first, we have for the triangles ABC and ADC the following expressions for their average valences: For ABC, $\frac{v_a + v_b + v_c}{3}$, for ACD $\frac{v_a + v_c + v_d}{3}$, and for the parallelogram, as the two triangles are equal, the arithmetical mean of the above expressions, or $\frac{2(v_a + v_c) + v_b + v_d}{6}$.

Similarly we get for the same parallelogram, using triangles ABD and BCD the following expression: $\frac{2(v_b + v_d) + v_a + v_c}{6}$.

For the equality of these two expressions, we have after reduction, $v_a + v_c = v_b + v_d$. That is, the sum of the valences at opposite corners of the parallelogram must be equal.

Constructing the valence prism, as shown in Fig. 4, it can readily be seen that the condition of equality of the sums of the valences at opposite corners means geometrically, that the prism shall be terminated by a plane surface. The condition just stated is hardly ever fulfilled in practice, and to obtain the most probable value for the valence of the prism, the arithmetical mean between the two different expressions derived above will have to be taken, as follows:

$$\frac{2(v_a + v_c) + v_b + v_d + 2(v_b + v_d) + v_a + v_c}{12} = \frac{v_a + v_b + v_c + v_d}{4}.$$

That is, the most probable average valence of a piece of ground, having the shape of a parallelogram is the arithmetical mean of the valences at its corners.

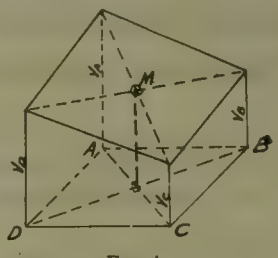


FIG. 4.

Analogous to previous derivations, we get for the mean yard value $\frac{v_a + v_b + v_c + v_d}{d_a + d_b + d_c + d_d}$. As the prospecting of dredging ground can generally be reduced to the described simple geometrical figures, no other shapes need be considered. Narrow deposits following the sinuosities of a stream do not lend themselves to this method of prospecting and are not considered in this article.

To test this method on the theoretical example, shown by L. A. Decoto, and compare the results from it with those obtained by him, I have divided the field into tri-

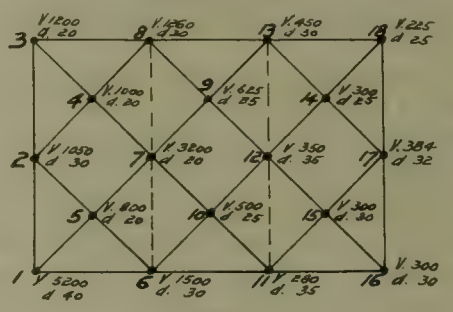


FIG. 5.

angles and squares, as shown in Fig. 5. In calculating the average yard value, it is of course unnecessary to take each figure by itself, it is only necessary to ascertain by inspection into how many triangles and squares each valence and depth enters, for instance, No. 2 would enter into three, No. 7 into four, etc.

We can thus write down for the sum of the valences:

$$2\left\{\begin{matrix}5200\\1200\\225\\300\end{matrix}\right\} + 3\left\{\begin{matrix}1050\\1260\\450\\384\\280\\1500\end{matrix}\right\} + 4\left\{\begin{matrix}800\\100\\3200\\500\\625\\350\\300\\200\end{matrix}\right\} = \begin{matrix}13850\\14772\\28300\\\hline 56922\end{matrix}$$

$$6925 \qquad 4924 \qquad 7075$$

For the sum of the depths, we have:

$$2\left\{\begin{matrix}40\\20\\25\\30\\\hline 115\end{matrix}\right\} + 3\left\{\begin{matrix}30\\30\\30\\32\\35\\30\\\hline 187\end{matrix}\right\} + 4\left\{\begin{matrix}20\\20\\20\\25\\26\\35\\25\\30\\\hline 200\end{matrix}\right\} = \begin{matrix}230\\561\\800\\\hline 1591\end{matrix}$$

And for the average yard value of the tract, we have:

$$\frac{56922}{1591} = 35.8 \text{ cents.}$$

To show how the calculation of the yard value of small tracts compares with that of larger ones, I have subdivided the tract shown by the dotted lines, running from hole No. 6 to No. 8 and from hole No. 11 to No. 13, and have calculated each of the three tracts separately. Only one of the calculations will be shown in detail, the one for tract comprised between holes 1, 3, 8, and 6.

Sum of valences:

$$2\left\{\begin{matrix}5200\\1200\\1260\\1500\\\hline 9160\end{matrix}\right\} + 3\left\{\begin{matrix}1050\\3200\\\hline 4250\end{matrix}\right\} + 4\left\{\begin{matrix}1000\\800\\\hline 1800\end{matrix}\right\} = \begin{matrix}18320\\12750\\7200\\\hline 38270\end{matrix}$$

The sum of the depths:

$$2\left\{\begin{matrix}40\\20\\30\\30\\\hline 120\end{matrix}\right\} + 3\left\{\begin{matrix}30\\20\\\hline 50\end{matrix}\right\} + 4\left\{\begin{matrix}20\\20\\\hline 40\end{matrix}\right\} = \begin{matrix}240\\150\\160\\\hline 550\end{matrix}$$

The average yard value: $\frac{38270}{550} = 69.6$ cents.

By a similar calculation, we obtain for tract 6, 8, 13, and 11: Average yard value $\frac{22130}{615} = 36.0$ cents.

And for tract 11, 13, 18, and 16: Average yard value $\frac{7112}{661} = 10.8$ cents.

Combining the three tracts, we have for sum of the valences: $38270 + 22130 + 7112 = 67512$, and for the sum of depths: $550 + 615 + 661 = 1826$.

And for the yard value of the whole tract:

$$\frac{67512}{1826} = 37.0 \text{ cents.}$$

It will be noticed that this amount is larger than the one obtained by considering the entire tract. The reason for the discrepancy lies in the fact that the yard values do not increase and decrease uniformly in all directions between the individual test holes. To show this it will only be necessary to take one of the squares of Fig. 5, for instance, the one formed by the holes 7, 9, 12, and 10 and find the valence at its centre. Figuring from holes 7 and 12, it would be the average between 3200 and 350 or 1785; figuring from holes 9 and 10, it would be 562, or only about one-third of the other value. This shows that the determination of the value of a small area from a few drill holes is very problematical.

Referring to Fig. 5, it can be seen that the area may be divided into triangles in two different ways, one being by vertical division lines, the other by horizontal. To check up the results obtained for the average yard value of the tract, the calculations were made for both subdivisions, resulting in each case in a value of 35.7c., which practically coincides with the result obtained by the method of division into squares and triangles, which latter saves a great deal of time and labor in the calculation. The rectangle between holes 1, 3, 8, and 6 was also figured by dividing it into triangles by vertical and horizontal lines, the former giving a yard value of 67.9c., the latter of 70.8c. The higher value obtained in the second case is due to hole No. 7, which in that calculation enters four times, while in the first case it occurs only three times.

It will be noticed that the yard value for the tract, as derived by the method here outlined, differs a little from the one shown by Mr. Decoto, being about 5% smaller, which is on the safe side. From the yard value thus obtained should be deducted a certain percentage to obtain the actual recovery, and, while I have data on this subject, they are not exhaustive enough, nor do they cover a sufficient range of different installations, to warrant any but the most general conclusions, which may be stated as follows: The higher the prospect value, the greater should be the percentage of loss in recovery, starting with about 5% on 5c. per yard, and extending to perhaps as high as 50% on 75c. per yard; it being understood that these prospect values are for large areas and a great number of prospect holes. When it comes to small areas, covered only by two or three holes, a rough guess, tempered by good or poor judgment is all that can be offered. It is to be understood that the judgment is good when the results show in your favor and vice versa. The trouble is that it is impossible to be sure of your judgment beforehand.

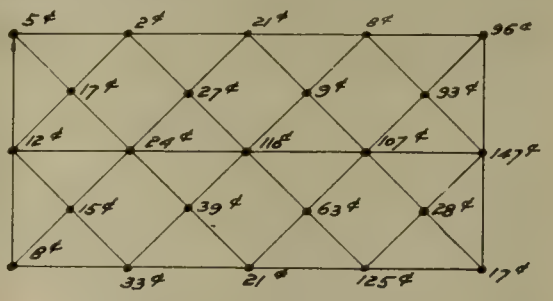


Fig. 6.

It may be imagined by those not familiar with dredging prospects that the theoretical example shown by Mr. Decoto represents unusual conditions. To set at rest any doubts on this score, I have shown in Fig. 6 the results obtained in prospecting part of a large piece of ground, which will illustrate the practical value of Mr. Decoto's theoretical example.

L. J. Hohl.

San Francisco, August 1.

[The importance of this subject warrants further discussion. What have you to say?—Editor.]

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

COMMERCIAL MANGANESE ores at present in America are those which contain at least 35% of manganese.

RAINFALL in some mining countries is very heavy. At the Ashanti mine, West Africa, the fall was 21.54 in. in 27 days of July; while 4.82 in. fell in 4.5 hours on June 23, resulting in part flooding of the mine. The temperature ranged from 67 to 68° Fahrenheit.

STAMP BATTERY SHOES, when worn to from one to two inches in thickness, may be used as dies. A cast-iron false die is used for this purpose. This is fitted with a recess into which the shank of the inverted shoe fits snugly.

COMPENSATING WEIGHTS, to allow for the loss of crushing power resulting from wear of stamp shoes, are sometimes used. These consist of halved cast-iron collars which are clamped on the stem just above the head. An alternative method of maintaining output, which involves considerable labor, is to transfer shoes when worn down, to a battery having heavier heads.

CYANIDE BULLION may be brittle from a variety of causes. Lead is the most common cause of brittle bullion. It may get into the bar if an excess of lead salts is used to facilitate precipitation; it may be that the zinc contains a little lead. Of course sulphuric acid treatment does not remove it from the precipitate. Bullion containing over 10% zinc is likely to be brittle, especially if there is but little silver present.

ORDINARY METHODS OF COMMUNICATION are not sufficient for the great mining enterprises of today. At the Homestake properties, in South Dakota, a complete telephone system is maintained, reaching into the mine, and to all surface plants at Lead, to the timber camps, pumping stations, electric-generating stations, etc. The telegraph is also used, and the latest equipment for communication to be installed is a wireless telegraph.

LARGE ITEMS OF WASTE will be found, by close inspection, to exist at nearly all mines, no matter how small the scope of operations, if there is no adequate check on supplies issued to the employees. A warehouse, or storeroom, where various fittings are kept, and issued only on requisition, will, properly handled, effect remarkable economies. At a certain mine the consumption of screens on the stamp batteries was almost halved by an energetic manager. This same mine's consumption of giant powder was almost cut in two. The same ratio holds good with nearly all of his other supplies, such as pipe fittings, bolts, nuts, screws, crucibles, candles, blacksmith coal, and dozens of other items.

TEMPERATURES in a beehive coke oven charge during a 44-hour burn are as follows, according to T. B. Williams, of Canmore, Alberta, Canada: fresh charge put in oven, 1260°F.; period of ignition, two hours later, 1330°; air admitted above charge, four hours later, 1870°; some draft shut off, eight hours later, owing to too violent ignition, 1760°; volatile hydrocarbons being driven off, and part burned above the charge, from 1830 to 1540°; oven door luted up and oven tranquil, 1470 to 1260°; and owing to the drop in temperature, a little air was admitted and a small amount of the fixed carbon was burned off, after which the cover was placed on and the door luted up tight, 1980 to 1800 degrees.

ANALYSIS of the strong circulating solution at the Meyer & Charlton mine, on the Rand, is as follows, according to H. E. Williams, in the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa:

	Per cent.	Parts per 100,000.
Sodium cyanide	0.03880	38.80
Sodium ferrocyanide	0.00570	5.70
Sodium zinc cyanide	0.04080	40.80
Sodium cuprocyanide	0.00660	6.60
Sodium nickel cyanide	0.00419	4.19
Sodium aurous cyanide	0.00091	0.91
Sodium cobalticyanide	0.00290	2.90
Sodium cyanate	0.00780	7.80
Sodium thiocyanate	0.01458	14.58
Sodium sulphate	0.16630	166.30
Sodium chloride	0.04614	46.14
Calcium sulphate	0.06600	66.00
Calcium hydroxide	0.02440	24.40
Free ammonia	0.00136	1.36
Total	0.42648	426.48

The total cyanogen expressed as sodium cyanide is small, notwithstanding that the liquor is one of the strongest on the Rand. The double zinc cyanide formed must for the greater part be brought into play as a solvent for gold, the zinc being removed from solution and alkaline cyanide liberated by some reaction, or reactions, that take place during the operation of gold extraction, and there are many such possible reactions, otherwise one cannot account for the comparatively low amount of this compound which is present in the liquor. Again, the total free cyanide returned by the usual Liebig test, in the presence of so many other double cyanides, is much too high as an expression of the actual free cyanide present, even when potassium iodide indicator is used.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

NEW YORK

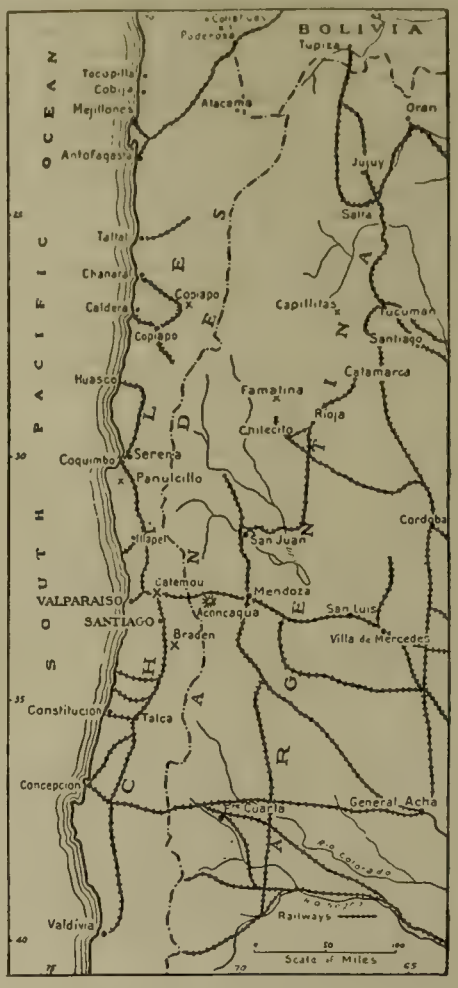
ALLEGED DISCOVERY OF LARGE GOLDFIELD IN ALASKA ABSOLUTELY UNTRUE.—NIPISSING OPTIONS AT PORCUPINE.—A. S. & R. CO.'S REPORT.—WORK AT CHUQUICAMATA AND BRADEN.

New York had its first really thrilling mining news in a long while last week when the daily papers published an account of an interview supposedly given out in Tacoma by Stephen Birch, who is president of the Beatson Copper Co., vice-president and manager of the Kennecott Mines Co., Alaska Development & Mineral Co., and a director of the Copper River & Northwestern railroad and the Alaska Steamship Co. In the alleged interview Mr. Birch was made to say that in the Broad Pass district, which is southwest of Fairbanks and northeast of Mt. McKinley, there is a newly discovered gold-bearing district surpassing even the Transvaal. The gold-bearing veins, at the northwest, were from 200 up to 2000 ft. in width. A 100-ft. vein averaged $15 per ton across the whole width, and a 14-ft. 'pay-streak' on the hanging wall side averaged $250 per ton. The poorest of these wonderful veins was supposed completely to eclipse the Alaska Treadwell and Juneau. Reporters scurried off to find Daniel Guggenheim, and persuaded him to say that if Mr. Birch said such things they must be so, which was promptly rendered in the papers as a statement that Mr. Guggenheim had a telegram from Mr. Birch confirming the wonderful discoveries, and that Mr. Birch was bringing sackfuls of the ore to New York with him. A few days later Mr. Birch arrived in person and explained that he had not been in Tacoma, nor had he visited the Broad Pass region, concerning which he had no information. He had actually been on the east slope of the Wrangell mountains, and had there seen some quartz veins that were of promise as prospects. On this slender basis, probably from an overheard conversation, the wild story was set afloat.

Morton Webber, with a corps of assistants, is now engaged in valuing the McIntire mine for the Nipissing Mines Co., which has an option on shares, and if the ore reserves prove equal to the vendor's representations, the option will be promptly exercised. The Nipissing has also taken an option on the Teck-Hughes. This is the first venture of the Nipissing into the Porcupine district, and it is interesting that its attention is directed toward promising properties instead of mere prospects. The Nipissing has been doing well lately. The war has not affected operations, as the mine has enough cyanide on hand to last until the middle of February.

The report of the American Smelting & Refining Co. for the six months ended June 30 showed a surplus of $1,956,691 available for dividends, as compared to $2,017,894 in the same period last year, corresponding to 3.91% and 4.03% respectively. In his accompanying statement, the president, Daniel Guggenheim, draws attention to the good showing made during a period of disturbance in Mexico, and adds: "the income account for the period shows surplus earnings over both preferred and common stock dividends to be $956,691." Details of the report will be given in another issue.

The disturbance incident to the war has not had any marked effect on construction and development work at Chuquicamata, Chile, and it is hoped that it will be possible to start the first unit of the leaching plant some time during next March. The electrical equipment for the power-house, transmission line, and electrolytic plant had been contracted for in Germany, but fortunately it had nearly all been shipped, and was either in Tocopilla or on board Chilean steamers when the war broke out. As the German ports are not yet blockaded, it is possible that even the small amount not yet shipped can be forwarded, and if not the American plants affiliated with the German company will undertake delivery. The difficulty with the management of the Antofagasta-Bolivia Railway Co. over water-supply has been practically settled,



MAP OF CHILE.

and was indeed never so serious as it appeared. Even if the Chile Copper Co. had been unable to secure the gravity supply from the Loa river, it could have secured a sufficient supply by pumping from a point within its own property lines. And there is a third source of water-supply also available, but at a considerable distance. The pipe for the water-supply line has been delivered, and is now being laid. Operations at the Braden have been much interfered with by the unusually hard winter which has been experienced there, but the

output for August, which is at the end of the winter in Chile, was 4,532,000 lb., the largest month in the history of the Company. This was largely due, though, to cleaning-up around the smelter. The output for the first eight months of this year has amounted to 18,315,000 lb., as compared with 11,056,000 lb. last year for the same period. The mill recovery during August averaged 72.7%. Shipments of blister copper have been diverted from Europe to New York. Nothing has been done recently in regard to the proposed leaching plant at Braden.

WASHINGTON

No Mining Legislation Probable This Session.—Conservation Bills.—Alaska Coal Land Leasing Bill.

Though there are a considerable number of bills in Congress bearing specifically on mining, it is generally conceded that they have no chance of enactment in what remains of this session. Some hoped for bills are thus deferred and some not desired are postponed and probably prevented from becoming law. M. D. Foster, of Illinois, chairman of the House committee on mining recently, said: "I see no chance for further mining legislation during this session of Congress, not even for the commission to codify the mining laws and the mine-rescue legislation. Most of the mining bills carry appropriations, and the leaders in Congress are set against granting any more appropriations for anything. It has to be tremendously necessary to get it by. No such pressure exists in mining legislation, however much desired. I am quite sure we will be able to get action in Congress on our more desired projects in the short winter session. There will then be no such pressure in the treasury, and after elections Congress is always more liberal toward legislation carrying money. It is only a matter of waiting a few months—six months. That we can do." However, the conservation bills are making their way through the House and they affect mining. They have not yet got through the House, and there seems no likelihood that the Senate will undertake to consider them at this session. An attempt was made last week to get the Senate to consider the bill granting the leasing of coal lands in Alaska. The bill has passed the House and came from the committee of public lands of the Senate with a report on it by Key Pittman of Nevada. He surprised the Senate by asking the body to consider the bill immediately. Mr. Shafroth of Colorado at once opposed this, saying: "I have very serious objection to a leasing system. I think it is wrong. I do not think it is expedient and I do not think it is practicable. This is a great measure and it seems to me that a proposition to put it through by unanimous consent cannot be seriously made." The Senate bill referred to requires that after the execution of surveys the President shall designate and reserve from use, location, sale, and lease 5120 acres of coal-bearing land in the Bering coalfields and 7680 acres in Matanuska coalfields to be mined under the direction of the President when it becomes necessary by reason of an insufficient supply of coal at a reasonable price for the requirements of government works, construction and operation of government railroads, for the Navy, for national protection, or for relief from oppressive conditions. The unreserved coal lands shall be divided by the Secretary of the Interior into leasing blocks or tracts of 40 acres each, or multiples thereof, in no case exceeding, however, 2560 acres, the leases to be awarded through advertising and competitive bidding to United States citizens or associations. There may be a consolidation of leases and holdings, but not beyond 2560 acres. It is a felony to get more in any manner. For the privilege of mining and extracting and disposing of the coal the lessee shall pay to the United States such royalties as may be specified in the lease, to be, however, not less than 2c. nor more than 5c. per ton, payable one month after the shipment of the coal from the mine. An annual rental is also required to be paid of 25c. per acre for the first year, 50c. for the next four years, and $1 per acre for every year thereafter so long as the lease runs. The leases are to be for not more than 50 years. To provide for strictly local and domestic needs, arrangements are permitted in the bill by which the Secretary of the Interior may issue limited licenses granting the right to prospect for, mine, and dispose of coals on specified tracts not to exceed ten acres and without payment of royalty for the coal mined. [Telegraphic advices state that the coal, petroleum, phosphate leasing bill passed the House Wednesday last.]

KALGOORLIE, WESTERN AUSTRALIA

Good Developments in the Golden Horse-Shoe Mine at 2900 Feet.—Calc-Schist Not Stopping Deep Prospecting.—Chaffers, Bullfinch, and Sons of Gwalia Mines.

In a cross-cut on the 2900-ft. level, in the middle of May, the Golden Horse-Shoe company cut No. 4 lode, 100 ft. east of the shaft, where it assays $18.36 per ton over a width of 15 ft. and carries visible gold and telluride. This is a very important development, because this lode was only 15 ft. from the Great Boulder boundary at 2630 ft., 39 ft. at 2780 ft., and is now 95 ft. at 2900 ft. At 2630 ft., the lode where cut assayed $25.42 per ton over a width of 7 ft., and at 2780 ft. $14.28 per ton over 16 ft., so that it has maintained its width and value to the lowest point yet reached. On all three levels the lode has also been proved to carry telluride and visible gold in places. Apart from these rich developments in the deepest levels, the Company has opened a practically new mine at the south end of its 24-acre property. Down to No. 12 level the ore-shoots in No. 2 and 3 lodes, which have provided the bulk of the mill supplies, since No. 4 lode originally passed into the Great Boulder ground at 950 ft., cut out before reaching 500 ft. south of the main shaft. On No. 13 level the shoot in No. 3 lode was worth from $6 to $8.64 to 800 ft. south of the main shaft, or 70 ft. south of No. 2 shaft. On No. 14 level the shoot was longer and assays from $7.68 to $28.56 per ton up to the Chaffers boundary on the south, a distance of 1100 ft. south of the main shaft. Similar results have been met with at both No. 15 and 16 levels, and the shoot in No. 3 lode has already been proved to extend as far south as No. 2 shaft at No. 17, 18, and 19 (2000 ft.) levels. The shoot in No. 2 lode has not been driven on to the same extent, but still it has been proved to continue in highly profitable ore as far south as No. 2 shaft, from the thirteenth to the sixteenth levels, whereas at No. 10, 11, and 12 it was very poor after passing 500 ft. south of the shaft. Several winzes between levels are now being driven to open this ore.

There appears to be some chance of its being proved that Malcolm Maclaren and other geologists were as premature in predicting the early demise of the Kalgoorlie-Boulder mines, because of the intrusion of calc-schists, as geologists were in the Kolar field of India a dozen years ago, because of an intrusion of a barren zone. In spite of Mr. Maclaren's pessimism, the managements of the Lake View Consols, South Kalgurli, and Oroya Links are continuing deeper development and report satisfactory results, and even the Kalgurli company is not quite satisfied that profitable ore will not be found in deeper ground, and continues prospecting by diamond-drilling.

Erection of the new plant on the Chaffers at Kalgoorlie is making slow progress and seems unlikely to be in operation much before the end of the year. The stack is the largest in the district, being 7 ft. 9 in. diameter. Sinking winzes to connect No. 15, 16, and 17 levels is making good progress, and the shaft has been re-skidded from the surface in preparation for the starting of the mill. The working capital called up since last July of $231,000 has been nearly all

spent, and the future success of the Company will have to depend chiefly on the revenue from the mill. The management has not followed John Morgan's (former manager of the South Kalgurli and who reported on the Chaffers) advice given in May, 1912, to sink deeper for the rich ore being opened in the Horse-Shoe. The deepest level in Chaffers is 2261 feet.

On December 31, 1912, ore reserves of the Bullfinch mine at Southern Cross, above 210 ft. were given as 177,300 short tons assaying $13.10 per ton, of which 117,300 tons was in No. 3 northern series. Although only 29,900 tons was treated from here during 1913, the ore reserves at the end of 1913 included no ore in No. 3 northern series above 210 ft., and only 24,700 tons above 310 ft. This shows that the result of the creep or collapse of ground was the loss of 87,400 tons above 210 ft., and a curtailment of development at 310 ft. In fact, very little development has been done on No. 3 series since the creep, and during the last half-year monthly progress reports do not refer to it. Shaft-sinking has been entirely suspended for the last 18 months, and this may be accounted for by the fact that, in 1912, a diamond-drill hole from No. 3 level cut granite at a depth of 400 ft. at a distance of 700 ft. east of the main shaft.

Prospects of the Sons of Gwalia mine at Leonora appear to be improving at depth. The lode at No. 17 and 18 levels was poor, owing to the intrusion of epidiorite, but, at No. 19, the shoot for a length of 1100 ft. contained ore assaying $8.40 for the full width of the drift. A winze below this level, sunk 149 ft. to the horizon of No. 20 level, was in ore assaying $14.88 per ton over a width of 62 in. At the bottom of this winze a drift put in 100 ft. assays $22.26 per ton over 116 in. A prospecting shaft is being sunk in the northern section of the property to try and pick up an ore-shoot beyond the epidiorite intrusion.

Gold production of the state in June was $2,145,400, with $476,000 in dividends. Yields of the principal mines were approximately the usual average given in former issues of this journal.

TORONTO, ONTARIO

Conditions at Cobalt.—Dome Gold Yield.—Iron and Steel Companies' Position.—Consolidated Mining & Smelting Co.'s Dividend.

The short-lived period of depression in the Cobalt silver industry, following the outbreak of the war, has passed away, and the output is again normal, shipments going forward freely to the smelters. On September 8 the Kerr Lake, after a three weeks' suspension, resumed with a full staff. The Drummond Fraction is resuming with 25 men. Shareholders of the Bailey mine are being asked to oppose the sale of the property for debt. It is stated that a deliberate attempt is being made to wipe out the stockholders' interests, and a protective committee has been formed to fight the sale.

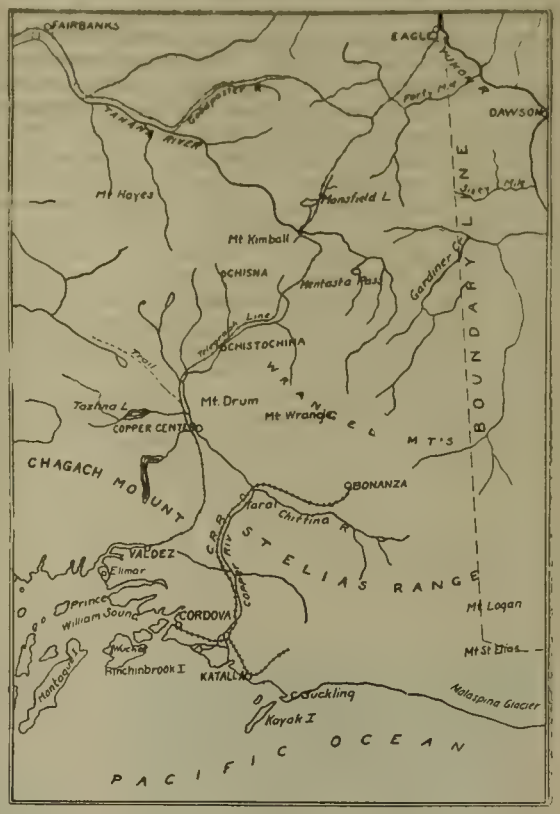
The output of the Dome for August was the largest since January, amounting to $90,893. The amount of ore treated, 20,170 tons, exceeded that of any previous month, and the average value was $4.50 per ton.

Whatever may be the outcome of the movement to induce the iron and steel manufacturers to pursue a policy of expansion, with a view of capturing a portion of the German export trade, the present condition of depression is reflected in the passing of the dividends on deferred and common stocks by the Nova Scotia Steel & Coal Co. The president, R. E. Harris, in a circular to shareholders, states that this action has been taken in view of trade depression which has been emphasized by the European war. It certainly will not tend to restore confidence, especially if, as is considered likely, it foreshadows a similar course on the part of the Dominion Steel Corporation, which is in a distinctly less favorable position than the Nova Scotia.

CORDOVA, ALASKA

Changes at the Bonanza.—Jumbo Developing Favorably.—Mother Lode, Great Northern, and Other Copper Mines.—Nabesna, Nazina, and Chisana Placers.

The capacity of the mill at the famous Bonanza mine, owned by the Alaska Syndicate, has been increased within the past few weeks from 300 tons to 500 tons per day. The development work is going forward and is now down to a 700-ft. level with an incline something over 1300 ft. long, still in a splendid body of ore. As is well known, great quantities of high-grade glance are found in this property, ranging from 60 to 72% copper. The development work is still opening up large bodies and the ore is brought to the mill over an aerial tram three miles long. Another aerial tram is being erected



MAP OF CORDOVA DISTRICT.

from the millsite to the Jumbo property which belongs to the same people. This tram will be 3½ miles long and will be completed before winter. The Jumbo lies on the same contact as the Bonanza and promises to be even a better producer than the Bonanza. They are now down below the 400-ft. level and the ore taken out has paid for all development up to date, notwithstanding that it has been hauled to the mill by team.

The Mother Lode copper mine, lying twenty miles distant by trail and on the opposite side of the mountain from the Bonanza, is owned by New York people, of whom James J. Godfrey is president. Last winter this Company shipped 500 tons of high-grade ore to the Tacoma smelter, hauling it over snow and ice. Development work has gone steadily ahead and the property is said to be looking well, but no ore is shipped because of the lack of transportation.

Work on the Alaska United Copper & Exploration Co.'s group of claims at the head of Dan creek, known as the West-

over group, is being pushed by the superintendent, Mr. Foster. They have a vein of solid bornite ore 8 ft. wide with a depth of 400 ft. All this property needs is a railroad connection to put it in the shipping class. This is also true of a group of claims owned by the same company at the head of the Kuskalina, and known as the Finch group. The Tjosevich property, directly across the Kennecott glacier from the Bonanza mine, is being examined by representatives of the Granby company, and nothing but assessment work has been done on this property this year. This is also true of the Great Northern Development Co.'s properties on the Kotsina and Kennecott rivers, in which James J. Phillips, Jr., of New York, is largely interested. These properties are being patented, and over half a million dollars has already been expended in developing an enormous body of ore ranging from 3% to 8%. If the government would permit the coal of Alaska to be used for smelting purposes, this property would be a big producer. Development work is still going forward on the Hubbard and Elliott copper properties on the Kotsina. The Alaska Copper Corporation, which owns the Rarus and Nugget groups of claims on the Kuskalina, Alfred B. Iles, superintendent, is arranging for transportation to connect with the C. R. & N. W. R. R. at Strelna. The California-Alaska Mining & Development Co., A. E. Lathrop, manager, has proved its copper properties in the Kotsina, and is patiently awaiting the construction of a railroad into this district before beginning active mining operations. There are 18 claims in the group.

The Nabesna district has been thoroughly examined by representatives of the Alaska Syndicate this season. Henry Bratnober, the veteran mining man of Alaska, had been developing claims here for the past six years. Its future development wholly depends upon transportation. Should a government railroad reach the area, it will open the largest field for tonnage in Alaska outside of the Kennecott district.

The placer fields of the Nazina district show much more activity this year than ever before. George Max Esterly and Ham S. Andrus have two hydraulic plants fully equipped and in operation, one on Chittitu creek and the other on Rex gulch. Both are driving into a 42-in. flume, with two 4-in. giants, and using a 5-in. giant for stacking tailing. Up to August 1 they had moved more yardage than in any one year since they began operations, and a good clean-up is promised. Forty-two men are employed. H. G. Birch is operating a similar plant on Dan Creek Mining Co.'s ground on Dan creek and using 25 men. This is the first year's active operation on this property, and a very fine showing was made up to August 1. Bert Carvey is operating a small plant and working four men on the bench gravel of Rex gulch and taking out gold. George W. Brooks has a small hydraulic plant in operation on No. 14 Rex, using ten men and mining good gravel. This is the first year's operation of this plant. Coppis, Kernan, Taylor, Stanton, and Sorenson are shoveling in on Chittitu, Rex, and White creeks, using a few men each, and all doing well. Cliff Cayantte has struck good gravel on the bench ground on Dan creek. He is using five men shoveling in and is taking out from $300 to $400 per day per man, according to current rumor. This man deserves great credit for tenacity, having held this property for the past ten years, working in the summer to get a grub stake, and in the winter driving a tunnel in order to tap what appeared to be an old channel. This year he succeeded in running the tunnel through, and is now getting his reward. Murray and Stevenson are building a small hydraulic plant on Young creek, another tributary of the Nazina, and claim to have pay ground. De Witt, Balduff and Maxwell are sluicing on Reader gulch, and Erickson on Upper Young. As was said, much more activity is displayed in this district this year than ever before since the discovery of gold in 1902. Work will continue at least until October 1, and the output is variously estimated by the operators from $350,000 to $750,000.

The Chisana district has not developed into the producer that was hoped or expected. Still, it has not had a fair chance. Provisions were scarce, the proper machinery lacking, and no real prospecting done. The total output will be close to $200,000, and it is believed by those best posted that with proper machinery and intelligent work, this district will become a large producer. Surely there is nothing more discouraging in this camp than was encountered at Fairbanks the first two or three years, except the lack of transportation, Fairbanks having had the advantage of the two large rivers, the Yukon and the Tanana. But should the government railway be constructed so as to tap the Nabesna copper district, this would be overcome. The situation throughout this part of Alaska is very encouraging, and large development is looked for in the next few years.

JOHANNESBURG, TRANSVAAL

TRANSVAAL TIN-MINING INDUSTRY SUFFERS FROM LOW PRICE OF METAL.—ALBU GROUP OF MINES.—MESSINA COMPANY'S AFFAIR.

The low price of tin during June caused some uneasiness to the holders of tin shares in this state. That month's price of Straits tin was £136 or so per ton, compared with £202 last June, and £228 in January 1913. The Transvaal tin-mining industry is comparatively new, but its history is an interesting one, and the losses incurred in speculating in tin properties have been abnormally heavy. Practically the whole of the tin concentrate produced in South Africa is shipped to the Straits Settlements. The output during May was 319 tons valued at £25,956. Owing to the patchy nature of the tin deposits, it has taken several years to establish the industry in the northern Transvaal, where most of the tin mines are situated. It has been suggested by the *South African Mining Journal* that, considering the low price of the metal the mines ought to close down.

In common with all mining groups on the Rand, the experience of the Albu group, or General Mining & Finance, as it is called, has been disappointing during the past year. Controlling some important properties, extending from one end of the Rand to the other, this corporation has always faced the mining difficulties encountered by its subsidiary companies with more than ordinary boldness, and rendered more liberal assistance than many of the other controlling groups. Mines operated by this Company include the New Goch, Roodepoort United Main Reef, Cinderella Consolidated, Rand Collieries, Meyer & Charlton, Van Ryn, and West Rand Consolidated.

Some startling revelations have been made to the shareholders of the Messina Development Co., owner of the well known Messina copper mine in the northern Transvaal, by the report of Price, Waterhouse & Co. of London on the affairs of the Company. Some time ago the failure of Chaplin, Milne, Grenfell & Co. and the Canadian Agency were announced, but little was it expected that the Messina company would be involved in the failures. It now appears that it has discounted bills accepted by the defunct firms amounting to £71,000, and that arrangements have had to be made with the National Bank of South Africa to enable the Messina company to meet its present financial requirements. Loans to the Canadian Agency amounting to £183,000 have been made by the Messina against various securities, some of doubtful value, and to most of the shareholders the disclosures have come as a great shock. The Messina is the only copper mine at work in the Transvaal, and considerable capital has been expended in making a railway to the mine. The mine is situated in the northern extremity of the state, above Pietersburg, not far from the Rhodesian frontier, and unlike other copper lodes in that neighborhood, metal contents continue to a fair depth.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press

ALASKA

Chisana

After September 15 the postoffice at Chisana was closed, in spite of protests of the governor and residents of the district. About 150 people will winter there. Gold output so far is placed at between $250,000 and $300,000.

Juneau

The Alaska Treadwell 240 and 300-stamp mills worked 30.74 and 30.62 days, respectively, in August, crushing a total of 81,596 tons of ore. Gold saved by amalgamation was $155,636, and by cyaniding 1942 tons of concentrate $157,158, a total realizable value of $309,666, an average of $3.83 per ton. Operating expenses were $81,575, and construction $11,590, leaving a net profit of $216,501. Mine development amounted to 530 ft., and the stock of broken ore decreased 54,387 tons.

Nome

The Bangor dredge is in operation. W. W. Johnson, of the Union Construction Co. of San Francisco, has been in charge of construction.

Port Wells

The Granite mill was shut down for 19 days in August, on account of repairs to the concrete foundation. Gold from the plant worth $14,000 was taken to Valdez early in September. The output is now about $1000 per day.

ARIZONA

Cochise County

The Copper Queen smelter at Douglas is to receive custom ores again in a few days, while it is probable that the Calumet & Arizona plant will do likewise. The Warren mining district shows marked improvement of late.

A meeting of creditors of the Tombstone Consolidated Mines Co. is to be held in Bisbee on October 7, when the final report and dividend from this bankrupt concern will be discussed. The property now belongs to Phelps, Dodge interests.

Gila County

The administrator of the estate of F. L. Dupen, who was killed in the Miami mine last June, is suing the Company for $60,000.

Greenlee County

As the Shannon Copper Co. has sold no copper since July 30, the mines and smelter have been shut down indefinitely. The properties produce about 750 tons of ore per day and 1,000,000 lb. of copper per month. Over 500 men are employed. Old employees are offered Company's houses free of rent.

CALIFORNIA

The total value of all mineral products of this state last year was $100,791,369, against $93,219,149 in 1912, according to the U. S. Geological Survey. Some of the principal yields were as follows:

Product.	1913.	Value.	1912.	Value.
Oil, barrels	97,788,525	$45,709,400	87,268,536	$39,616,387
Gold, fine ounces	987,187	20,406,958	953,639	19,713,478
Cement, barrels	6,018,262	8,896,734	6,093,790	8,215,894
Copper, pounds	34,575,007	5,359,126	33,451,672	5,519,526
Clay products	.....	5,344,958	.....	5,912,450
Quarry products	.....	4,118,935	.....	3,902,313
Borax; asphalt	.....	3,200,000	.....	.....
Natural gas	.....	1,883,450	.....	1,134,456

California is first among the states west of the Mississippi river and fifth among all the states in value of its mineral production.

Oil production of California in August was 9,034,853 bbl. from 5984 wells, an increase of 65,158 bbl. over July. Shipments amounted to 7,971,224 bbl., a decrease of 300,000 bbl. compared with July. Stocks were 54,018,481 bbl. on September 1, against 52,954,852 bbl. on August 1.

Amador County

(Special Correspondence.)—For the first time in the history of California, a first-aid contest was held at the picnic grounds, between Sutter Creek and Jackson, on Labor Day, September 7. Teams were entered from Amador City, Sutter Creek, and the Kennedy mine at Jackson. A team also started from Plymouth, but owing to an automobile break-down did not reach the grounds in time to participate. Results of competitions were as follows: first prize, Kennedy team, $65 cash, general average of team, 99%; second, Amador City, $30, average 97%; and third, Sutter Creek, $20, average 94%. The Kennedy mine team was composed of the following: H. E. Stewart, captain, R. White, Wm. Dougherty, Gordon Ireland.

TEAM FROM KENNEDY MINE WHICH WON FIRST PRIZE, AT LEFT; TEAM FROM KENNEDY MINE ILLUSTRATING METHOD OF PREPARING MAN WITH INJURED SPINE FOR TRANSPORT ON MINE CAGE, IN MIDDLE; AMADOR CITY TEAM AT WORK, AT RIGHT.

John Church, and Nick Snell. Amador team: L. C. Cain, captain, O. Anderson, Williamson, J. Brown, E. Worth, and D. Kelley. Sutter Creek team: Henry Loge, captain, Wm. White, Gustave Schroder, Fr. Gehirohi, James Jury, and W. R. Forbes. The judges were Dr. Gall, Dr. Endicott, and S. E. Robbins. Contributions to prizes were as follows: Miner's union, $50; Mr. O'Brien, superintendent of Original Amador mine (for winning team), $20; Kennedy mine, $5; Argonaut mine, $5; South Eureka mine, $5; Central Eureka mine, $5; Keystone mine, $5; Bunker Hill mine, $5; Treasure mine, $5; Fremont mine, $5; and Plymouth mine, $5; a total of $115. The contest was a part of the program at the miners' picnic. It was watched by a large crowd of interested spectators who favored the contestants with much good (?), if unsought, advice, and seems to have aroused more interest in 'first aid to the injured' work than has ever been stirred up in the state.

Jackson, September 19.

A spirited drilling contest was held at Jackson on Labor Day, but owing to the soft character of the rock the local champions' drill stuck at the tenth minute of the fifteen.——Rescue-car No. 5 of the U. S. Bureau of Mines is to be at Jackson from September 28 to October 5. It is now at Colfax.

The Bunker Hill company paid its monthly dividend of $5000 last week. This makes $45,000 for the current year and $746,000 to date. Work at 1950 ft. is encouraging.——The Fremont Consolidated also paid $4000, making $36,000 for 1914 and $254,000 since starting.——The Brunswick Consolidated company has declared dividend No. 5, of 6%, or 6c. per share, amounting to $23,717, payable October 15. This makes a total of 27c. per share in dividends paid by the Company and 18c. per share paid in 1914. The total authorized capitalization is 500,000 shares of the par value of $1 per share, and the total number of shares issued is 395,287.

Placer County

The Placerville Gold Mining Co., an English concern, was operating the Pacific mine at Placerville before the war, but has since leased it to P. D. Burtt and J. H. Santo. The mine has had a good record for production.——The Church Union quartz and placer mines may be reopened soon, as a writ of attachment has been released.

Plumas County

At the Bellevue gravel mine, on Wallace creek near La Porte, 10 men are washing tailing, which will take several weeks yet. A 3400-ft. adit was being driven when the war started, Scotch people being heavily interested, but they have decided to continue work.——Eight men are employed at the Motor gravel mine, near Port Wine, and gravel will soon be extracted.

Shasta County

It is reported that 18 ft. of manganese ore has been discovered near Heroult by T. P. Peterson of Redding. It is just across the Pit river from the Noble Electric Steel Co.'s smelter.——No furnaces are in blast at the Mammoth plant, owing to a general overhauling of the bag-house, and building of new tracks about converters, and additional cooling pipes for fume.

Sierra County

A pipe-line is being constructed for the Wide Awake gravel mine near Downieville, to wash some good ground opened. ——Twelve men are at present employed at the Miners' Home mine at Howland Flat.

Trinity County

Twelve men are prospecting the Paulsen ranch, near Lewiston, for dredging purposes.——The Trinity Asbestos Co. has the installation of machinery for its new plant, 27 miles from Carrville, well under way. The first unit will have a capacity of 50 tons of asbestos per day. A large tonnage of ore is available. Oakland people are heavily interested.

Tuolumne County

(Special Correspondence.)—A new company has become interested in the Atlas mine, near Tuttletown, and operations have been resumed. The one-mile adit being driven to cut the workings of the Springfield Tunnel & Development Co.'s property is in over 1600 ft., and better progress is being made owing to a more favorable condition of the rock formation. Development has been in progress for several months at the Louisiana mine, near Tuolumne, and prospects are good at this time. A rich development has just been made on the 700-ft. level of the Providence, southeast of Tuolumne, which has for the past few years been operated by the New Providence Gold Mining Co. The extent of the new orebody is not yet known. The rock is speckled with gold, besides containing high-grade sulphide.

Sonora, September 12.

COLORADO

Gilpin County

Lessees in the Carr mine are doing fairly well, as is shown by the following table of recent shipments:

Lessee.	Tons.	Gold, oz.	Silver, oz.	Copper, %.
Boyd and Co....	4½	2.75	6.77	6.20
Boyd and Co....	2	2.60	5.40	3.00
Holmes and Co...	3½	2.22	8.03	7.73
Eatwell and Co..	3½	3.78	5.90	3.65
Terrill and Co..	2½	1.50	3.50	1.35
Curnow and Co..	3½	2.00	4.00	6.60
Holmes and Co..	6½	1.70	5.00	6.00
Sylvester and Co.	5¾	1.98	3.68	2.00
Williams and Co.	9½	1.11	3.23	1.10

The last three on the list represent concentrate from the Stroehle plant.

Gunnison County

The Good Hope gold mine at Vulcan is being unwatered, and mining is to be resumed. The shaft is down 700 ft., and good ore is said to exist above this point.

Saguache County

Rich gold-bearing ore is reported to have been discovered on the Baca land grant, near Crestone, recently thrown open to prospectors. B. F. Tripton, of Cripple Creek, is in charge of the mineral area of the estate.

Teller County (Cripple Creek)

Practically all of the Cripple Creek holding corporations with producing companies are taking advantage of the ruling of John W. Sheafor, district judge, relative to becoming coplaintiffs with the Granite and Vindicator companies in the suit decided in their favor. On September 12 the Gold Dollar, Petrel, Gold Sovereign, and Pharmacist companies filed their petitions. Under the judge's ruling, the assessment on producing mines will be reduced 3.33 mills, the determined illegal over-assessment.

There is said to be a shortage of cyanide for some mills in the district, especially the Neville, Wild Horse, Isabella, and Gaylord.

Work has been resumed on company account at 1100 ft. in the Gold Coin shaft of the Granite company, which is situated in the centre of the town of Victor. Dan McCarthy is superintendent.——Ore containing about 5 oz. gold per ton has been shipped from 1100 ft. in the South Burns shaft of the Acacia company.——The Gaylord plant is working again. August returns were $3600.——Development in the Elkton is decidedly encouraging of late.——About 700 tons of $20 ore is being extracted from the Abe Lincoln mine per month by Hahnewald Leasing Co., and eight sets of sub-lessees. Prospects are good.——The Cresson Consolidated has taken over the Maggie properties.

The annual report of the Jerry Johnson Gold Mining Co. has been published. All ore mined has been from old stopes

at 300, 400, and 450 ft. The only encouraging development is the opening of good ore 300 ft. from the main shaft. A total of 3369 tons of ore was shipped worth $78,672. Freight and treatment cost $21,942. Royalties received were $14,057. At August 31, 1914, the cash balance was $30,727. The mine is under lease to Frank Caley up to January 1, 1919, provided he erects a 50-ton mill by the beginning of 1915.

MICHIGAN

Houghton County

The Michigan College of Mines is offering special short courses for miners, millmen, and smeltermen, which is something new for this institution. Regulations for entrance are few.——Excellent progress is being made in cross-cutting in the South Lake mine, records of 55 and 60 ft. being made in five days respectively, and 200 ft. for the past month. Average distances driven in this district are from 130 to 150 ft. per month.——In testing about 10,000 tons of 'rock' from the Franklin's Allouez conglomerate lode at the Allouez-Centennial mill, a recovery was made of 14 lb. of copper per ton. Loss in tailing was nearly 7 lb. per ton.——After spending over $2,000,000 in exploration, the Winona company's mine is filling with water.

MISSOURI

Jasper County

Heavy rains have flooded a number of mines during the past week. The East Hilltop mine of the Oronogo Circle company was badly damaged.

MONTANA

Fergus County

Estimated gold yield of the Barnes-King company in August was $27,400 from 4200 tons of ore, with $10,000 profit.

Silverbow County

At its 11 operating shafts the Anaconda company has 2800 men on night and 3000 on day shifts.

NEVADA

Clark County

Rich gold ore from the Boss mine of the Goodsprings district is reported to contain high platinum content, and is confirmed by Ledoux & Co. of New York and the U. S. Geological Survey.

Elko County

(Special Correspondence.)—Mill tests which the Eastern Star Mining Co. has been conducting in San Francisco have been completed, and it is announced that a 10-stamp cyanide mill will be built, construction to start as soon as the surveys can be made and mill plans drawn. The mine is in the Gold Circle district in the western part of the county. The tests were conducted by the California Ore Testing Co. under the supervision of W. B. Chidester, who will have charge of mill construction for the Eastern Star Mining Co. The tests show an extraction of 96.2% gold and 84.4% silver, a total extraction of 94.5%, in a 24-hour treatment, crushing in solution. The capacity of the mill will be about 60 tons per 24-hour day.

Gold Circle, September 18.

Humboldt County

About a half-mile per day of the new line into Rochester is being laid, according to A. A. Codd, and less than six miles remains to be completed. The 60-hp. engine and frame of a Winton automobile was placed on light railroad trucks and acts as a locomotive to haul material for the line.

Contracts have been let for the complete mill of the Rochester Consolidated Mining & Milling Co. It is of 100-ton capacity and is to contain the following machinery: Blake jaw-crusher to crush 100 tons in 8 hours, ten 1550-lb. stamps of Allis-Chalmers manufacture who also supply other machines, Dorr classifiers, two 5 by 18 ft. tube-mills, Dorr thickeners, Dorr agitators, Dorr continuous decantation system, zinc boxes and sampling plant. All will be motor driven from the Nevada Consolidated Power Co.'s plant. Back-geared motors will be used to drive the stamps.

There are no troubles with gas now in the Seven Troughs Coalition mine. The daily output of ore is 40 mine-cars assaying $100 per ton. Ore at 1200 ft. is still high grade.

Lyon County

Ore received at the Mason Valley smelter during the week ended September 16 totaled 2461 tons, of which 1870 tons was from the Mason Valley mines, and 389 tons from the Nevada-Douglas. A rumor that the plant was to be stopped is without foundation.

Mineral County

At a distance of 4400 ft. from the mouth of the adit, rich silver-lead ore has been opened for 130 ft. in the Lucky Boy property at Lucky Boy. This is at a depth of 600 ft. vertical. The adit is to be continued to the Hubbard shaft, about 1400 ft. ahead of the present face, and all virgin ground. Stoping is to be started on the orebody.

Nye County

At 200 ft. in the White Caps, at Manhattan, the lode is 24 ft. wide, averaging $20 per ton. A raise in this shoot shows higher grade ore. Oxidized ore ready for treatment is worth $40,000.——A new system of handling ore from the Big Pine open-cut is now in operation. A Blake crusher is working at the collar of the main shaft, and breaks ore hoisted from 200 ft., to where it is dropped from the open-cut, where two men mine 200 tons per day. After passing over grizzlies, the oversize, assaying 60c. per ton, is trammed to the waste dump, representing 48% of the total product. By this means the ore milled is three times the value of the ore before separated by crushing and screening. Tests are being made to see if the ore cannot be sent direct to a tube-mill from the crusher, eliminating the stamps.——Sampling and testing at the Commercial mines has been suspended temporarily. Only two 200-ft. holes were drilled.

Tonopah mines produced 10,094 tons of ore, worth $207,680, during the past week. In August the Belmont yield was 315,286 oz. bullion from 15,455 tons, with a profit of $128,582. ——The Tonopah Mining Co. produced 227,610 oz. silver and 69 tons of concentrate from 11,970 tons of ore, with $84,020 profit.——Jim Butler profits were $20,951 from 4096 tons. Profits for the year total $199,921.

NORTH CAROLINA

Montgomery County

The property of the Candor Mines Co. has been bought by the Martha Washington company, which is developing the adjoining property, and will use the Candor mill for treating its ore. The Candor mine is now shut down, and operations in the Uwarra are at a low ebb.

UTAH

Juab County

A large cave-in in the Centennial-Eureka mine on September 17 resulted in 12 miners being buried. Rescue work was difficult.——No ore is to be shipped from the Grand Central mine until the market improves, but development continues at 600, 800, and 1000 ft., also shaft repairing.——Machinery is arriving for the new concentrating plant of the Chief Consolidated mine.——To treat the lower grade ores of the Victoria mine, the manager, J. C. Lynch, states that a mill and cyanide plant may be erected next year.

Salt Lake County

The Ohio Copper Co.'s property is in the hands of receiv-

ers, and the mine and mill have been closed indefinitely. About 250 men are affected.

SUMMIT COUNTY

Work at the Daly-Judge mine and mill was resumed on September 18 and 20. The main shaft has been retimbered in places, development done, and the mill overhauled.

WASHINGTON

FERRY COUNTY

The Lone Pine, Pearl, and Surprise mines of the defunct Republic Mines Corporation are now controlled by West Virginia people, and J. L. Harper and other Spokane associates. The properties are under a three-year bond for $200,000, $10,000 having been paid. The San Poil mill is also to be taken over under a four-year bond for $185,000. The new syndicate is negotiating for the Last Chance and other claims at Republic.

CANADA

BRITISH COLUMBIA

The Standard Silver Lead Mining Co. has cut its monthly dividend for September to 1¼c. per share, corresponding to a dividend of $25,000, making $1,550,000 paid since April 1912. Shipments are now suspended, and the earnings in July were only $30,550, as only 25c. per ounce has so far been advanced on silver. The cash on hand at July 1 amounted to $226,315.

ONTARIO

The Nipissing company produced silver worth $212,965 in August, but only shipped $69,855, the balance being stored at the mine. Prospecting by hydraulicking revealed a vein of low value. Vein 98 is now 540 ft. long and 65 to 80 ft. high. The Little Silver branch vein at shaft 63 is 2 in. wide, assaying 2500 oz. per ton. The Company is being sued for $5000 by A. Brazeau, who alleges that he was injured in the mine this year. Development at the Teck-Hughes at Kirkland Lake, which the Nipissing has under option, has opened a vein parallel to the main orebody.——During the first 18 days of August the Alexo mine shipped a total of 564 tons of nickel ore to the Mond Nickel Co. at Coniston.

MEXICO

(Special Correspondence.)—A scarcity of labor is retarding extensive mining, milling, and smelting operations in the state of Chihuahua, according to recent reports. Recruiting for the army of General Francisca Villa, which was carried on up to a short time ago, is said to be principally responsible. However, it is expected that many Mexican laborers will now return to Chihuahua districts from copper centres of the United States, where operations have been curtailed. The Chihuahua smelter, one of the American Smelting & Refining Co.'s plants, is operating only two furnaces. While in San Francisco recently, R. M. Raymond, director of the Exploration Co., Ltd., London, stated that the El Oro Mining & Railway Co., one of the concerns controlled by the Exploration company, would be soon operating again on a large scale. He said that the Company was fortunate in having on hand a large supply of cyanide, shipments having arrived after operations were suspended. It is understood that some of the other important mining concerns of Mexico also have plenty of cyanide in stock as a result of the arrival of shipments during the late trouble. No arrangements have yet been made for the resumption of work at the Zacatecas camp of the Santa Rosa Mining & Milling Co., another concern controlled by the Exploration company. Pachuca and Guanajuato companies are resuming work in those districts. In the state of Jalisco, the Amparo and Cinco Minas companies are operating in a limited way, and work probably will be in progress soon at the Casados, El Favor, Mololoa, Espada, and Amajac camps. A decision to resume mining and milling has been reached by the American company owning the Lluvia de Oro gold mine in western Chihuahua. This Company maintains its shipping agency at San Blas, on the Southern Pacific Railroad of Mexico. T. H. Pomeroy, an oil man from Tampico, who arrived here a few days ago, reports that lightning recently fired a lake of oil at the big Potrero del Llano gusher of the Pearson interests south of Tampico, and that when he left that Mexican port the destruction of the well was feared. The Dos Bocas well, the first large gusher brought in by the Pearson interests, was burned out a few years ago. The Potrero del Llano was credited with a capacity of 100,000 bbl. daily, and was the greatest gusher of the Tampico before the Corona.

San Francisco, California, September 21.

Direct trains between Mexico City and El Paso, Texas, without stopover or change of cars by passengers, were started by the Constitutionalist authorities on September 9. They were interrupted September 23 on account of threatened trouble with Villa, whether temporarily or not is uncertain. *The Mexican Herald* came through from Mexico City to San Francisco, California, in 7 days. The service from the capital to Nuevo Laredo, Tamaulipas, was resumed September 12. Also a service from the capital to Manzanillo and Guadalajara, with a change of cars at Colima. The line from San Luis Potosi to Tampico is in working order; and repair work between San Francisco and Vera Cruz is nearly finished. All is quiet in the states of Tepic and Sinaloa, and work is being resumed by some Americans and other foreigners. Coal mines in Coahuila are being operated again, and damaged towns are being repaired. Federal troops are being disbanded by the Constitutionalists. Military passes are not required by persons leaving Mexico City, save officers of the former federal army. Prices of corn and sugar have been lowered, and a fine will be inflicted on attempts to sell above the fixed price. On September 13 there was a great demonstration in honor of the late President Madero. His clothes are now in the Museum. *Bonos* or treasury notes issued by Carbajal are to be withdrawn from circulation, and ₱5,000,000 of Constitutionalist notes in 10, 20, and 50 *centavos* have been circulated. Business with New York has been done at 20 to 25c. per *peso*. There is still a disturbance in Sonora, and Villa with an army of about 5000 men is to proceed against Governor Jose Maria Maytorena and Gen. Benjamin Hill who renounced the Carranza government. After this campaign, part of the army will move against former federal garrisons in Lower California who have refused to surrender.

MAP OF MEXICO.

PERSONAL

C. A. Rodgers has gone to Mazatlan.

Address of B. Frank Hand is wanted.

Karl Eilers returned from Europe on September 16.

C. R. Corning has returned to New York from Bolivia.

Stephen Birch has returned to New York from Alaska.

Morton Webber has gone to Porcupine on professional business.

Gelasio Caetani left for Rome Friday. He hopes to return in February.

R. E. Hore is soon to be married to Miss Morrison at Calumet, Michigan.

Donald F. Irvin sailed September 15 from Boston for Costa Rica and Havana.

James Whipple is in the hospital at Los Angeles suffering from stomach trouble.

A. W. Geiger is back from Eagle River, Alaska, and has been in Trinity county.

Ralph Stokes, who returned to England to join the army, is a veteran of the Boer war.

Alton L. Dickerman is at Houghton, Michigan, after an extended trip through the East.

E. C. Morse is now superintendent of the mill at the Ogle Mt. mine, at Scotts Mills, Oregon.

J. Kojima, metallurgist for the Ashio Copper Co., is expected to arrive in New York early in October.

Richard L. Grider is making an examination of placer properties on the Tipanni river, Bolivia.

George H. Garrey is at present making a geological examination of zinc-bearing lands in Tennessee.

C. M. Eye will sail for Manila on the *Manchuria* today, the sailing of the *Minnesota* having been canceled.

Theodore J. Hoover is on his way to California, where he expects to stay a few weeks, returning to New York.

Heinrich Ries has returned to Cornell from Europe, where he visited the iron deposits of Lapland and the mineral districts of Bohemia.

H. M. Zeisemer and F. B. Anderson, consulting engineers for the Copper Queen, recently examined the Commercial holdings in Copper Basin.

Owing to interruption of steamer schedules by the war, Ferdinand McCann went to Mexico from Hong Kong by the Japanese line instead of to the Argentine by way of the Suez.

J. M. Callow, president of the General Engineering Co., of Salt Lake City, left last week for Miami, Arizona. He will go from there to Superior to inspect the Magma Copper Co.'s mine.

Arthur L. Walker is returning to America from Kyoto, having decided to cancel his trip through Korea and China, on account of the war. He will visit smelting plants in the western United States before returning to New York.

John R. Stanton has been elected president of the Mohawk and Wolverine mining companies, succeeding Joseph E. Gay. Frank M. Stanton succeeds his brother as treasurer of these companies, and G. W. Drucker has been succeeded by J. W. Dunston as director of the Mohawk, but the vacancy has not been filled in the Wolverine.

The American Institute of Mining Engineers will hold its next annual meeting in New York City, beginning February 16, 1915. Papers for this meeting should be with the secretary not later than November 23.

The American Mining Congress will meet at Phoenix, Arizona, from December 7 to 11, inclusive.

SOCIETY MEETINGS

	Date.
OCTOBER	
Colorado Scientific Society, Denver	3
American Institute of Electrical Engineers	9
American Institute of Mining Engineers, Pittsburgh	10
American Iron and Steel Institute	23-24
NOVEMBER	
Colorado Scientific Society, Denver	7
American Institute of Electrical Engineers	13
DECEMBER	
American Society of Mechanical Engineers	7-8
American Mining Congress, Phoenix, Arizona	7-11
American Institute of Electrical Engineers	11
American Museum of Safety	11-20
FEBRUARY 1915	
American Institute of Mining Engineers	16
AUGUST 1915	
Geological Society of America, San Francisco	17-20
SEPTEMBER 1915	
International Engineering Congress, San Francisco	20-25
American Institute of Mining Engineers, San Francisco	27-30

Obituary

Caradoc James, well known in Western Australia and London, and recently metallurgist at the Tarquah mine, West Africa, died at sea in July on his way to England from Africa. He had been in that territory for several years, with the usual long vacations necessitated by the climate.

C. A. Stewart died on August 28 at Westhampton, Long Island, following several operations which he had undergone in the spring. He was a graduate of Columbia and Cornell universities, having taken his Ph.D. in geology at Cornell. He was later appointed professor of geology in the State University at Idaho, where he did notable work and had made much progress toward securing the establishment of a state geological survey. Last spring the state of his health made it necessary for him to come to New York to undergo an operation, a second proved necessary, and he did not recover from its effects. He was one of the most brilliant of the younger geologists, and if his life had been spared a few years more he would have made a notable mark in his chosen profession. He leaves a widow, to whom the sympathy of his many friends is extended.

James Porter Evans died suddenly of pneumonia at his home in Denver on Sunday evening, September 13. He was born at Zanesville, Ohio, November 29, 1860, and went to Denver in 1881 to engage in the railroad business, rising through various positions to that of auditor for the Denver & Rio Grande railroad. In 1895 he went to the Colorado Iron Works Co., of which he was vice-president and general manager at the time of his death. His activities in connection with the development and manufacture of mining and smelting machinery brought him into intimate contact with many men of note, and in his sudden demise the mining industry loses a prominent figure. Mr. Evans had drawn to himself a wide circle of friends to whom he had endeared himself through his upright character and genial disposition. Upon these his loss will fall as a personal bereavement. He was a member of many societies, among them the American Institute of Mining Engineers. He is survived by his widow and one daughter, Elisebeth.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, September 24.

Antimony	15 —15¾
Electrolytic copper	13⅝—13¾
Pig lead	4.00— 4.05
Quicksilver (flask)	$75
Tin	36 —37½
Spelter	6½— 6¾
Zinc dust, 100-kg. zinc-lined cases	15

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, September 24.—The metal markets are quiet, there being none for copper, while lead and spelter are quoted at 3.85 and 5c. respectively. Dividends declared are as follows: Old Dominion, 25c. per share on October 8; Old Dominion Copper Mining & Smelting Co., and United Globe Mines, both controlled by the Old Dominion of Maine, $2.25 and $3.50 per share, respectively, on October 7; International Nickel, 1½% on preferred and 2½% on common, on November 1; Eagle & Blue Bell, 5c., on October 1; Consolidated Mining & Smelting Co., of Canada, 2%; and Anaconda Copper Mining Co., 25c., against 75c. last quarter. Exports of manganese from Russia have been prohibited, except to Allied nations. The steel trade is dull, and as a whole only 60% of mill capacity is being operated.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The average price of bar silver in London in August was 25.979d., or 51.958c. per ounce. The market is unchanged there at about 24¼d., and nearly all buying at present is confined to coinage orders. Stocks in Bombay are now 6000 bars. Writing on September 10, Samuel Montagu & Co., of London, state that the tone of the market has improved somewhat, due to decreased supplies from America. Regarding trade demands, the metal is a drug on the market. Imports of silver into London up to this date were 60,420,385 oz., compared with 79,561,836 oz. in the same period of 1913.

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally 1-5 to 1-4c. per pound more. Prices are in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	....
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

The New York market continues stagnant, and foreign market easier. Prices range from 12 to 12.5c. per pound. Exports for the month, up to the 23d, total 11,897 tons. England takes copper in increasing quantities, but naturally most of the shipments made are on bookings previous to the war.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending		Week ending	
Aug. 27	80.00	Sept. 10	75.00
Sept. 3	75.00-85.00	" 17	75.00
		" 24	75.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	....
Mch.	40.20	39.00	Sept.	39.70	....
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

There is no change to report in this metal. Large orders would pay a somewhat lower price than the above quotation. In the last 'Press Bulletin' issued by the U. S. Geological Survey is given a general summary of the quicksilver situation, covering production, uses and prices, most of which has been published in the 'Press' from time to time.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Sept. 17	3.85	Aug. 12	3.85
" 18	3.85	" 19	3.88
" 19	3.85	" 26	3.87
" 20 Sunday		Sept. 2	3.90
" 21	3.85	" 9	3.85
" 22	3.85	" 16	3.85
" 23	3.85	" 23	3.85

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	....
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

St. Louis quotes are 3.60 to 3.62½c. per pound, with slow sales.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Sept. 17	5.00	Aug. 12	5.25
" 18	5.00	" 19	5.60
" 19	5.00	" 26	5.77
" 20 Sunday		Sept. 2	5.75
" 21	5.00	" 9	5.50
" 22	5.00	" 16	5.25
" 23	5.00	" 23	5.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	....
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

St. Louis wires that immediate demands seem satisfied and the market is dull. Ore, basis of 60% metal, is down to $44 per ton. Buyers' orders are easily filled. Exports from New York since August 18, when the movement started, total 11,000 tons.

TIN

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	....
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

The nominal price of Straits tin in New York is about 31.75c. The market has only a limited number of sellers. Deliveries up to September 17 at Boston, Baltimore, and Philadelphia totaled 2902 tons, and metal afloat and due by the end of the month is 1815 tons.

MINING DECISIONS

Oil and Gas Lease—Lessee in Wrongful Possession

Where a lessee under an oil and gas lease brings in a gas well after the term stipulated in the contract of lease has expired, he will not be held for exemplary damages where it is shown that he acted in good faith, and under the advice of competent counsel, and before suit was brought.

Cooke *v.* Gulf Refining Co. (Louisiana), 65 Southern, 758. May 25, 1914.

Coal Mines—Width of Barrier Pillars

The Pennsylvania Legislature having provided that the width of barrier pillars between two coal mines should be determined by a tribunal, consisting of the mine engineer from each of the adjoining mines and the district inspector, the finding of such a tribunal that the width of the pillar in a given case should be 300 ft., made by a majority of the tribunal after opportunity for inspection and hearing had been given all the members and parties interested, will not be disturbed.

Mill Creek Coal Co. *v.* Curran (Pennsylvania), 91 Atlantic, 424. March 23, 1914.

Ore on Dump—Realty or Personalty

Whether or not ore extracted from a mine and placed on the dump is realty and a part of the mines or personalty, depends upon the intention of the owner thereof at the time of its extraction. Unless it be shown by the evidence that there was a specific intent on his part at the time to consider the ore as personalty separate from the mine, it will be treated as a part of the realty and pass under a subsequent deed conveying the mine.

Steinfeld *v.* Omega Copper Co. (Arizona), 141 Pacific, 847. July 9, 1914.

Patent Improvements—Not Allowed

The certificate of the surveyor-general as to improvements upon a mining claim required by section 2325, Revised Statutes, is not conclusive upon the Land Department, which may, in the presence of anything tending to impeach the correctness thereof, wholly disregard the certificate and require further showing as to improvements. No part of the value of permanent and immovable improvements on a mining claim, made long prior to the location thereof by the present claimant, under a previous location embracing the same ground, solely to improve and develop the prior claim can be accredited as patent improvements on the latter claim, there being no privity shown between the former and present locator.

C. A. Sheldon *et al.* (Land Department), 43 Land Decisions, 152. February 21, 1914.

Gas Lease—Suit on Implied Covenants

A gas lease provided that a test well should be drilled to completion, and if gas were found in sufficient quantities to be marketable, for royalties to the lessor. The lessees drilled the test well and found gas in profitable quantities, but thereafter neglected to extract the same or drill further wells, or pay royalties to the lessor. The lease provided that the lessee should hold the premises for five years or as much longer as gas or oil should be found in paying quantities. Held, that the lease conveyed, in effect, a freehold estate, and that the lessor was entitled to sue for damages for breach of covenant to extract the gas and pay royalties, and not merely for a forfeiture of the lease.

Doughetee *v.* Ohio Oil Co. (Illinois), 105 Northeastern, 308. June 3, 1914.

BOOK REVIEWS

The Mineral Industry During 1913. Edited by G. A. Roush. P. 1010. Ill., index. McGraw-Hill Book Co., New York, 1914. For sale by *Mining and Scientific Press*. Price, $10.

This, the twenty-second volume in the series established by Rothwell, is consistent in general form and scope to the preceding volumes. Its editor, Mr. Roush, who came new to the task this year, is, however, to be congratulated upon having produced one of the best volumes of the series. The individual chapters have been prepared as heretofore in collaboration with many men, and while not of equal value, they are, on the whole, wonderfully consistent and serviceable. The special chapters are: 'Progress in Ore Dressing and Coal Washing,' by Robert H. Richards and Charles E. Locke; 'Hydrometallurgy of Copper,' by Thomas T. Read; 'Analysis of Smelter Contracts,' by Gelasio Caetani (reprinted from the *Mining and Scientific Press*); 'The New International Diamond Caret of 200 Milligrams,' by G. F. Kunz (reprinted from *Trans.* A. I. M. E.); 'Data of the World's Principal Mines,' by S. F. Shaw (reprinted from *Eng. & Min. Jour.*); and the usual summaries by countries.

A Text-Book of Geology. By James Park. P. 598. Ill., index. Charles Griffin & Co., London. J. B. Lippincott Co., Philadelphia, 1914. For sale by *Mining and Scientific Press*. Price, $4.50.

In the introduction to this text-book the veteran professor of geology in the University of Otago, gives some excellent advice to the student entering upon the subject. In particular, he says: "Make an early acquaintance with the facts of geology as presented in the field. Miss no chance of travel or exploration with the experienced geologist. Cultivate the faculty of exact observation, and be mindful not to form hasty conclusions. Remember that things are not always what they seem. Make extensive collections of rocks and fossils, and be careful to keep the fossils of each horizon apart. Take every care to preserve your fossils from injury. The dictum of the Hon. Walter Mantell that 'a fossil that is worth collecting is worth its paper' is as true now as when made to the author forty years ago, and applies equally well to rock specimens. Do not attempt to describe new species; leave that to the specialist. Even when you have gained some note as a writer on geology, refrain from coining new terms. * * * Do not select a single specimen of a rock for analysis and regard it as representative of the whole mass, as the results may be altogether misleading. All sedimentary and igneous rocks vary considerably in composition in different parts, the former because they are mechanically formed, the latter on account of the development of large phenocrysts or the proximity of sedimentary or other rocks. Select fresh unweathered examples whenever procurable, and, except it be any analysis of a particular fragment that is required as an aid to microscopical examination, select the average sample or samples with as much laborious care as you would sample a coal seam or an ore vein. Unless you are a specialist, which is unlikely, do not attempt the analysis of your rock samples; do not think that because you have waded through the analysis of a rock specimen or two in your graduate course that you are competent to undertake the systematic analysis of a rock."

The body of the text follows the usual lines, beginning with a brief résumé of the principles and scope of the science, and continuing through a study of geologic processes to their products, to a brief history of the earth, and closing with brief sketchy chapters on economic geology, field geology, and geological surveying. Illustrations are chosen from a wide field and the book is excellently printed.

New Machines and Devices

Auto-Trucks for Ore Transport

Owing to the war in Europe, the supply of magnesite from Austria was cut off, and some of this mineral from a California mine was brought to tidewater on Jeffery 'Quad' trucks, and then shipped east by way of the Panama canal in the *Nebraskan*. It was thought that when this magnesite mine was opened that it would be necessary to build a railroad over the mountains in order to carry the product out, but by this

JEFFERY QUAD DELIVERING MAGNESITE ORE TO THE STEAMER.

time the United States government had finished its tests of the Jeffery truck, demonstrating the ability of this vehicle to carry a two-ton load anywhere that a four-mule team could pull a load, with the result that this truck was found very suitable for this strenuous kind of transportation.

Commercial Paragraphs

The McCord Mfg. Co., of Detroit, shows in Catalog No. 12 the force feed lubricators of this firm.

The Nordberg Mfg. Co. is distributing Catalogs 23 and 24, descriptive respectively of the steam and air and the electric hoists manufactured by that Company.

The Western Electric Co., of New York, has issued a leaflet describing a new portable vacuum cleaner of the outside bag type, which embodies several improvements.

The Hammond Iron Works have come promptly to the front and are distributing a convenient little map of Europe. Carry it in your pocket and keep in touch with the armies that are fighting.

The Hardsocg Wonder Drill Co. is marketing a new rotating sinking drill which is known as No. 90. It is designed not only for sinking but for block-holing, hitch-cutting, and similar duties.

A. Leschen & Sons Rope Co., of St. Louis, monthly bulletin describes the new state capitol of Utah. During construction of this $2,000,000 structure the contractors used 12,600 ft. of $\frac{5}{8}$ in., and 1100 ft. of $\frac{3}{4}$-in. 'Hercules Red Strand' wire rope, made by this firm.

The Stephens-Adamson Manufacturing Co., of Aurora, Illinois, monthly, *The Labor Saver*, No. 65, is devoted to coal handling machinery in all its uses. Some interesting pictures are shown of screens, elevators, jig driving gears, stokers, bucket carriers, conveyors, and other equipment.

The 'Giant' low-grade fuel oil engine manufactured by the Chicago Pneumatic Tool Co. is described in *Ideal Power* for July. This is designed to stand especially hard service and to burn various crude and residual oils. It is based upon ten years experience in building gasoline engines.

The Senn Concentrator Co., of San Francisco, recently published a booklet entitled 'Senn Pan Motion.' In it are described the standard 8 and 12-ft. concentrators, which have large capacities; and the pan-motion amalgamator, which has a capacity of 50 tons per 24 hours. A description of the pan motion appeared in this column last week. The catalog is attractively gotten up.

The Luitwieler non-pulsating pumps are described in a reprint from the *Engineering Magazine* for August and a series of interesting pamphlets covering the 'Luitwieler System of Pumping,' the 'Luitwieler System of Non-Pulsating Triplex Pumps,' and the 'Luitwieler Non-Pulsating System' issued by the Luitwieler Pumping Engine Co., of Rochester, New York. In these pumps a cam is used to transmit power from the driving shaft to the plungers, and, while the principle is old, the method of application is such as to give a highly efficient machine suitable for many uses around mines.

The National Tube Co., of Pittsburgh, Pa., *Bulletin* No. 9C describes some expansion tests of 'Kewanee' pipe unions. Nine unions, ranging from $\frac{1}{2}$ to 2 in., were connected by short lengths of corresponding size pipe, with a 'regrinding' valve at one end of the pipe. Steam at 140-lb. pressure was turned on for 5 minutes to 92 hours, the fittings thus being heated to the steam temperature at this pressure. Steam was turned off, and the whole immersed in a vat of water of 48°F. temperature for 5 to 30 minutes. This test was repeated 50 times, and the unions held tight after all. Service tests were made of several other unions, these being disconnected 1000 times, showing no leaks.

The G-O riffle, manufactured by the General Ore Concentrating Co., is made from monel metal that unique combination of copper and nickel. It is machine made with great accuracy and its peculiarity is that the points are integral with the riffle itself. As a result there are no irregularities as in the ordinary wooden strip nailed to the deck of the table, and it is possible by reason of this and the hard, true edge presented to secure absolutely uniform results. The riffles are furnished in various sizes and can be fitted to any deck. Not only do they permit better work, but they are quicker placed, and last longer. Therefore they decrease loss of time and so increase plant capacity.

The Ingersoll-Rand Co., of New York, has recently perfected and placed on the market a new type of hoist, known as the 'Little Tugger.' It is intended for light lifts, having a capacity of 1000 lb., and as it only weighs 300 lb. complete, and is $21\frac{1}{4}$ by $16\frac{1}{2}$ by $20\frac{1}{8}$ in., is suitable for mining and other work. Underground it may be clamped to a drill column or stretcher bar, shaft bar, or timber, for hauling various loads. The drum is 6 in. diameter, and will hold 700 ft. of $\frac{1}{4}$ or 450 ft. of $\frac{5}{16}$-in. rope. At a rope speed of 85 ft. per minute, and 80-lb. air or steam pressure, the load is 1000 lb. The motor or engine is of the reversible square piston type, and there are no dead centres.

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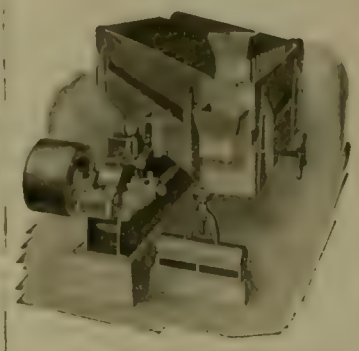

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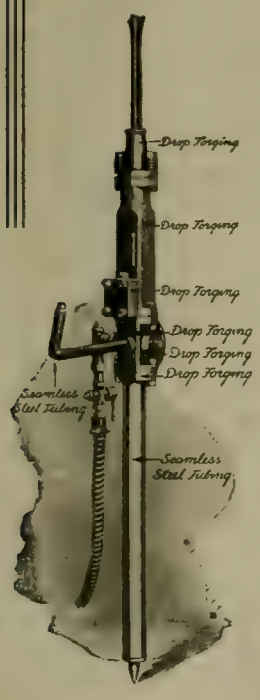

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NOTICE

Cyanide will shortly be available from Germany for all users in the United States. While it is released subject to the condition that it shall not be re-exported, it is believed that this will not be construed to prevent shipments to Mexico and possibly to South America. The matter has been arranged through the good offices of the Secretary of State and Secretary of Commerce, and an American ship is to be sent at once to Amsterdam to bring back dye-stuffs and 1000 tons of cyanide that is available for immediate shipment. In the meantime there is plenty of cyanide here for use, though not enough to permit everyone to buy a year's supply in advance. See editorial and market pages for details.

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EDITORIAL

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WAR news must give way this week to editorial discussion of technical matters. We can promise to even the score by a double measure next week of Mr. Rickard's pen pictures of conditions in London.

DEVELOPMENT, production, and construction at many copper mines in the United States have been curtailed somewhat on account of the war, but it is encouraging to hear that work goes on unabated at the Chile Copper Company's great plant at Chuquicamata, and leaching may be started by April next. All seems well at the Braden mine, also in Chile.

PLANS for the meeting of the American Institute of Mining Engineers at Pittsburgh, October 8, 9, and 10, include excursions to the Homestead or McKeesport works, the Harbison-Walker plant, and the testing plant and experimental mine of the U. S. Bureau of Mines. The preliminary list of papers indicates that the technical program will be up to standard and full of interest.

WAR has conferred unusual interest on the papers published in the *Annales de la Société Géologique de Belgique*, of which the volume for last year has recently appeared. Among other studies of regions made familiar to everyone through the daily news reports, M. Ch. Stevens contributes an '*Etude des terrasses de la Sambre*' in which he concludes "*L'inégale résistance des roches à l'érosion a causé ces différences topographiques dans une meme vallée.*" The fierce resistance of maddened human beings to each other's advance has since then imparted an entirely new aspect to that unhappy country.

STEAM STAMPS are discussed at length in this issue. While experience seems to indicate that the heavy stamps find their best field for usefulness in northern Michigan, the old firm of Fraser & Chalmers did build such stamps for the Boston & Montana, the Anaconda, and the W. A. Clark mines in Montana, as well as for the Homestake and for a Japanese mine. The later Allis-Chalmers company, as well as the Nordberg Manufacturing Company, has not attempted to push these stamps except in the Lake Superior country. The Allis-Chalmers company does make a small steam stamp, the 'Tremain,' which has given good account of itself in Rhodesia and various other countries. The reason for this difference in usage is discussed elsewhere.

GERMANY has afforded one of the great markets for copper. Aside from approximately 50,000,000 pounds of domestic production, the Empire has imported about 425,000,000 pounds per year, and of the 100,000,000 or more pounds sent annually to Holland, a large part found its way into Germany. Part of this has been re-exported in the form of manufactured goods and part has evidently gone into manufacture of war material, but the domestic consumption for ordinary uses is enormous. No doubt the demand for copper in the Empire just now is especially large. Great Britain regards copper as conditional contraband and is using every effort to prevent supplies reaching Germany through neutral territory as well as direct, as related on another page. The suggestion, therefore, that American ships load with copper and cotton to Holland, returning with cyanide, dye stuffs, and medicines from Germany involves peculiar difficulties. In ordinary times the North German Lloyd line sailing from Baltimore to Bremen finds in cotton and copper a heaven-born combination of bulk and weight, comparable only to the pig iron and coke of the Scotch and Belgian ships that come to California. In war times, however, the economically sound routing of freight is not always possible, since other conditions must be taken into account.

CONCERNING COPPER QUOTATIONS

Our contemporaries in Chicago and New York, the *Mining and Engineering World* and *The Engineering and Mining Journal*, have been indulging in a discussion concerning metal quotations that has become at times so heated as to threaten losses by volatilization. We have no desire to mix into what is 'a very pretty quarrel' as it stands. However, our friends in Chicago have intimated broadly that the *Journal* quotations are not only inaccurate but are not independent. In this we believe them to be mistaken. The *Journal* is a bit pompous, mayhap, and its assumed superiority, though generally merely amusing, becomes wearisome at times, but it is honest and uncontrolled. If we have occasionally shied a stone at the famous glass house, it has been mainly with an eye to decoration of the landscape through the internal explosion that never failed to follow. Differences in policy, we hope, do not necessarily imply differences in honesty, and the *Journal*, as is true of technical publications in the United States without

notable exception, enjoys a well deserved reputation for honesty and independence.

As to the latter we are privileged to quote the following from a personal letter from Mr. T. A. Rickard: "I note also that the Chicago paper again suggests that *The Engineering and Mining Journal* is controlled by a special interest and that the copper prices are untrustworthy on that account. Well, as you know, I used to have something to do with the *Journal*, and I can testify to you that it was absolutely independent of the Guggenheims or any other financial group, and I am willing to give long odds that it is just as independent now." Coming as this does from one who has served as editor of both the *Journal* and the *Press* and is now editor of *The Mining Magazine*, it voices the opinion of an informed and independent critic.

However, the *World* has shown that there is a discrepancy between the average quotation, as published in the *Journal* and the average sale price as realized by a number of the large copper selling concerns. We believe this is more an indictment of a system than of an individual; but the system is one that obtains generally in trading in commodities and securities. That the *Journal* quotations are as nearly correct as it is practicable to make them, we are satisfied for the excellent reason that careful comparisons ranging over many months and several years, show that they check with our own, of which, as a matter of course, we know the source absolutely. Furthermore, they do not differ materially from the quotations in *The Iron Age*, which has its own market observer, and a very capable one. A large silver dealer tells us that our quotations of that metal are consistently nearer the market than are those of the *Journal*, but in the main the quotations made by the *Press*, *Journal*, and *Iron Age* check closely. They do not agree so closely with those given by *The American Metal Market*, and they are consistently lower than those reported by the Associated Press. The reason for this lies in the fact that the two last named depend largely, if not entirely, upon the New York Metal Exchange, and it is true, if unfortunate, that the big business is not done on the exchange. The condition is not unlike that in San Francisco, where only small lots of metal are bought and sold. Our own San Francisco quotations are therefore always higher as to most metals than our New York and St. Louis quotations. Nobody pretends to think than any considerable body of metal is sold or could be sold at San Francisco prices. The difference between the two sets of New York quotations, while due to the same sort of conditions, is naturally much less.

The quotations published by the *Journal, Press,* and *Iron Age* take into account the quantities sold on each day, but this quantitative factor is lost when weekly, monthly, and yearly averages are made, and that is the source of the trouble. Each quotation represents as nearly as possible the price at which copper was sold in quantity on the day mentioned, but the amount sold varies greatly from day to day. For weeks, perhaps, only small lots will change hands, though each day there is a ruling price at which only, large amounts could be bought or sold. That price is the correct price for such copper as is settled for as of that date. The larger companies have, probably, the shrewder dealers, the more complete information, and the better financial backing, which permits them to wait for favorable prices. On the average they sell more of their copper when the price is high than when it is low, and therefore their average return for the year is a trifle above an arithmetical average of entirely honest and fair daily quotations. That is all there is to the matter. As to the intimation that the Guggenheim interests, the Anaconda, or any other group, can fix the price of copper or control its quotation price; it needs but to review the list of dealers and to note the amounts each sell, as printed, for example, in the *Press*, May 3, 1913, to make evident the fact that the copper market is keenly competitive.

Despite the fact that the Guggenheims control more than 60 per cent of the lead production of the United States, there is also keen competition in the sale of lead. It is to be remembered that the largest individual lead-producing company in the world, the St. Joseph Lead Company, is not under the Guggenheim blanket, and that there are other independent sources of supply. The conditions as to lead and copper differ and it is common to name the American Smelting & Refining Company price separate from the general market price when, as happens frequently, there is a slight difference. Even here, however, the daily price is a fact that can be determined by any competent market reporter and does not depend upon esoteric information.

At the beginning of the war in Europe both the *Journal* and the *Press* suspended regular quotations. The reasons, perhaps, have not been fully understood. As a matter of fact there was no general market for copper, so no general quotation was possible. The conditions were closely analogous to those in the security market when the New York Stock Exchange closed. That was a war measure designed to prevent ruinous selling. Suspension of copper quotations was with the same object in view. No one doubts that with European demand at first absent and later greatly reduced, with domestic demand below normal, and a large surplus impending because of the impetus of production, copper prices would have dropped to five cents or less per pound before the curtailment could have made itself felt. Stopping quotations forced the small producers to join the big companies in reducing production, but if this is held to be a hardship, let the miner ask himself how he would have liked to continue to ship under his contract and settle for the copper at five cents per pound. Stopping quotations was a war measure, and, we believe, a proper one, but in any event the responsibility does not rest with the technical press; there being no general market, general quotations could not be made.

Since suspension of the regular quotations we have printed each week such data as were available covering prices at which copper was being sold. Admitting that the market is artificial, these figures still have value.

We publish this week the first general summary covering actual settlements made in New York by the large companies since the latter part of August. These represent real transactions in considerable quantities, but even they can hardly be considered to indicate prices at which the market would absorb copper if bidding were open as usual. These do, however, represent *the price at which copper is being sold*. We are glad to add that English demand is proving better than anticipated; domestic consumption, while sub-normal, is improving; no new production is coming into the market; and copper producers are already beginning to plan for a greatly increased output when the war closes. With a little patience and continued exercise of the good sense which producers and dealers have shown since this trouble came on them, these trying times will be passed without disaster.

CYANIDE NOW AVAILABLE FROM GERMANY

Further steps are being taken at Washington to secure for American mines a supply of cyanide from Germany. We are especially glad to mention this active and intelligent work on the part of the State Department in this case, because mining men generally have felt that the attitude of the Department toward them and their troubles in Mexico has been none too sympathetic. However, in this instance, from the Secretary down, the Department has been graciousness itself and is proving extremely helpful.

As we noted last week, the American ambassador at Berlin had been informed that export of cyanide to Mexico and the United States would now be permitted. Through the courtesy of Mr. Charles Butters we are permitted to repeat the following dispatch, received Monday last from Mr. Robert Lansing, acting secretary of state:

> Despatch from Berlin states that although American ambassador has been informed by certain exporters that Secretary of Interior had agreed to export of cyanide, dye stuffs, chemicals, and medicines on guarantee that they were for the United States only, ambassador is now informed by under Secretary of Foreign Affairs, shipments of goods of this kind will not be allowed in Holland ships but in American ships only. Ambassador suggests ships could take over cargo of cotton and copper consigned to Holland merchants and return with above commodities. If America wants dye stuffs, cyanide, and chemicals, American ships must be sent. Would appreciate your suggestions at conference to be held September 30 at 3 p.m. at State Department to consider means for sending American ships. Will your firm share in expense? Suggest you send representative to Washington for conference or authorize someone in Washington to represent you.

Mr. Butters arranged for Mr. G. W. Shepherd of his staff, and Mr. Thomas T. Read of ours, to attend the conference. At the conference, as noted in our market pages, arrangements were made for immediate shipment of cyanide from Amsterdam in American ships. While the exchange proposed involves difficulties, as noted elsewhere, Germany is showing every disposition to respond to the needs of American industry as far as circumstances will permit, and we have strong hopes that a way will be found to permit importation of the cyanide. For our own part, we shall be glad to cooperate to this end with all concerned.

LARGE VERSUS SMALL STAMPS

For some years the tendency in stamp-milling has been toward the use of heavier stamps, and while it has not come into extensive use in this country, the heavy Nissen stamp has found much favor in South Africa, and in Cornwall as well. On another page Mr. Algernon Del Mar describes the large steam stamps which have long been standard practice in crushing the native copper ore, and raises the question whether they may be used to advantage in stamp-milling gold ores. Some further discussion of this question, in which we hope our readers will join, will not be without interest.

In the first place, we must take it for granted that a stamp is an uneconomical crushing machine. The stamp is not intended, and should not be used, for crushing any ore except ore in which native metal is scattered through brittle rock. For that purpose it is the logical machine, reproducing on a large scale the method anyone would instinctively use to free a mass of metal from adhering rock; namely, the striking of blows which crack open the brittle gangue and leave the ductile metal free. No matter how superior their mechanical efficiency, crushers which work by trituration or pressure are not suited to this work, as has been proved by experiment in the Lake Superior district. The stamp is therefore the proper machine for the crushing of gold ore and metallic copper ore, and with this as a major premise the characteristics of different types of stamps may be critically considered. Natural impulses are often safe guides to follow. Anyone would naturally employ a large hammer to drive a large nail and a small hammer to drive a small nail. If the use of a large stamp, striking a heavy blow, for crushing ore which is fed to it in small pieces, and the use of lighter stamps when the feed is finer is critically considered it will be found to be logically sound. The problem is not so simple as this, however. The use of large steam stamps for crushing gold ore can not be put on simple efficiency basis with their use for metallic copper ore. For many years it was the custom in gold milling to catch as much gold as possible inside the mortar, and amalgamated plates and grooved liners were used for this purpose. The problem in stamping was not simply to crush the quartz, but to crush as much as possible without scouring the inside plates. Mr. T. A. Rickard, in his 'Stamp-Milling of Gold Ores,' has lucidly discussed the effect which this and other considerations in gold milling has had on the design of the mortar and the force and speed of the stamp blows. In copper milling, on the other hand, provision must be made for the large masses of native copper, which, if allowed to remain between the stamp and die, would uselessly con-

sume large quantities of energy in being pounded into flat masses and gradually broken into fragments which would pass the screen. This involves the use of a roomy mortar, with spaces into which this copper can find a retreat, which is the probable reason for the otherwise illogical use of a die smaller than the stamp shoe. The hydraulic discharge for allowing the copper to escape from the mortar box has greatly helped to solve this problem, and it may be that the mortar now employed on the steam stamps is too roomy to give the maximum efficiency of discharge. If any studies of this feature have been made they have not come to our attention.

As long as amalgamation was the *sine qua non* of stamp-milling of gold ores, the steam stamp had another disadvantage in that it is necessary to lubricate the steam piston and oil was constantly finding its way down the stamp stem into the pulp, a proceeding which the millman regarded with horrer. Much of this can be prevented by care, however, and now that the catching of gold on the plates is not so important a consideration, so long as it is caught before the tailing escapes from the cyanide plant, the efficiency of the stamping operation is more of a consideration than it once was. It may therefore prove to be more economical to give stamp-mills, in gold practice, a coarser feed, and use a steam stamp to strike a harder blow. Unquestionably the stronger blow is the better for the coarser feed. The trouble with the steam stamp, however, is that the length of the stroke of the steam piston is necessarily irregular, depending upon the amount of ore on the die. Thus the steam escapes at the end of the stroke with only part of its energy utilized, thus producing poor steam efficiency. In order to overcome this, the steeple-compound stamp was devised by Mr. Bruno Nordberg. Even this only partly overcomes an inherent difficulty. More recently Mr. F. L. Bosson has brought about the use of a low-pressure steam turbine to utilize the exhaust steam from the stamps, mixing the flow with boiler steam if necessary. This gives a better net total of efficiency, but detailed figures showing the gain have not yet been made public. This arrangement has already become the standard practice of the Calumet & Hecla, Copper Range Consolidated, and other large Lake Superior companies, though only a few steam turbines have so far been installed. It is to be hoped that detailed studies of the mechanical efficiency of this combination may soon be made public, so that the managers of large gold mills may have the necessary data on which to base conclusions as to whether large steam stamps working in conjunction with steam turbines would yield them a better net efficiency than the present practice of using heavy gravity stamps.

If gold mill operators are prepared to abandon the use of the stamp as an amalgamating device, and will send the stamp-mill pulp directly to tube-mills, passing the tube-mill discharge over amalgamated plates before sending it to the cyanide plant, the question may be raised as to whether it is necessary to retain stamps for the preliminary crushing of the tube-mill feed. The verdict of experience seems to be that the tube-mill is an excellent crushing device to free gold from its adhering gangue, the impact of the pebbles furnishing a sufficiently heavy blow for the comparatively small particles with which the tube-mill is fed. The logic of the situation would then seem to be that the crushing of the tube-mill feed should be done by the most efficient machine or machines, regardless of their principle of crushing action. This scheme of milling is about to be put into practice in the new large mills of the Alaska Gold Mines, and publication of the results of operations there will be awaited with the keenest interest by mill operators everywhere.

THE HALL PROCESS

Smelting men have no more difficult problems to face than those involved in rendering harmless the fume from roasting and furnace stacks. Among the most interesting attempts at the solution of the problem is that made by Mr. Theodore J. Hoover and his associates who propose by means of the Hall process to reduce the sulphur to the elemental form by roasting sulphides in an atmosphere lean in oxygen. We published an outline of the process July 5, 1913, and have since printed several notes on the progress of the tests at Coram. This week, through the courtesy of Mr. H. F. Wierum, who is in charge of the experimental work, we present a full account of the present state of affairs. Mr. Wierum discussed the matter before the New York section of the Mining and Metallurgical Society last week, and this publication is with his consent and in accord with an arrangement made at the time the experimental work was undertaken. The paper is full of interest and we commend Mr. Wierum for both his frankness and his caution. Everyone of experience recognizes the difficulties that lie in the way of such pioneer work, but not everyone is willing to discuss his own difficulties so illuminatingly. Evidently the Hall process has elements that show distinct promise; but evidently, also, there is much that is still to be learned.

Anyone may speculate as to the reactions involved and we may perhaps be permitted to question whether the old one between H_2S and oxygen, whereby sulphur and water is formed, does not enter into the result. Another question that suggests itself is whether, in the oxidation on the lower hearths "with free admissions of air" in the later experiments, SO_2 was not produced in the ordinary way, to be later reduced on the upper hearths by reaction with hydrocarbons, substantially as in the Thiogen process. If either of these surmises are well founded, there are disheartening possibilities of litigation over patents. We hope that whatever may be the chemistry involved, neither actions nor reactions will lead into the courts. Close quantitative work on fundamentals is still needed in connection with several of these processes, but nothing will so clear the way as such delightfully lucid and honest statements as Mr. Wierum has given.

Steam Stamps From the Gold Miner's Point of View

By ALGERNON DEL MAR

While the facts here set forth may be familiar to millmen using steam stamps, to the gravity stamp millmen the huge plants on the shores of Lake Superior are a revelation. My first thoughts were of the application of these stamps to the milling of gold ores, but after studying many stamp-mills I came to the conclusion that while for the copper ores of the district the gravity stamp would be useless, for gold ores the steam stamp would be at a disadvantage. Each type of machine has its usefulness, limited by the many conditions inherent in the physical character of the ores and the conditions under which the operations of milling are conducted.

The Problem in Copper Milling

The problem at the copper mills is to extract the maximum amount of copper at a minimum expense from rock that contains copper entirely in the metallic form. The masses of copper which reach the mill are of any size up to that passing the bars of the rock-house grizzly, which, judging from the appearance of the feed at the stamps, are commonly 4 in. apart. It will at once be seen that an ordinary stamp could not handle masses of copper of such size, for there is no place in the mortar for it to rest, except under the stamps, where it would be pounded to bits; a process not at all desired, for while 80% at the most might be saved by pounding the copper into pieces, 100% of this coarse copper is saved by separating it from the rock as soon as possible and holding it near the stamp in as large pieces as possible. The comparison, then, is between a steam stamp taking a 4-in. product and reducing it to ⅝-in. mesh (with the rock-breaker work not charged to the mill account, for this is done at the 'rock-house' at the shaft), and two rock-breakers working say to 2-in. mesh followed by gravity stamp crushing to say 10 mesh with no masses of metal to be taken care of. The character and amount of the free copper in the Lake Superior ores determines the process following the stamps, just as in a gold mill the amount and character of the gold determines the after process, but with this difference: a pound of copper is worth but 14c., while a pound of gold is worth about 2000 times this amount.

Any comparisons that may be made between steam and gravity stamps must include the difference in wages. In the Lake Superior district men are paid about 60% of what the same class of labor earns in gold mills, and the cost of power, which is far below that obtained in gold mills, must also be considered. In the Lake Superior region power may be generated or bought for less than one cent per horse-power hour. It is also to be remembered that the smallest copper mill with one stamp, crushing say 600 tons per day, would be a large-sized gold mill; the largest mill, with 28 steam stamps crushing approximately 12,000 tons per day, is of greater capacity than any gold mill. To crush the same tonnage of gold ore would require from 1500 to 3000

NORDBERG STEEPLE-COMPOUND STAMP.

gravity stamps. I cannot justify my faith by figures, for exact comparisons are not possible under the circumstances, but I do believe that, leaving out the mass copper, the gravity stamp is more economical than the steam stamp, per ton of ore stamped, even in localities where steam must be the motive power. A typical mill, one of the best in the Lake Superior district, shows by indicator cards that 2.3 tons per horse-power day was the crushing capacity of the mill. The complete stamp head in this mill weighed 6650 lb. The lifting velocity was 9.6 ft. per second, and the falling velocity 23.1 ft. per second. At 108 drops per minute, in 24 hours this stamp crushed 605 tons through a 5/8 mesh screen. I do not believe there is a stamp in the district, so far as I could gather, even on the softest ore, that had a capacity of over three tons per stamp per horse-power day.

South African Practice

This may be compared with the gold mills in South Africa, which crush from 5 to 6 tons per horse-power day through a 9-mesh screen. The only reason I can find for this difference in capacity is that, while in the gravity stamp-mill but a small layer of ore is kept between the shoe and the die, and thus the full force of the blow of the stamp is utilized, in the steam stamp, capacity is sacrificed to safety. From 6 to 8 in. of ore is always kept on the die, and should this be lowered to 3 or 4 inches the vibration in the shaft or stem is so intensified that the piston rod is liable to break. To change a piston rod means about 16 hours work, during which time the 600 tons per day equipment of the whole mill is at a standstill, while in the gravity mills the operator is not so particular, for he only loses the capacity of 5 stamps for half an hour when a stem breaks. The greater capacity of the gravity stamp-mill is partly balanced by the comparatively greater outlay in first cost.

In mills where no regrinding is done, the process being to stamp, jig, and concentrate, the cost per ton is about 16c. Of course, that cannot be approached in a gravity mill on account of the cost of labor and power; but if 4c. per ton be allowed for concentrating, the cost for steam stamping is 12c. per ton. At the Goldfield Consolidated, the cost of stamping is 13.3c. per ton, at the Alaska Treadwell 13.8c., at the Black Oak in California 11.26c., and at the Liberty Bell 19c. These gravity mills are all of much less capacity than the copper mill cited. The screen mesh is much finer, as is likewise the size of the feed.

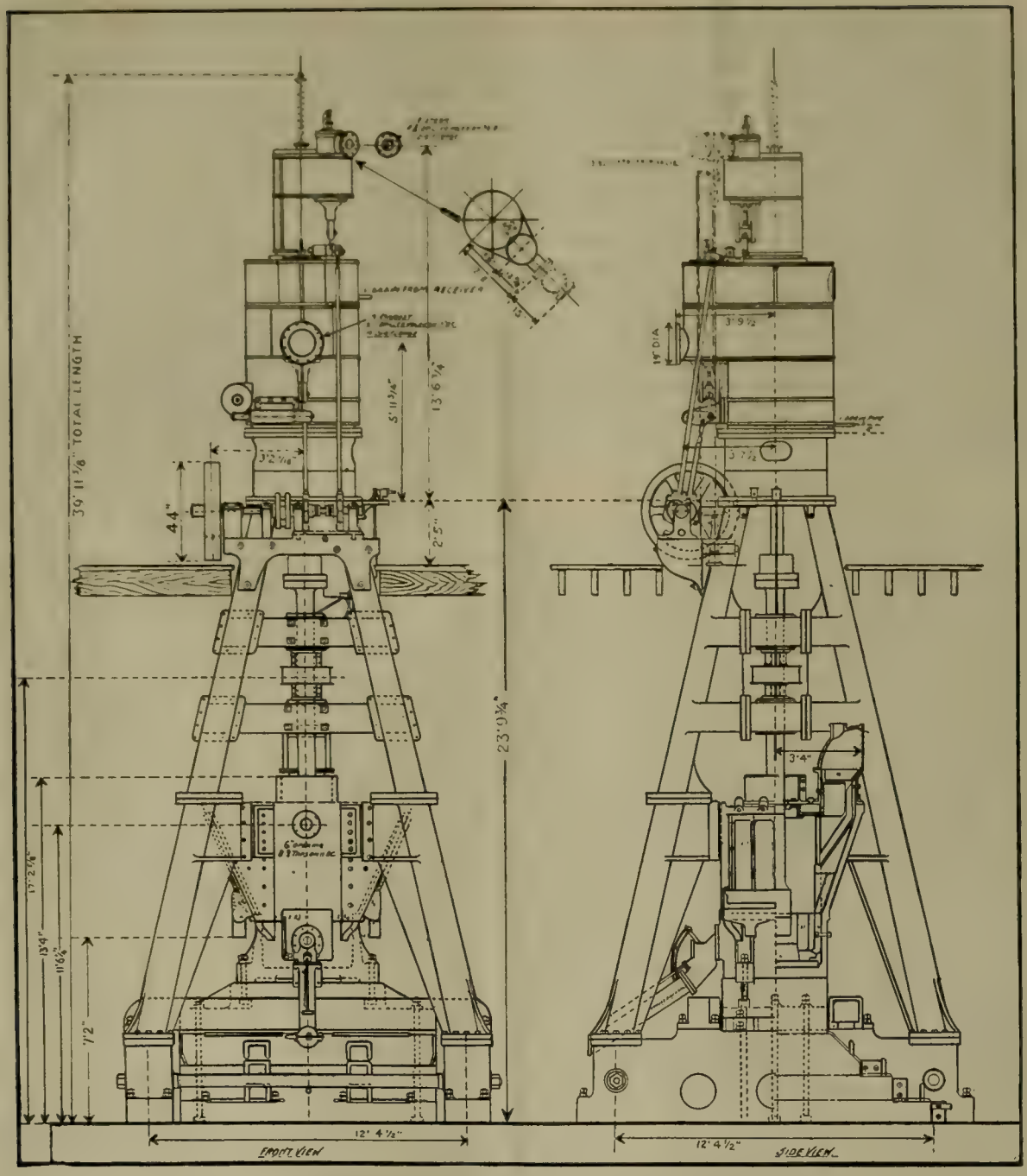
Steam stamps may be divided broadly into two types: the simple and the compound, the first type being represented by the Fraser & Chalmers simple and the Morris simple cushioned, and the latter by the Nordberg 'steeple-compound.' This refers to the steam portion of the stamp which may be superimposed upon a mortar with a circular opening, quadruple discharge opening, or with a two-side discharge, with four-post, two-post, or A frame. In the compound stamps there is economy in steam when they are run with a condenser, but when the exhaust steam is diverted to a low-pressure steam turbine the compound stamp does no better work than a simple one. In other words, better total efficiency is obtained by utilizing the low-pressure steam in a turbine than in the low-pressure cylinder of the stamp. Those not familiar with the steam stamp are at once struck with the fact that the rate at which the stamps drop, from 103 to 107 per minute, is regulated outside of the machine itself, the valve gear being operated by belt and pulley from a line shaft driven by power from an independent engine or motor.

One engineer usually takes care of two stamps, but three is possible by the use of an arrangement whereby the feeder man can at any time stop the stamp. This division of authority between engineer and feeder is by some operators thought to be a poor plan. A steam stamp is not fed automatically like a gravity stamp, but a man must be at each mortar to feed the ore as required, at the same time picking out all lumps of copper coming down the chute, which will amount to 6 to 8% of the total metal saved in the mill. Should anything happen requiring that the stamp be stopped, he pulls a cord which releases a catch and allows a 75-lb. weight to pull the steam-valve lever, shutting off the steam. Even if it were not possible to eliminate this 6% of copper from the mill system with a man at the feeder, the importance of not allowing a break of the stamp is so great that no mechanical feeder could be trusted. Some mills have a shaking feed, but a man is kept there just the same to pick out the copper and regulate the ore going to the stamp. The feed spout is always high enough above the mortar and inclined sufficiently so that all the feeder has to do is to regulate the feed with a bar bent like a poker. He does not shovel at all.

Drop and Stroke

The stamps drop with a stroke of from 24 to 25 in., with 6 to 8 in. of ore on the die, as already mentioned, and when the stamp has reached a safe limit on its downward stroke the bonnet on the shaft strikes a bell. It is therefore the business of the feederman to keep the stamp as near as possible to the point where the bell will ring. In a mill with, say, one steam stamp crushing 600 tons per day, there will be one engineer and one feeder on each shaft, and a repair crew of at least four men, which is about the same force as is required in a 100-stamp mill.

A new shoe for a steam stamp weighs from 780 to 800 lb., and when rejected weighs 380 to 400 lb. They are made of chilled cast iron, costing 3½c. per lb., and ¾c. is returned for the worn shoe, making the actual cost about 3c. per lb. This shoe will last from four to seven days, during which time it will have crushed 2000 to 4000 tons of ore at a cost per ton of ½ to ¼c. for iron. Various kinds of steel have been tried, but none proved equal to cast iron in cost. This shoe cost per ton cannot be approached in a gravity mill, for the



ALLIS-CHALMERS STEAM STAMP FOR MICHIGAN COPPER MINES.

freight alone is often more than the cost of cast iron delivered at the Lake Superior mills. Even should a steam stamp be transported to a gold mine, no means of comparison would be available. It is known that at the end of every four days or a week the shoe must be changed, taking at least half an hour, during which time the whole mill is idle, while in a stamp-mill only five stamps at a time are hung up every 120 to 150 days, and sometimes not even this, for the shoe may be changed on a clean-up day. The steam stamp must be hung up at least once a day to examine the wedge that holds the shoe to the shaft. This takes at least five minutes. This, in the case of the gravity stamp, is not necessary, so on the whole it may be said that the gravity stamp operates more of the time than a steam stamp. Account must be taken of the fact that the steam stamps do not run on Sundays, but repairs are made on this day if necessary.

A steam stamp die weighs about 800 lb. and is replaced when there is yet 500 lb. left; but this 300 lb. wear is distributed over seven months to a year, so that the cost of die material is a negligible quantity. The die is held down by a ring which in turn is held down by the staves or lining of the mortar, in which one section is bolted to the mortar, thus insuring that the die cannot be misplaced. The shoe is 24 by 16 in., rounded at the two ends, while the die is round and slightly less in diameter than the shoe. This is directly the reverse of gravity mill practice where the die is slightly larger than the shoe, but as the layer of ore on the die in the case of the steam stamp is thick enough to protect it from wear, the ring about the die takes any wear due to this cause. The depth of discharge or distance from top of the die to bottom of screen opening with a new die is 9 to 9½ in., increasing to 12 or 13 in. with a worn die. I measured one mortar in which the discharge was 16 inches.

Drawing Copper from the Mortar

About midway up the inside of one of the staves, or mortar lining, is a 5-in. diameter hole sloping downward at 45°. This is the opening in the mortar of the Krause discharge. A stream of water enters the 3-in. water-supply pipe, forming a hydraulic sorting column sufficiently strong to keep the ore in the mortar, but not strong enough to prevent lumps of copper from settling in the pipe. These are then drawn off at convenient times into a box. Some mortars have the opening at the top of the staves, while others have a hydraulic jig to answer the same purpose. From 10 to 15% of the total copper recovered is taken from this discharge, not entering the mill system at all. Thus the feeder and the mortar discharge together take out about 20% of the copper in the ore. The necessary object being, as mentioned, to take out the copper as soon as it is freed from the gangue, a 3/16-in. screen is placed after the stamp to take out the oversize passing the ⅝-in. battery screen. The oversize is jigged in a bull jig to take out the coarse copper, and the tailing is crushed by rolls or returned to the stamps. The 3/16-in. pulp passes to Woodbury classifiers, the product suitable for concentration being treated on Wilfley tables. This is the general scheme of treatment in those mills not requiring regrinding of the 3/16-in. mesh product, the elimination of waste taking place wherever most convenient and suitable. This is the right treatment where the 3/16-in. mesh tailing does not contain enough copper to pay the cost of regrinding and concentration, but in most of the mills where the sand tailing contains sufficient copper to pay the cost, regrinding and reconcentrating the product is the rule. While the cost of milling has increased to nearly double that in the mills where stamps and rolls alone are used, the extraction of copper has also increased. By careful comparative tests, extending over several years, C. H. Benedict has demonstrated that the pebble-mill is better adapted to this work than the Chilean mill.

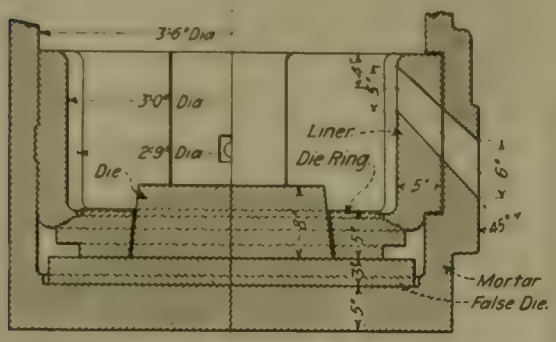
The system of concentration varies in different mills only in details, the plan everywhere being to remove a fairly clean copper product from each table and return the middlings to other tables suited for that class of work. The Wilfley table is the standard machine for concentrating coarse or fine ore. An interesting jig classifier is in use at the Quincy mill. This is the Shields and Theilman classifier, which is a series of small hydraulic counter-current jigs, taking but little floor space for its capacity. This machine was described in the *Mining and Scientific Press* of June 7, 1913.

On visiting the various mills I was struck at once with the readjustment due to the introduction of the Hardinge mill. Of regular tube-mills none are being installed, and only one was in use so far as I went. The visitor may well ask how Mr. Hardinge did it. One answer is that he was willing to undertake the building of mills for this work, while none of the tube-mill makers offered anything. While but one of the users told me he thought conical mills had any appreciable sizing action, and while few believe it any more efficient than a cylindrical tube-mill, and some thought there was no difference, yet all liked the mill because it is of handy size, its not occupying an excess of space per unit, and giving a product more even in composition than the Chilean mill, besides costing less for attendance and repairs. That the product was of a more even grade than that from the Chilean mills, I could see by comparing the material from each, on the tables. At one plant an 8-ft. Hardinge mill, a 4-ft. diam. 26 ft. long tube-mill and Chilean mill have run side by side, and while no economy in operation is claimed for the Hardinge over the tube-mills, yet they are preferred for other reasons, the Chileans going into the discard. It is only fair to the Chilean mill advocates to say that the mills tested are out of date in every respect, and to the advocates of ordinary tube-mills that the 4-ft. mill was too small in diameter for the work it had to do. The average feed to the regrinding plant has the following composition: 10 mesh, 17.1%; 20 mesh, 42.1%; 40 mesh, 34.8%; +60 mesh, 2.5%; and —60 mesh, 2.9%. A 6-ft. cylindrical tube-mill, I believe, would have shown better work for comparison.

Spare Mills for Regrinding

The ratio of water to ore in the tube-mill feed varies from 3 or 4 to 1. This is much higher than that used in gold milling, but I was reliably informed at one plant, where the ratio was 3 to 1, that less water could not be used with benefit. I believe a careful investigation into this point will in future yield results. The new Calumet & Hecla regrinding mill plant, not yet completed, will contain 64 Hardinge mills, 8-ft. diam., 18-in. cylinder, and 320 Wilfley tables. The mills will be in two rows of 32 each, with an extra mill always ready repaired. These 64 mills are all run in boxes set on steel girders and not on concrete. There are two concrete foundations for spare mills. When a mill needs relining or other repairs, it will be lifted by a traveling

crane, taken to the spare mill, and the contents emptied direct into it, and will then be put on the other concrete foundation to be repaired. The crane will then lift the other mill, now filled and ready, and put it in the place of the one taken out, the whole operation not requiring more than half an hour.



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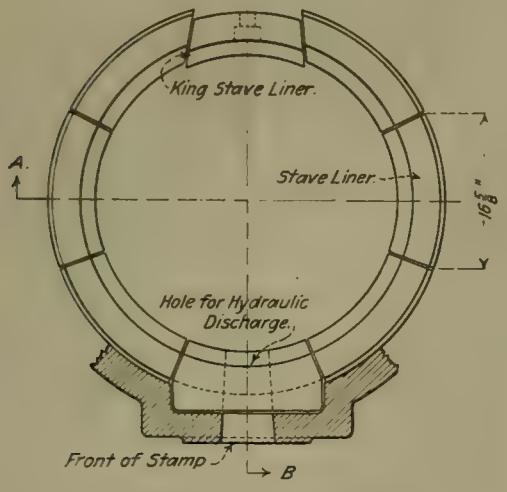


DIE, RING, AND STAVE LINERS; ALLIS-CHALMERS STAMP AT WINONA, MICHIGAN.

These mills are all silex lined and run by 40-hp. motors at 475 r.p.m. They are driven by Westinghouse motors geared direct from the shaft. It is claimed that a saving of from 10 to 15% is made over those run by belt or intermediate plain geared shafts. Generally in the district the pebbles are fed at the discharge end. A boy takes care of three mills, throwing the pebbles in as far as practicable. No better way has yet been devised of feeding the pebbles, but there is no reason why the pebbles could not be fed in the feed end, especially where the scoop feed launder is dispensed with and the ore fed into the cone through a pipe. The objection to feeding pebbles with the ore in the scoop feed is that the scoop presses the pebbles in the feed box, which in time breaks or spreads the box out of shape.

That neither Chilean nor tube-mills are ideal regrinders for this copper ore is evidenced by the fact that but 50% of the copper is recovered from the tube-mill product and less than this from the Chilean. One reason for this poor extraction is that the grinding action in both these mills has a tendency to flatten the copper particles into thin sheets which are easily floated off on the concentrators. There is a good field for a machine that will regrind 3/16-in. mesh material to a slime at a small expense, and in such a way that the copper particles are granular or in some shape not easily floated. Such a machine has been tried, namely, the Lovett grinder. The machine may be compared to a pan without sides, in which the die has a circular motion and the muller a horizontal motion back and forth over the revolving disc. The result of these two motions is that the copper is rolled up in little balls or spirals. With this machine there is a saving of 20% over that made by tube-mills, but the power and wear costs are high and the output per machine is small. I have no doubt that this saving could be increased by passing the finished product through rolls with a grip sufficient to flatten out some of the spirals, for there is a tendency of some of them to go into the tailing.

The following interesting experiments with two different sized Hardinge mills will serve to show the requirements of regrinding. It will be seen that sliming is no objection. In fact, some operators would not object to 80% through 200 mesh, so, while the pulp going to the conical mills is somewhat coarser than in a gold mill, the resultant product is not much different. The figures were given to me by R. R. Seeber, of the Winona Copper Company:

1. Hardinge mill, 6-ft. diam., 5-ft. cylinder, 30.5 r.p.m.; 8140 lb. pebbles, plus feed; run by G. E. induction motor, 3 phase, 60 cycle, 2200 volts, 9.5 amp., 850 r.p.m., 35 hp.; G. E. starting compensator, type NR 1628, form a5. From rest this mill required 52 amp., attaining full speed at 9.5 amp. in 6 seconds. The mill feed dry weight was 1.75 tons per hour, with 30.3 average kilowatt. The screen tests were as follows:

Mesh	10	20	40	60	100	200	200
Feed	66	17	7	5	2	2	1
Product	..	..	..	6	17	26	51

2. Hardinge conical tube-mill, 8-ft. diam., 30-in. cylinder, 26.3 r.p.m.; 11,000 lb. pebbles plus feed. Motor, Allis-Chalmers induction motor, 3 phase, 60 cycle, 2300 volts, 11.5 amp., 850 r.p.m.; Westinghouse 'Autostarter,' type 184B, style No. 31239a. From rest this mill required 63 amp., attaining maximum speed in 6 seconds. The mill feed dry weight was 2.53 tons per hour; average kilowatt, 42.2. The screen analysis was as follows:

Mesh	10	20	40	60	100	200	200
Feed	35	18	7	8	13	11	8
Product	..	1	3	9	21	33	33

For those interested in efficiency tests, I find that by the "reduction by area" method the efficiency of the 6-ft. mill compared to the 8-ft. mill is as 104 to 90. Mr. Seeber worked the comparison out by Stadler's method based on Kick's law, finding the ratio to be 13.27 to 8.63. There can be no doubt that the first ratio is more nearly correct than the second, for it is most improbable that the 6-ft. mill could be half again as efficient as the 8-ft. mill.

Experimental Development of the Hall Process

By H. F. WIERUM

The Hall process aims to eliminate sulphur from sulphide ores or matte without allowing any SO_2 to escape, and to recover the sulphur thus eliminated. The purpose of this article is to describe what measure of success has so far been attained. For some four or five years prior to 1914, my problem had been to make as much and as rich an SO_2 gas as possible, at the Tennessee Copper Co. works, which I had charge of, in order to make sulphuric acid. It was quite a wrench to my feelings, therefore, to be required to turn around and try to make a gas as poor as possible in SO_2. But the interest in the process soon became fascinating, and it was a hardship for me to have to stop the experimental work at Balaklala, in California, just as the A B C's of the process were being well developed.

Early Work in Europe and Brooklyn

William A. Hall, the original inventor of this process, tried out his first ideas, I believe, at a little place near Paris called Levallois. He used a small brick-lined circular furnace about 18 in. diameter, with a removable tile top, into which he introduced pyrite, and which he heated by means of very low-grade producer gas carrying but 130 B.t.u. per cubic foot. The results obtained in this furnace were interesting only as an impetus to further investigations. Without any regard as to how many pounds of pyrite was treated, or how many cubic feet of gas was used, the tests simply resulted in a fairly complete desulphurization of the pyrite without any detectable SO_2 in the fumes, which consisted of a mass of white or yellowish white sulphur vapor, as they appeared to the eye, when leaving the discharge pipe of this furnace. Steam in small but entirely unmeasured quantities was introduced at the same time as the gas, through jets placed between the gas burners on the furnace. To say the least, it was a startling sight to see pyrite introduced into a glowing red-hot furnace and then to be able to breathe the discharged fumes without any of the familiar choking odor of SO_2 being detected.

These experiments were repeated on a similar furnace, but with different gas, in London, and later in Brooklyn. The gas used both in London and Brooklyn was the ordinary city gas of from 500 to 600 B.t.u. per cubic foot. The results were the same. It should be noted that in both these preliminary experiments air was carefully excluded from this furnace, except such air as was blown into the gas burners themselves, in quantities just sufficient to completely burn the amount of gas introduced. Lest some of you question in your minds whether air was really excluded, let me explain that the manner in which it was excluded was a very efficient one, namely, the maintaining of a rather heavy back pressure in the furnace so that when any opening in the furnace was made the flame and sulphur fume would shoot out from such an opening instead of the air being drawn in.

Of course, it has long been known that about one-half of the sulphur in FeS_2 can be distilled from it by a mere application of heat; about 1300°F. is required to start the distillation effectively. The remaining one-half, however, it has always been contended, cannot be dislodged from its connection with the iron or any other base by simple heat. With these experiments just recorded before him, Mr. Hall drew up his first patent papers and attempted his first theory in the premises; and of all the many prominent and experienced engineers who witnessed these first little tests, I do not know of one who was not strongly impressed by what he saw. They were puzzled, however, and many a pencil was set busy trying to figure out possible chemical reactions that had apparently heretofore escaped the scientific world. Now it is entirely possible to write a reaction which will account for what the eye saw during these short tests, but whether such a reaction actually takes place *I am not prepared to say*, and every metallurgist is perfectly free to form his own opinions as to the feasibility or otherwise of such combinations as the following.

Reactions Involved

Let us assume, first, that about one atom of sulphur has been distilled by mere heat from FeS_2, leaving a sub-sulphide of iron which can be roughly designated as FeS. Now comes the first chemical reaction:

$$6FeS + 6H_2O = 6FeO + 6H_2S$$

Many will doubt the ability of any heat obtainable in a roasting furnace to break up water in any such manner as this. Nevertheless, here was this little furnace, with an air-supply insufficient even to burn completely the gaseous fuel used, turning FeS_2 into Fe_3O_4, with only the oxygen of water, available as a stable equivalent for the S, in combination with Fe. Red-hot iron decomposes water, why not red-hot FeS, or Fe_6S_7, or carbon, or red-hot anything that it is not known positively will not do it? Such were the questions the experimenters had to ask themselves. So we go bravely on, and accuse the little furnace of decomposing enough water to satisfy the second reaction of the cycle:

$$6FeO + 3O = 3Fe_2O_3$$

Following this comes the third chemical reaction, which I think is quite feasible under suitable conditions, especially provided the two foregoing reactions can be brought about:

$$3Fe_2O_3 + 6H_2S + 5O = 2Fe_3O_4 + 6H_2O + 6S$$

It seems fruitless, however, to discuss whether or not any such cycle of reactions actually occurs. I simply wish to emphasize one fact, that in the little furnace described above, FeS, carrying some 48% of sulphur was freed from its sulphur down to about 5%, by a treatment with producer gas at a temperature of about 800 C., introduced with insufficient air to burn completely this producer gas, and with some steam present, at the same time maintaining such a strong back pressure that no suction whatever existed in the furnace and no outside air could possibly have been drawn in.

Larger Furnace Tests

The next step in investigating what happened was the construction of a slightly larger furnace, mechanically rabbled, but of the same general design as these little pot furnaces just described. The only step accomplished by this increase in size and efficiency of the furnace was the obtaining of a record of how long the ore was under treatment, and in keeping accurate and continuous data concerning the amount of SO_2 contained in the fumes. The result of the official tests, which were conducted under the auspices of two of our most respected and experienced chemists and metallurgists, was that the SO_2 was always below 0.10%, that the sulphur in the calcine was down to 3% or under, and that the weight of ore treated per square foot of hearth area was approximately the same as the weight treated in the regular McDougall furnace per square foot of hearth area per 24 hours.

One other point was tested in this second furnace. Some chemically pure sulphide of iron was bought, corresponding to the formula of FeS. This contained no feeble atom, or unstable atom of S, and yet this material was decomposed under exactly the same conditions as the pyrite, with practically identical results. In the later trials, this experience with monosulphide of iron and also with some matte (which roughly answers the formula of monosulphide of iron) has always puzzled me, and still continues to puzzle me.

When the tests had reached this point, I was called upon to carry out certain experiments that had been arranged for by the gentlemen controlling the rights to this process, at a large smelter in California which had been closed down for some time, and I had only rather meagre data to go on in equipping a unit to handle 25 or 30 tons of ore per day when the largest scale upon which this process had been tried had been about 25 or 30 lb. per day. I was unfortunately very much pressed for time under existing conditions, and had to attempt the impossible in getting a gas plant built, furnace equipped, and some tests completed in three months' time. The result of this haste was that I was unable to try out the producer gas plant, or to change it to a generator plant, in the specified time. So, to make a long story short, it was found necessary to extend the time to be devoted to these tests, and when this was arranged the gas plant was put in excellent shape with washers and a fairly large gas holder, so that when we started up again, about January last, we had good clean gas to deal with. During this second construction period, however, we equipped a second McDougall furnace with oil burners. Strangely enough, the totally unsatisfactory tests made with oil burners in Brooklyn led the staff to believe that crude oil was not a suitable fuel for this purpose, and therefore the equipment of a furnace with oil burners was simply undertaken as a side issue. However, this furnace later proved more valuable in developing the process than did the gas-fired furnace.

About January 1, 1914, the gas-fired furnace was started, but unfortunately it was impossible to keep it operating during the month of January for 24 hours at a stretch, not because of any difficulty with the plant or process, but purely and simply because Shasta county, California, was then enjoying unusually bad weather. Storm after storm interrupted the electric power-supply of the plant, and no sooner would the furnace be heated and filled with ore and the sulphur coming off nicely through the flues, than the power would go off, the blowers and motors all stop, and immense volumes of SO_2 begin to pour from the stack. These interruptions occurred on an average of twice a day for the first two weeks of January, and nearly once a day for the last two weeks, so that I became quite discouraged over the possibility of obtaining any reliable results in time. Meantime, however, the oil-fired furnace was made ready, and one occasion when the shut-down was more prolonged than usual was seized upon to stop the gas furnace and start the oil one, which was far less dependent upon electric power. During the early part of February, steam power sufficient for most of the requirements having been hastily provided, the oil-fired furnace was operated. Although still subjected to many interruptions, these were gradually eliminated, and the weather became better, so that after a week or so real progress began to be made.

Ore Used in Tests

The ore provided for treatment was crushed to ½ in., and as this ore was not in the slightest degree friable, being very dense, ½-in. pieces were found to be distinctly too big. Therefore, a system of screen analysis was adopted on the calcine, and while from day to day the sulphur elimination in the material which passed the 10-mesh screen seemed to improve, nevertheless it was found extremely difficult, if not quite impossible, to roast the ore down to the 5% point aimed at under the conditions which we first imposed upon the furnace.

Careful analyses were made of the atmosphere existing on each hearth of this 18-ft. McDougall furnace which was employed and in the flue leading away from it, and for the first two weeks tests were conducted in an atmosphere which contained about 1% or less of free oxygen and a rather generous percentage of CO; in other words, a highly reducing atmosphere throughout. It was under these conditions that the experiments failed to produce a better calcine than about 11 or 12% sul-

phur in the 10-mesh material. The larger pieces of ore as they came from the furnace were barely singed, and an analysis of these showed about 26% sulphur; the original ore having contained roughly 40%. But I should record that in all this period hardly a trace of SO_2 existed in the escaping gases.

Time was again pressing, due to certain business arrangements which had been made, and I found it impossible to try all the variations which I would like to have tried under completely reducing conditions in the furnace. I therefore began slowly to allow a little oxidation to occur on the lower two hearths of the furnace, and in doing this finally hit upon a set of conditions which seemed economically very important to the industry and to the problem of fume destruction. Let me state briefly in figures what the best results were, maintained constantly for several days, and each will be able to judge for himself whether or not there is reason to hope for important commercial developments in this process. For about a week the ore was fed at the rate of 24 tons in 24 hours. During this period the sulphur remaining in the 10-mesh calcine averaged 5½%. The sulphur remaining in the total sample of ½-in. material, coarse and fine together, averaged about 8.8 per cent.

Oil Consumption

The oil consumption was about 22 gal. of oil per ton of ore. The oil used was a very cheap material carrying 25% of asphalt and of about 23°B. gravity. The SO_2 in the fume escaping from the furnace for the entire period was a trifle over 0.3%. The labor required is practically the same amount as is required for ordinary McDougall roasting, and, of course, the more furnaces and the larger tonnage treated, the lower the labor cost per ton, inasmuch as it takes just as many men to tend and feed one furnace as it does four. Note that although the figures just given are the averages of almost hundreds of samples of gas and calcine, the entire period showed improvement toward the end and afforded an opportunity of studying what changes in the furnace itself would conduce to still more favorable results. Toward the end of this period, when the staff became more familiar with the behavior of the furnace under this controlled atmospheric condition, the best results, maintained for 24 or 48 hours, may be stated briefly as: oil consumption, 16 to 17 gal. per ton of ore; 10-mesh calcine, 5.3% of sulphur (although for two or three days the calcine ran between 2.8 and 3.6% sulphur); and SO_2 frequently as low as 0.06%. It is necessary to bear in mind the fact that these tests were all made in an existing furnace with all the mechanical arrangements, such as the speed, angle of the rabble blades, depth of the bed of ore carried, and the length of time in the furnace, adjusted for regular conventional pyrite roasting operations, and it is not surprising that some of these conditions demanded alteration in order to obtain the best results from quite a different operation. Such alterations were beyond the bounds of possibility in the short time available, and metallurgical common sense must therefore come to the rescue in predetermining roughly what effect certain changes will have. I wish to avoid too many statements of my own private opinion, but will give for what it is worth the conclusion that my study of the matter has brought about in my own mind as to the possibilities. I think that with 10-mesh ore and arrangements for more frequent rabbling, and suitable means for keeping the ore in certain portions of the furnace for a greater length of time than the present conventional practice provides, the following results can without difficulty be maintained as a regular thing: In an 18-ft. McDougall furnace I believe it possible to treat 40 tons of 10-mesh ore daily with a consumption of 500 gal. of oil, roasting it down to 5% sulphur, and controlling the escaping fumes so that they will never exceed 0.3% SO_2, and would probably average 0.15% or less. I trust that no one will get the idea that this last set of results which I have given have actually been accomplished; they are simply my opinion, based upon the experience that I have had, of what can be attained in time.

Now for a word or two about the chemical reactions. In the upper portion of the furnace, about one-half of the sulphur is distilled by mere heat. The lowest portion of the furnace, say one-third of the hearth area, is devoted to the oxidation of the iron, copper, and remaining sulphur by a free admission of air. In the middle third of the furnace portion, a strongly reducing atmosphere and rather high temperature, say 1500°F., are maintained. It is in this central portion of the furnace where the SO_2 formed below is broken up and reduced to elementary sulphur. It is an undeniable fact that some H_2S is formed in the upper regions, and it is equally undeniable that H_2S will react upon SO_2 under certain conditions, forming water and sulphur; but I have not been able to prove that the $H_2S + SO_2$ reaction is the controlling feature in the reduction of SO_2. When a too strong reducing atmosphere is permitted in the presence of liberated elementary sulphur and steam, certain undetermined organic sulphides are formed which seriously interfere with the production of sulphur. There seem to be two ways of avoiding this interference. First, the avoiding of too great an excess of fuel. Second, a quick drop in the temperature at the point where these conditions of excess oil vapors and free sulphur exist. Naturally, the former is the more economical way out, but both have been proved feasible.

Failure of Washer

In attempting to save the sulphur, a Feld washing machine was provided to wash the elementary sulphur from the gases, and for the first two or three hours after a free discharge of elementary sulphur had been secured from the furnace it looked very much as if this machine would take care of the sulphur most effectively. But four or five hours continuous running led up to serious trouble. The thick, creamy-looking emulsion that came from the washer was led into tanks provided with sand

filter bottoms, and the filtrate from these tanks was beautifully clear and free from any sulphur; but presently a disturbance in the draft condition of the furnace appeared, and investigation proved it to be caused by a complete clogging of all the gas passages in the washer. Fortunately, facilities had been provided for by-passing the gases around the washer and allowing them to escape into the air from the stack. This was done, and upon opening the washer it was found to be completely clogged up with yellow and gray sulphur, so sticky and plastic that neither a stream of water under high pressure nor a jet of steam would remove it from the interior surfaces. Anyone familiar with the construction of a Feld washer will appreciate how impossible it was to clean the inaccessible spaces between the lead cones in this washer when once stuck up with this plastic mixture, and after this first experience it was only possible to use the washer for an hour or so at a time, and then very ineffectively. Most of the time during the experimental work in California the gases, which consisted of a thick, heavy yellow cloud of sulphur, were discharged through a fan to the stack and thence out into the atmosphere. Innocuous, it is true, but tantalizingly uneconomical.

Electric Precipitation of Sulphur

To the small furnace in Brooklyn we had previously, in the course of our tests there, attached a treater of the Cottrell precipitation type, and found that this electrolytic discharge was completely efficient in collecting the sulphur. Unfortunately, business arrangements could not be made in the time at our disposal to install a Cottrell precipitation plant in connection with the McDougall trials in California, so that until very recently I have been unable to say positively how the liberated sulphur can be recovered. Though I and most of my associates are reasonably sure that the Cottrell method will prove both economical and efficient, it goes without saying that much experimental work would be required before satisfactory plant details could be worked out.

However, while looking into certain proposals in Hungary about two months ago, I happened upon a government sulphur factory which had been in operation for many years. This was at a little place called Zalatna, in Transylvania, and I was greatly pleased to see with what facility the elementary sulphur was washed out of the gases in simple and inexpensive wooden towers which contained many baffle-boards over which a saturated solution of chloride of calcium was flowing. The consumption of chloride of calcium was almost *nil*, the emulsion coming from the foot of the towers was led into a series of tanks where the sulphur settled out quite completely without any filtering, and the clarified chloride of calcium solution was again pumped to the top of the towers. The settled sulphur is then heated in closed drums under a light steam pressure, the molten sulphur is drawn off at the bottom, and the $CaCl_2$ recovered is drawn off at the top. Naturally this suggestion seems the cheapest way of solving the problem, and I had three towers half constructed in London, with the object of duplicating the performance which I witnessed in Hungary, when the war broke out and all business was stopped. Arrangements had about been perfected whereby I was to construct in the northern part of Norway a plant similar to the one with which I experimented in California, but the war has also put a complete stop to that, so that the Hall process has had ill luck again.

I have here described quite frankly practically everything that there is to be told concerning experimental work with the Hall process thus far. I have found a feeling prevailing among many people, who have heard of this process, which I very much regret. This is a feeling that claims have been made which are too broad and complete really to deserve credence, and I am glad of an opportunity to state that no further claims are being made than can be deduced from the results here presented. I realize that there are many points still to be perfected, but I feel strongly that the Hall process, now in process of development, constitutes an important improvement on methods of handling gases which will ultimately play a big part in abating the fume nuisance and in supplying the market with sulphur.

Efficiency of the Burro

By WM. A. BURR

*The burro fills a place in the mining and metallurgical world that no machine can entirely fill. He can carry steadily on his back, loads ranging from 125 to 250 lb. He can forage for himself if necessary. He can make his own trails. He can ascend the loftiest peaks with his load and climb to places with comparative ease that a man can only reach with difficulty. His cost ranges from $4 on the southern border of the United States to $20 in our own vicinity, for average animals. He is almost as easy to raise as a chicken, and is broken under the pack in one day. His rate of travel loaded, for inferior animals is seven miles per day, and for animals in good shape fourteen miles; the average may be taken as eleven miles.

In packing from mine to mill a distance of one-half mile, a burro could make ten trips a day if properly handled, and consequently carry three-fourths of a ton of ore at a cost of 45c. per ton, providing not less than a dozen burros are working together. On a one-mile haul three burros could deliver one ton of ore per day and thirty burros could keep five 1000-lb. stamps dropping with a transportation cost of 75c. per ton; while with a three-mile haul 150 burros could keep a 10-stamp mill supplied with ore at a cost of $1.50 per ton or less. And I recommend to you the re-adoption of these valuable little animals in the solution of your difficulties in transporting ores in mountainous places off the railroad where roads are not passable for wheeled vehicles.

*From an address delivered before the Northern California and Southern Oregon Mining Congress.

OFFICE AND LIVING QUARTERS OF CREW.

Building a Placer Mining Dredge With Electric Power Plant in Portugal

By H. G. PEAKE

Portugal has, for a great many years, produced small quantities of placer tin, but only within the past three years has any deposit been proved which would warrant the erection of a plant of any magnitude. During the summer of 1912 certain areas in the northeastern part of the country were drilled and on the Gaia river near the town of Belmonte, district of Beira Baixa, sufficient ground suitable for dredging was proved to warrant exploitation. It was thereupon decided by the owners to build a suitable power plant and a dredge.

Owing to the slight snowfall, even in the highest altitudes of this district, the summer flow of all of the streams is small, so it was decided to erect a steam plant for generating electric power at the railway station of Belmonte. This station is about two and one-half miles from the town of Belmonte, on one side of a low divide, and the dredge site is on the opposite side about five and one-half miles from the town. This made the transmission line about eight miles long. The power station is equipped with a Babcock & Wilcox water-tube boiler, with superheater. A Ratteau high-pressure steam turbine is direct connected to the dynamo. This dynamo has 250-kw. capacity at 80% power factor, runs 3600 revolutions per minute, current 60-cycle, 3-phase, voltage 6600. The exciter is mounted on the generator shaft. A jet condenser is placed directly under the turbine. All water from the condenser delivers into a hot well. From here it flows by gravity to a sump and is pumped to the cooling tower by a 4-in. centrifugal pump. This cooling tower is erected over a large concrete basin and the water flows by gravity to the condenser tank from this basin. The water supply for the plant is taken from a small stream about 2800 ft. distant.

Transformers are situated at the dredge, stepping down from 6600 volts to 440. All of the motors are operated at this voltage. The transmission line follows the government road. Poles and cross-arms are of wood and the transmission line of hard drawn copper. The technical work and the construction of this plant was under the direction of J. S. Soares, formerly of Marysville, California.

The ground to be dredged is alluvial, averaging 17 ft. deep and is quite level. The climate is such that dredging can be carried on all the year round. Practically all of the land is under cultivation, so no timber has to be cleared away, and the only boulders found are on the surface along the river banks, where they have been placed to prevent the water cutting away the soil.

It was decided to build a 4-cu. ft. close-connected dredge with steel pontoon. This equipment was built by Fraser & Chalmers of London, and after considerable delay in dealing with the customs authorities of Portugal the material was shipped to Lisbon. From Lisbon all material was transported by rail to Belmonte station and from the station to the site where it was to be erected, the material was transported by auto truck and ox carts. During the delay on account of customs, living quarters were built, work was carried on at the power

GENERAL VIEW OF VALLEY WITH FLUME TO DREDGE PIT.

PLACING THE SWINGING WINCH ABOARD.

plant, a pit was prepared for the dredge, and a temporary machine shop was put up. On November 17, 1913, the first bottom plate was laid and the dredge was placed in commission on April 19, 1914. The crew employed on this construction work was made up of eight American dredge men from the Oroville district, three Englishmen from Fraser & Chalmers' shops, four Portuguese riveting crews from Lisbon, and about 20 native Portuguese laborers.

The dredge was designed to dig 26 ft. below the water line. The general arrangement is similar to California practice, except as to sluices and stacker. There are

eight sluices, four on either side, running fore and aft, each sluice is 90 ft. long, 43 ft. on board the dredge, and 47 ft. projecting beyond the stern. These sluices are arranged with head gates so that one on each side may be cleaned up while the others are in operation. The conveyor is horizontal, mounted on a stationary steel frame, the carrying belt is 10 ft. 6 in. above the deck, and the discharge is at a point about 30 ft. beyond the stern.

This design was adopted with the view of leaving the dredged ground as nearly level as possible so that it could again be used for agricultural purposes. It was possible to adopt this type of dredge on account of the small percentage of heavy wash in this particular alluvial deposit. Probably not more than 20% of the material will be rejected by a screen having one-half inch diameter perforations.

The sluices are fitted with riffles and the concentrate is shoveled to the head of each sluice and into a hopper feeding a worm-type conveyor. This conveyor delivers into a second screen, where the material is sized for jigging. The jigs are directly under the main revolving screen, and are driven by a separate motor. So far as I know, this jigging plant is the first attempt to handle the concentrate in this manner on a placer tin dredge. The usual custom has been to wash and clean the concentrate in the sluices to a certain extent, then transfer to a plant on shore and finish the cleaning. In one plant, visited in Cornwall, this process made it necessary to stop the dredge for about two hours each day while the concentrate was being transferred to wagons. The shore station in this instance had one small jig which removed the heaviest particles of cassiterite. The fine material was further treated by hand. About 30 to 40 tons per day was transported from the dredge to the shore station.

With the jigging plant, as installed on the dredge in Portugal, it is anticipated that practically a clean concentrate will be made. In any event, the bulk of material to be taken ashore will be so reduced that it will not be necessary to shut the dredge down in order to transfer it. The fine concentrate from the jigs will, in this case, consist of material averaging approximately 70% titanic iron and 30% cassiterite. To remove this large percentage of iron, a Weatherill magnetic separator has been installed at the power station. The concentrate is dried on a large steel plate, placed over a horizontal flue, extending from the boiler to the smoke-stack. It is then screened, nothing over $\frac{1}{16}$-in. diameter going to the separator. The oversize from the screen will undoubtedly contain some particles which carry considerable granite. It remains to be found by operation what percentage of this material there will be. If very much of it is found, it is planned to install a small set of crushing rolls to free the cassiterite. It will then be rewashed, dried, and run through the magnetic separator.

THE COMPLETED DREDGE AT WORK.

MINERAL PRODUCTION of Illinois in 1913 was valued at $131,825,221, of which coal mines contributed $70,313,605; petroleum, $30,971,910; and brickyards, tile works, and potteries, $15,195,874. In 1912 the value of the total mineral production was $123,068,867, including $70,294,338 for coal, $24,332,605 for petroleum, and $15,210,990 for clay products. Portland cement was worth $4,784,696, an increase of $1,340,611. Manufacture of pig iron and coke, the raw materials for which are imported from Lake Superior districts and West Virginia, amounts to about $55,000,000, the Chicago district being one of the most important in America.

IMPORTS of crude and manufactured mineral products into the United States in 1913 was $270,000,000, of which 74% was raw material.

Method of Mining at Republic Mine, Republic, Michigan

By R. B. WALLACE

*To illustrate the method of mining used at this hard-ore mine we will take as an example a body of ore averaging 20 ft. wide and 80 ft. long and extending several hundred feet in height. These 'lenses,' if we may call them such, do not always stand vertical, but may be inclined as much as 20 or 30 degrees.

The first step in extracting the ore is to drive a 7 by 7-ft. drift through the entire length of the orebody. The ore is then cut out the full size of the orebody to a height of 15 ft. and the stull over the tramway put in place. Breaking is then commenced and the ladder-

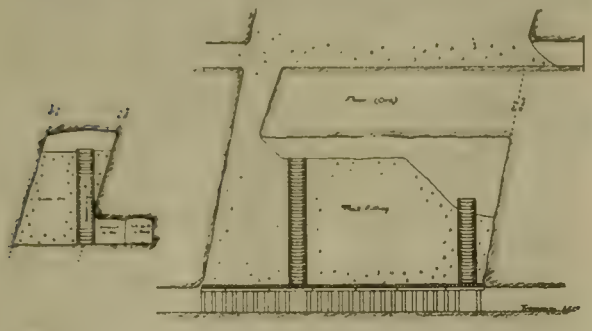


Fig. 1. Fig. 2.

way mills are built up as is shown in Fig. 1. Fig. 2 is a longitudinal section through the stope showing the openings for drawing off the ore left every 25 ft. in the side of the timbered tramway. Only enough ore is drawn off to enable the miner to set up his machine.

In some places where the orebody is of greater length, this method has been modified, since the timbered tramways have to be renewed before the stope is finished. A drift is run parallel to the orebody about 10 ft. back in the foot-wall, and from this drift cross-cuts are made every 25 ft. into the stope; through these the ore is drawn off and access is obtained to the ladderway mills. A cross-section through one of these cross-cuts is shown in Fig. 3.

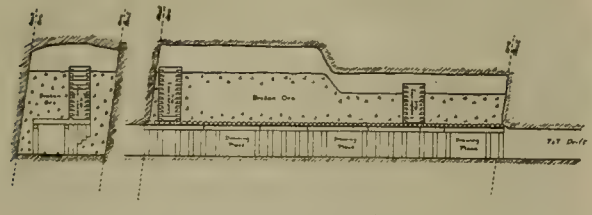


Fig. 3. Fig. 4.

In the old workings are some floors which are being taken out. The process is slow, as the open stope below has to be filled with waste rock. There is an abundance of this and sometimes it is intermixed with enough ore from caved pillars and floors to pay for separating and handling the rock. Fig. 4 is a longitudinal section of a stope which is almost filled with waste rock preparatory to mining the floor. When the stope is filled to within 6 ft. of the back, breaking is commenced and the ore is thrown down the mills. More filling is leveled across the stope and the floor is thinned till finally it is broken through.

*From advance proofs of a paper read before the Marquette meeting of the Lake Superior Mining Institute.

Natural Gas Production

The production of natural gas in the United States in 1913 was the greatest in the history of the industry. The total yield is estimated by B. Hill, of the U. S. Geological Survey, at 581,898,239,000 cu. ft., valued at $87,846,677, an average price of 15.10c. per 1000 cu. ft., as compared with 562,203,452,000 cu. ft., valued at $84,563,957, an average of 15.04c., in 1912, the increase being 19,794,787,000 cu. ft. in quantity, and $3,282,720 in value. Of this total product, about 32% was utilized for domestic purposes, or 184,885,662,000 cu. ft., valued at $50,522.415, an average price of 27.33c. per 1000 cu. ft., and 68% was utilized for industrial purposes, or 397,012,577,000 cu. ft., valued at $37,324,262, an average of 9.4c. The industrial consumption includes gas used for both manufacturing and producing power.

West Virginia led with 245,453,985,000 cu. ft., valued at $34,164,850. Pennsylvania was second, with 118,860,-260,000 cu. ft., valued at $21,695,845. On the other hand, Pennsylvania was the leading state in 1913 in quantity of natural gas consumed, with 177,463,230,000 cu. ft., valued at $28,709,565, and Ohio second with 128,-204,722,000 cu. ft., valued at $27,055,824. The extraction of gasoline from natural gas, or casing-head gas, from oil wells in the United States has become an industry of some importance in the past three years. Returns received from producers of gasoline of this character indicate that the production in 1913 amounted to 24,060,817 gal., valued at $2,458,443, an average price of 10.22c. per gallon, as compared with a production of 12,081,179 gal., valued at $1,157,476, in 1912, and 7,425,839 gal., valued at $531,704, in 1911. In 1913 West Virginia produced 7,662,493 gal. of natural-gas gasoline, valued at $807,406; Oklahoma, 6,462,968 gal., valued at $577,944; Pennsylvania, 3,680,096 gal., valued at $405,186; California, 3,460,747 gal., valued at $376,-227; and Ohio, 2,072,687 gal., valued at $212,404. The balance of the 1913 output was produced by Illinois, Colorado, New York, Kentucky, and Kansas.

NINETEEN MINING COMPANIES are operating in Honduras, Central America, but only three or four are actually producing. The Rosario mine in 1913 produced 76,128 tons of ore yielding 1,593,885 oz. silver and 11,193 oz. gold.

Weighing Minute Spheres of Gold and Silver

By J. I. BLAIR

In assaying ores or other substances for gold and silver it very often happens that the resulting 'button' or tiny bead of the metal that remains in the cupel is so small that it cannot be safely removed from the bone-ash cupel. For a long time in all such cases the result of the assay was given as a 'trace,' meaning that only a trace of gold or silver was found. But with the advent of better metallurgical processes for the treatment of the poorer ores it has become essential that the trace shall be a known quantity. Before, it meant anywhere from a few cents to fifty cents per ton of material treated. Since weighing these buttons was out of the question it became necessary to estimate their weight from their size. For this purpose a graduated scale was scratched on a piece of circular glass which could be inserted into the lower tube of a compound microscope. By this means the diameter of the bead may be obtained, and from this the volume of the metal and the weight of the button may be calculated. The instrument may be calibrated by using a piece of platinum wire of known diameter as a standard, or any other material of which the diameter is known.

To facilitate the work, tables have been prepared which make it possible to read direct the weight of the bead from its diameter and then the quantity of gold per ton of ore or material assayed. Such tables are easily prepared to fit each one's need.

In making up a table the following formula was used: The diameter in hundredths cubed, multiplied by the weight of a sphere of water 0.01 mm. in diameter, multiplied by the specific gravity of the metal. A sphere of water 0.01 mm. diam. weighs 0.000,000,523,6 mg. (See 'Mitchell's Manual of Assaying,' page 755.)

In applying this method it was learned that a very cheap compound microscope could be easily fitted with the scale, which may be had at any good optical goods house. The complete instrument that I have used cost only $5—$3 for the instrument, and $2 for the scale. After receiving the instrument it should be tested. For this purpose several little beads, in their cupels, may be sent to the nearest school of mines, where the diameters can be measured with a standard instrument. These beads of known diameter are now examined under the new instrument and the number of divisions covered by each bead is read. From these measurements the width of each division is calculated. If the instrument purchased has a factor given, use that. As example, your microscope might come with a factor: 1 mm. = 0.033 or 0.028. In such a case, simply multiply the width of each division by the number of divisions covered by the image of the bead and then refer to your table, or, in the absence of that, calculate the weight by using the formula given.

Operating Costs at Mines Near Reefton, New Zealand

The Blackwater, Progress, and Wealth of Nations mines, controlled by English companies and in charge of A. Winter Evans, are in the Reefton district of the South Island of the Dominion, and the following costs per ton are given in the report for 1913:

Department. Mining:	Black-water.	Progress.	Wealth of Nations.
Labor and salaries	$2.00	$1.60	$1.34
Explosives	0.10	0.06	0.04
Timber	0.34	0.23	0.25
Air-compressor	0.13	0.06	0.09
Ore transport	0.13	0.25	0.13
Maintenance of drifts, cross-cuts, etc.	0.18	0.27	0.17
Pumping and baling	0.06	0.01	0.02
Hoisting	0.29	0.40	0.51
Drills, sampling, etc.	0.23	0.22	0.29
Total mining	$3.46	$3.10	$2.84
Milling and treatment:			
Ore transport	$0.04	....	....
Rock-crusher	0.03	$0.02	$0.04
Stamping	0.29	0.33	0.62
Concentration	0.03	0.13	0.05
Tube-milling	0.06	....	....
Cyaniding sand	0.32	0.24	0.33
Re-treating old tailing	...	0.18	....
Disposal of concentrate	0.06	0.16	0.08
Total ore treatment	$0.83	$1.06	$1.12
General expenses, including taxes, insurance, salaries, supplies	$0.61	$0.36	$0.46
Bullion charges	0.12	0.08	0.12
Total costs per ton	$5.02	$4.60	$4.54

Mining costs are high on account of the narrow lodes worked, faults, and bad ground. In the Blackwater the lode is from 11 to 24 in. wide, in the Progress from 51 to 58 in., and Wealth of Nations about 35 inches.

The stamp-mills and cyanide plants showed the following results:

	Black-water.	Progress.	Wealth of Nations.
Ore crushed, tons	45,053	34,996	23,661
Sand cyanided, tons	24,080	19,010	15,275
Concentrate produced, tons	462	442	152
Value of ore treated, per ton	$11.07	$6.73	$9.65
Recovery, per cent	84.19	80.37	78.89

Progress ore contains arsenic and antimony. Accumulated slime is to be treated later, so raising extraction.

MAGNESITE PRODUCTION of the United States in 1913 was 9,632 tons valued at $77,056, against 10,512 tons and $84,096 in 1912, according to the U. S. Geological Survey. California was the only producing state.

GOLD OUTPUT of the Rand in August was 711,917 oz., worth £3,024,037, compared with 728,096 oz., valued at £3,092,754 in August of last year.

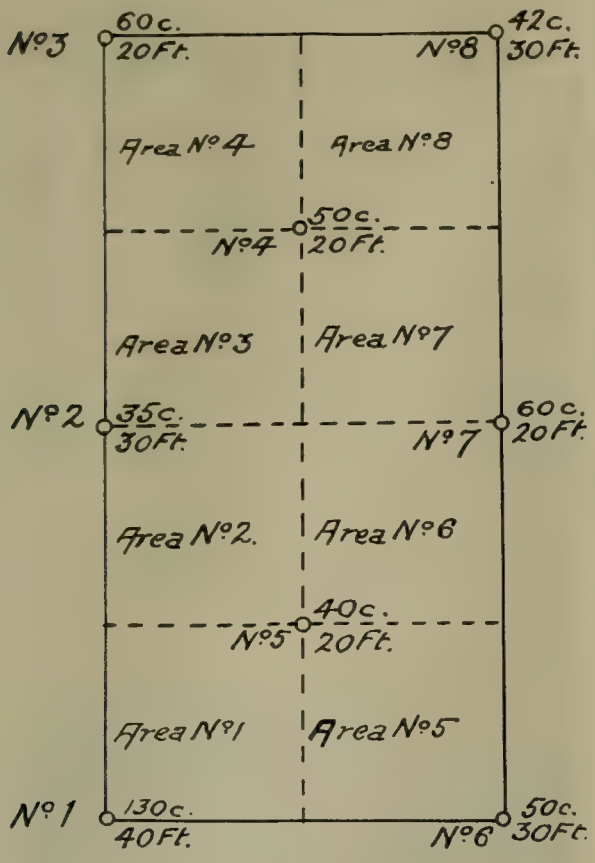
DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Valuing Placer Ground

The Editor:

Sir—Referring to Mr. Herrick's letter, on 'Valuing Dredging Ground,' in your issue of June 27, it may be of interest to note that if the average value of the area 'A' shown in the sketch be calculated by taking the average of the values and depths of the holes at the opposite corners of each of the 8 squares, into which the figure may be divided, as representative of each of the



squares, and taking the area of one of these squares as unity, the result will be as follows:

Area 1..... $\frac{130+40}{2} \times \frac{40+20}{2} = 85 \times 30 = 2550$

" 2..... $\frac{40+35}{2} \times \frac{20+30}{2} = 37.5 \times 25 = 937.5$

Area 3..... $\frac{35+50}{2} \times \frac{30+20}{2} = 42.5 \times 25 = 1062.5$

" 4..... $\frac{50+60}{2} \times \frac{20+20}{2} = 55 \times 20 = 1100$

" 5..... $\frac{50+40}{2} \times \frac{30+20}{2} = 45 \times 25 = 1125$

" 6..... $\frac{40+60}{2} \times \frac{20+20}{2} = 50 \times 20 = 1000$

" 7..... $\frac{60+50}{2} \times \frac{20+20}{2} = 55 \times 20 = 1100$

" 8..... $\frac{50+42}{2} \times \frac{20+30}{2} = 46 \times 25 = 1150$

$\frac{10025}{190} = 52.76$c. average value for area 'A,' or 2.13c. less than the value obtained by Mr. Herrick's method of calculation.

R. C. Jennings.

Plymouth, California, July 18.

[This discussion is bringing out such a variety of methods of calculating results, that there is evident need of more light. Who else has comment?—Editor.]

Solution Control in Cyanidation

The Editor:

Sir—In reply to E. M. Hamilton, who writes in your July 25 issue on the above subject, I would like an opportunity to point out that his letter does not deal in any way with the method of testing which I condemned in my original article, except in one instance where he seems to be in agreement with the views I hold.

The method I originally criticized was clearly referred to as (1) having been in general use since the commencement of the industry; (2) as giving an end-point indicated by a precipitate of silver cyanide; and (3) as being advocated in the most recent text-books. In continuing the discussion and in reply to Mr. Colbath I summarized these points by heading the paragraph

Liebig's Method.—Mr. Hamilton now enters a spirited defence of a titration test which is not only used by himself but by many other independent workers of his acquaintance; and he protests against what he terms an unkind assumption that I have considered himself and a number of his colleagues as 'hopelessly at sea.'

It is difficult to clear one's self from an accusation which has no connection whatever with the facts of the case. Has the method which Mr. Hamilton so ably defends against imaginary attack been in use since the

commencement of the industry? Obviously not because the first detailed description of its application only now appears in the technical press. Is the end-point in Mr. Hamilton's test indicated by the formation of silver cyanide or silver iodide precipitate? By no means. Mr. Hamilton explains that it is usually considered to be due to precipitation of zinc, and would presumably be cyanide of zinc. Is the method advocated in recent textbooks? I have seen no mention of it. Is it Liebig's method? Most certainly not.

Had Mr. Hamilton referred to my article, instead of Mr. Colbath's criticism, he would have seen that the method he advocates was not even mentioned. As a matter of fact, it was quite unknown to me at the time. Had he scanned the summary of tests he would have been in no doubt, as he says he was, as to what end-point I titrated. Had he read the article he would have found that I expressly mentioned the necessity for the measurement of all correctives and indicators, and so would have avoided the publication of attempts to disprove my results by using indicators without regard to amount.

While thanking Mr. Hamilton for coming forward with his results, I would like to say that I have nothing to add to or subtract from the figures I published last September. In both the neutral solution free cyanide test, as well as in Green's alkalinity test the final conclusions were only made after several thousand experiments, extending over twelve months, had been performed. Every effort was made to demonstrate any defect, or the superiority of any known method. Mr. Hamilton infers that the reactions and the results would have been different had I used lime instead of 'caustic' in my experiments. I cannot admit that lime is not a caustic alkali, neither can I follow Mr. Hamilton when he suggests that the addition of calcium hydroxide, instead of sodium or potassium hydroxide, would have resulted in a materially different reaction.

The solutions used in my tests varied widely and the method proved reliable even under artificial alterations of alkalinity, zinc, and cyanide content. On the other hand, no implication was made that the methods were suitable for universal application, but under the conditions the publication of the results seemed a normal procedure. I am sorry that Mr. Colbath and Mr. Hamilton object and, in doing so, protest against a slight on them and their colleagues which I have ventured to show exists only in their own imaginations.

A. W. Allen.

London, August 30.

[This discussion has elicited much of interest to cyaniders, and we thank them, in behalf of their fellow workers, for their contributions. We believe the discussion may well stop here. There are so many variables to be considered under working conditions that great exactness is not to be expected. After all, operators do know what to do if their solutions show extraordinary variations, and that is the main point. Until much more laboratory research be completed, we must rest content with that.—Editor.]

The Harrimans and Mining

The Editor:

Sir—An editorial paragraph in your issue of September 5 calls attention to the fact that on the death of any prominent financier, his holdings of mining stocks are usually found to include those of unsuccessful corporations.

Why not? The recent discussion on prospecting in your columns has clearly indicated that, even with the exercise of sound preliminary judgment, the majority of prospects ultimately prove to be failures. Yet one successful mine will make up for a score of such failures; and unless somebody is willing to develop prospects, despite a large proportion of failures, there will soon be no mines.

I know nothing of the specific unsuccessful mining ventures into which J. P. Morgan or E. H. Harriman entered; but I suggest, as a general proposition, that such men are just the proper persons to divert some part of their surplus into speculative mining ventures. They are in a position to obtain good advice, and, if necessary, to finance to any required extent a mine which shows promise. From the point of view of the miner, when I hear of some prominent financier backing a prospect, whether successfully or not, I feel that he has to that extent at least recognized an obligation which he owes to the industries that made his wealth. More power to his elbow; and better luck next time!

George E. Collins.

Denver, Colorado, September 22.

[We cordially agree with our correspondent that any wealthy man who spends part of his income in developing mining prospects deserves encouragement. We also agree that there must be numerous failures to make one success in this work. The 'investments' we had in mind, however, were of another sort. They were in companies that had been floated at fancy capitalization without, in some instances, any reasonable chance of success. As business ventures they were unsound, regardless of the probability or lack of probability of the prospect involved making a mine. The big men in business have not taken, and do not take, the making of a mine seriously, and they do not use in their mining ventures the same shrewd sense, nor do they utilize the technical advice, that they do when going into shipping, railroads, or ordinary commercial ventures. They bet foolishly on one prospect, often poorly chosen, nearly always managed by incompetent men, and when it fails they condemn mining. We have seen many cases where a good prospect and an excellent chance of making a mine failed for such causes.

All of us have seen metallurgical tombstones erected by wealthy men, men who had many successes to their credit, but who when entering the new field attempted the impossible, not even knowing that it was impossible. By all means welcome the Harrimans and Morgans to mining, but try and give them a chance to save their capital if they cannot make money.—Editor.]

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

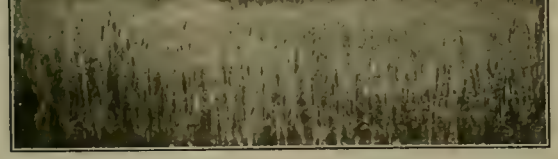
COARSE-CRUSHING PLANT of the Miami mine, Arizona, delivers ore of which 99% is reduced to half-inch size for the mill bins. Improvements during the past half-year have been responsible for this.

LEAD POISONING is prevalent in pottery industries. In the Staffordshire plants, England, from 1898 to 1912, there were 778 cases, but the complaint is decreasing and is now only 14 per 1000 employed, there being 5290 persons in the lead processes.

THE DOUBLE CYANIDE OF ZINC and an alkaline earth metal is undoubtedly a part-solvent for silver and gold when it occurs in working cyanide solutions. It is, however, unavailable as a solvent for zinc, so that the solution should contain active free cyanide, in addition to the double cyanide, before precipitation can be effected.

EXCAVATION by Americans at Panama totals 238,845,587 cu. yd. to date. Slides have increased the amount by 35,158,225 yd. There remains 14,772,224 yd. to be moved, of which 4,581,692 yd. is in the central division, mostly slides. After having handled 18,908,540 yd. of material in six years, the suction dredge *Culebra* has been retired from service. In that time it lost only 177 days, or 8.08% of the total possible.

DREDGING done by 51 bucket-dredges, 26 pump plants, and 15 jet-elevators in Victoria, Australia, in 1913, amounted to 16,706,023 cu. yd., yielding an average of 7.4 cents per yard. The report of the Sludge Abatement Board for 1913 has been issued, and among many interesting pictures of resoiling work done in the dredging districts, the accompanying halftone shows how



SHOWING WHEAT GROWING ON RESOILED DREDGED LAND, VICTORIA, AUSTRALIA. IN THAT STATE RESOILING IS UNDERTAKEN EXTENSIVELY IN CONNECTION WITH DREDGING.

wheat grows on this dredged land. The Briseis No. 3 bucket-dredge in the Beechworth district did this work. It is equipped with a belt-conveyor to restore the earthy overburden on top of the dredged gravel. The ground is left fairly level, but it is further graded and then plowed. Early in April 1914 this crop was ripe. The height of bank attacked was 36 ft., and 373,648 cu. yd. was moved for 2145 oz. gold.

WHAT AMOUNT OF COAL HANDLED DAILY will warrant automatic machinery? asks *The Labor Saver*. This is, of course, an academic question with no positive answer. One car a week will easily warrant a portable conveyor to assist the shovelers. One car a day will allow a pivoted bucket-carrier handling coal and ashes to pay a profit. Intermediate amounts are frequently handled satisfactorily by bucket-elevators, and screw-conveyors, while larger quantities, up to say 25 cars per day, use the pivoted bucket-carriers for both coal and ash. The average owner or operator prefers machinery to hand labor for this work at equal costs, and for this reason a great many small power-plants are being equipped at this time with automatic coal-handling machinery.

A FORMULA applicable to the calculation of recovery of valuable constituents of an ore by any process where the feed is separated only into concentrate and tailing, and where the analysis of these three products is known, is as follows, according to Ernest Wander, of Rolla, Missouri:

Taking as a basis 100 lb. of iron ore, which is fed to a magnetic separator,

let x = pounds of concentrate
y = pounds of tailing
and F = per cent iron in feed, divided by 100
C = per cent iron in concentrate, divided by 100
T = per cent iron in tailing, divided by 100

then $Cx + Ty = 100\ F$ (1)

$x + y = 100$ (2)

dividing (1) by T, and subtracting (2) gives:

$$\left(\frac{C}{T} - 1\right) x = \left(\frac{F}{T} - 1\right) 100$$

$$x = \frac{100\ (F - T)}{C - T}$$

Recovery in concentrate =

$$\frac{C\,x}{100\,F} = \frac{C}{F}\left(\frac{F - T}{C - T}\right)$$

It is apparent from this formula that the analysis of the three products, feed, concentrate, and tailing is the only information required to obtain the relative proportions of concentrate and tailing, and, knowing these proportions, x and y respectively, is obtained the simple formula: $\frac{C}{F}\left(\frac{F - T}{C - T}\right)$ = recovery.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

NEW YORK

OPERATIONS OF VARIOUS COPPER COMPANIES.—COPPER EXPORTS AND CONTRABAND LAWS.—NEW JERSEY ZINC CO. EXTENDS FIELD OF OPERATION.—AUSTRALIAN ZINC CONCENTRATE DIVERTED TO AMERICAN SMELTERS.

Several of the copper mining companies have made a further reduction in their output, and the Shannon has shut down completely. The Shannon is one of the companies which has a particularly high operating cost, so that in ordinary times the margin of profit is small.——The British Columbia Copper Co. has also shut down its smelter, although it is continuing the work of developing its orebodies with a reduced crew. Work on the proposed new mill has not yet been started, and will, of course, now be indefinitely postponed. According to the mine management, approximately 10,000,000 tons of 1.85% copper ore, containing 72c. per ton in precious metals, has been developed, and it is suggested that the first unit of the mill will have a capacity of not less than 1000 tons per day. ——It is said that the Granby company's Midas mine in Alaska will begin to produce early in November. It had been hoped by the management that production could be started this last summer, but the delay in securing and erecting equipment and the low price of copper combined to make it impractical to start the plant as soon as had been hoped. ——The United States Smelting, Refining & Mining Co. has deferred the quarterly dividend of 1½% on the common stock, which would have been paid October 15 under ordinary circumstances. In a statement to the stockholders, the management says that the operations of the past nine months have made earnings sufficient to pay the usual quarterly dividends on both common and preferred throughout the year, but in view of the uncertainty in the metal markets, and the fact that the Company is a very large consumer of cyanide without any assured prospect that it will be able to secure a supply in order to continue its gold and silver milling operations after the next few months, it seemed better not to declare the usual quarterly dividend on the common stock, though the regular preferred dividend of 1¾% was declared.

Most of the copper which is being shipped now is going to England. It has, of course, been difficult to get shipments through to the countries of the Continent, and especially since there is question whether shipments to a neutral country might not be really intended for one of the belligerents and so might be held up as contraband of war. Underwriters in London have been warned to use caution in insuring shipments of copper from the United States to Rotterdam, since they might be sent on from Holland to Germany. Exports for the week ended September 24 amounted to 7,854,000 lb. Shipments since the first of September have amounted to 28,174,000 lb., as compared to 41,638,000 lb. in the same period last year. Considering the difficulties of the situation, it will be seen that the exports are surprisingly good. The domestic demand is very fair, and the sales have been made at approximately 12c. f.o.b. New York. The Braden, which made a record production of 4,538,000 in August, will not be allowed to exceed 3,000,000 lb. per month in the future. The 'blister' is now being shipped to New York. The Arizona Copper Co. produced 3,778,000 lb. of copper in August, or a little more than its average for the past six months. As this Company is owned in Scotland, and Great Britain is now our principal copper buyer, the management doubtless feels that it is not incumbent on it to decrease output.

The New Jersey Zinc Co. has purchased additional property to that which it now owns at Friedensville, Pennsylvania, and will start prospecting for zinc ore near the old mines there. The zinc mines of the Saucon valley, Pennsylvania, the chief of them being the Ueberrath, Hartman, and Saucon, were famous 40 years and more ago when the zinc-blende, calamine, and smithsonite, which there occur in numerous fissures in a shattered limestone, were the basis of an important mining industry. The Ueberrath was a very wet mine, and its pumping engine was the largest of the day. Now that spelter is so high, it may well prove possible to work these orebodies, and additional ones may be discovered. The Butte & Superior reports that in August 6425 tons of concentrate, valued at $31 per ton, was made at a cost of $4.23 per ton. This shows a high grade of concentrate and a higher working cost than in July. The Connecticut Zinc Corporation, which was organized not long ago to take over the Oronogo Circle mine in Missouri, is also doing well. This is another famous old mine with an enviable record of profitable operations.

Zinc smelters in Kansas and Oklahoma are preparing to care for large shipments of Australian zinc ores. Several cargoes of zinc concentrate on the way to Liége and Limburg have been diverted and will be landed at Galveston after passing through the Panama canal. From Galveston the concentrate will be shipped by rail to Kansas and Oklahoma smelters. This change is not expected to have any effect on zinc ore prices in this country, as American mines will not be able to supply the demand for spelter, and mines in Joplin not operated for more than a year are preparing to open. There will be a good profit in shipment and reduction of Australian ores, and many cargoes are expected before the first of the year. The smelter at Liége, destroyed in the bombardment, was the largest in the world.

WASHINGTON, D. C.

THE EXPLORATION BILL BEFORE THE HOUSE.—THE SENATOR FROM COLORADO DISCUSSES THE LEASING SYSTEM.

Whenever it has opportunity these days for the consideration of business on the general calendar, the House of Representatives is paying attention to the bill for the exploration of coal, phosphates, gas, oil, and potassium, the third of the conservation bills, two others having already passed; one providing for the leasing of coal lands in Alaska and the other providing for the development of water-power on the public lands. The radium bill in the House still remains to be passed.

The exploration bill is giving rise to considerable debate, but more interesting and important is the debate in the Senate on the House bill for the leasing of coal lands in Alaska, which is being vigorously opposed by such senators as J. F. Shafroth, of Colorado, who sees in the bill a wedge to impose the leasing system as a principle to be followed in all forms of mining over which the United States still has jurisdiction. The senator has held the floor for some time and the bill has become the unfinished business of the Senate, indicating that it must be disposed of at some time or other to permit other legislation. It is thought likely that it will pass. Mr.

Shatroth has told the Senate that the leasing system is not right, that it was not contemplated by the forefathers in framing the Constitution and that it is inconsistent with our form of government. A leasing system, he declared, means perpetuation of title in the government which means exemption from taxation forever. You cannot, he pointed out, have a state or territory perform its functions of maintaining a government republican in form unless it has the power to levy taxes on all lands. To impose a royalty upon a people of a state, he asserted, is imposing a tax by the federal government which has never been imposed upon any other state or territory, and it is, moreover, a tax upon the consumer. "It is a tax," he said, "which when it reaches the consumer is many more times the royalty imposed by the government." He also declared the leasing system to be inexpedient, in that it created a great bureau and imposed federal offices in the states with respect to which the states have special interests and which has never been received by the people with welcome. He instanced the forestry bureau, which, he said, by controlling local affairs seeks to defeat the chief end of government among the citizens affected. He declared the federal leasing system to be impracticable. If the rental is low, the system will not be supporting, he said, and if high it produces an increased tax on production. The double jurisdiction of nation and state especially made the leasing system impracticable in that it would be productive of dissatisfaction, irritation, and litigation. He showed that even in the states a leasing system would be a failure because, he said, it creates a fund which takes the place of taxes for the support of the government among the very people who pay royalties. Colorado, he pointed out, has a sale and leasing system under which it leases considerable of its grazing lands, but it is able to maintain only nominal rentals. It would be more remunerative for the state, he asserted, to give its lands away, for thereby it would derive some substantial taxes for its revenues. The leasing of coal lands, he said, would prove a special failure in that as competition is sharp in the coal-mining business, no operator can hope for success unless he has the most improved machinery and the best facilities for mining and marketing his product. In nearly every instance, enormous capital must therefore be invested, and a railroad must be built to the mine from the nearest operated line. Men will not make large investments, he said, when they can obtain only a lease, subject to forfeiture on failure to perform any of its provisions. The senator examined the cost of coal under ownership and the leasing systems, saying that under the system of ownership in the United States the proprietors have produced the cheapest coal in the world and yet paid the highest wages to miners. The senator said private ownership and operation of coal mines in the United States, compared with public ownership and leasing elsewhere, was approximately saving a million dollars a day to the industries of the United States.

The radium bill, one of the five conservation measures, has been side-tracked for the present in the House. It was expected to follow the exploration bill, but the leaders deemed the consideration of the Philippine bill as more imperative; so this bill displaced the radium bill. Republicans charged that the Democrats were consorting with the 'radium trust.' There seems to be even less chance now of the passage of the act establishing the proposed commission for codifying the mining laws, or any general legislation providing for leasing mineral lands. The Alaska act will probably be pushed through. There is much interest in Washington in the appointments soon to be made to the new interstate trade commission and a disposition to concede at least one place to mining men. Among those favorably mentioned are J. F. Callbreath of the Mining Congress, E. W. Parker of the Geological Survey, and Hennen Jennings.

HOUGHTON, MICHIGAN

EMPLOYMENT FOR COPPER MINERS AND OTHERS BEING FOUND—NEW COURSE AT MICHIGAN COLLEGE OF MINES

With several of the mines closed, the Calumet & Hecla properties on three-fourths time, others working only half time, and all the employed working at reduced wages, the people of the Michigan copper country have before them the most serious problem of what to do for the workingman to better prepare him for the approaching winter. Every possible means is being considered to solve this problem. The recent strike not only placed the mining companies in such a financial position that they were not able to carry on full operations for even a short time, under the present market conditions, but it also left the miners in a more serious condition. Dividends have been passed by the mining companies, expressing their desire to consider the workingman rather than the stockholder. The road commissions of Houghton and Keweenaw counties are undertaking the building of new highways for the relief of the men affected by the closing and curtailment of the mines. Gangs of 40 and 50 men are being put on the roads as fast as needed. Married men are given the preference, and no single men will be considered until all the married men have been given employment.

That not only one class of men, but that all workingmen of the copper country are being given an opportunity to do something, is shown by the recent announcement of the Michigan College of Mines. This institution this fall will depart from

MINING AND ENGINEERING BUILDING OF THE MICHIGAN COLLEGE OF MINES AT HOUGHTON.

its previous high standard of entrance requirements and will admit to special short courses all practical men who can read and write the English language. While this step is not temporary, but rather has been under consideration for many years, its introduction at this time is most opportune. No doubt there are many men who, under the present lull of mining operations, will find the time and means to avail themselves of this opportunity to gain technical training for advancement in their particular line of work. Not only will the workmen who lack technical education, but many technically trained men, who in their practical experience have felt the need of more training in certain branches of their profession, will be given an opportunity to better themselves. This extension of the mining college offers an unusual opportunity to the practical men of the iron and copper countries.

Considerable interest is being taken in recent developments of the Calumet & Hecla White Pine property. The mine is at the extreme southern end of the district in territory which, except in one or two places, is practically unexplored. It is reported that a new and rich copper lode has been cut by the diamond-drill.

LONDON

FINANCING CORNISH TIN MINES, AND ACTION OF BANKS.—DEATH OF GILBERT PEARCE.—UNSATISFACTORY CONDITION OF DOLCOATH MINE.

In my last letter I referred to the disastrous effect of the war on Cornish mining, and mentioned that the firm of Bolitho had undertaken to lend money to the mines on the security of the tin concentrate. The Cornish smelters are not inclined to buy concentrate except at an inordinately low price, which is unacceptable to the mines, and a deadlock has ensued, the concentrate being stored until some new situation develops. The mines with little capital back of them are glad to avail themselves of Bolitho's offer, and thereby to keep operations going on a small scale. This action of Bolitho's is of more than passing interest, for it illustrates a phase of modern banking to which attention is being drawn nowadays, when contrasting the difference in England and Germany as regards the relationship of bankers to traders. It is said that English banks do not help to finance business ventures in the generous way that is customary in Germany. It may be mentioned, however, that, in the old days of private banks and of joint-stock banks of limited areas of operation, the industrial enterprise could obtain advances readily. The bankers knew their customers personally and were able to gauge their credit. A mine could at any time be allowed an overdraft, if its general credit and conditions were good. But when the policy of absorption of country banks by the large London institutions was commenced, the personal factor between banker and customer was gradually eliminated. The terms on which money was lent became stricter. The responsibility of a manager of a private bank was great, but his responsibility as manager of a local branch of a big London bank is made practically nominal. His individuality is suppressed in favor of an organization that threatens to be mechanical. Such things as loans to mines became quite impossible. The family of Bolitho were the owners of one of the great West Country banks, and in old days used to be a great help to the Cornish mines. But since the absorption of their bank by Barclay's, this phase of finance has come to an end, and it has been left for the Bolithos to undertake the lending in their private capacity as merchants. It will be remembered that the family had for many years a tin-smelting establishment at Chyandour, just outside Penzance, and it is only two years ago since they suspended operations.

While writing on tin smelting in Cornwall I have to record the death of Gilbert Pearce, who was head of Williams, Harvey & Co. at Hayle for many years. He was brother of Richard Pearce, who was so well known in Colorado as a pioneer in metallurgy. On his return from America a dozen years ago to his native land, Richard Pearce greatly assisted Williams, Harvey & Co. financially, and gave to its service his two sons. With a view to handling foreign concentrate to greater advantage a new smelter was built near Liverpool. The old plant at Hayle was kept in commission, but with Gilbert Pearce's death it will probably be closed, as it will be as cheap to ship Cornish produce at Liverpool as to treat it locally. Gilbert Pearce did not confine his energies to Cornish smelting by any means, for he was on the board of several mining companies working in Cornwall and the Malay States, and he helped greatly in the flotation of many of the Malayan properties in Cornwall under the leadership of James Wickett, the Redruth stockbroker.

As if Cornwall had not enough troubles, arising from the war and the low price of tin, an additional factor is the dismal outlook at Dolcoath, the premier mine of the county, and both historically and currently, one of the great mines of the world. About a year ago I mentioned that the developments at depth were unfavorable, and that the manager, R. Arthur Thomas, had decided to start a policy of prospecting parallel veins from the upper levels. Unfortunately, the results have been uniformly disappointing. Now comes the news that during the past six months the work at the bottom of the mine, at 3300 ft., has disclosed no cassiterite worth working. During the half-year from January to June, the output of tin concentrate, and the yield per ton, were the smallest on record since the present company was formed in 1895; whereas 1015 tons was obtained from 28,717 tons of ore during the first half-year ended December 31, 1895, only 728 tons was recovered from 57,254 tons during the half-year under review, the produce per ton falling from 79 to 28½ lb. In spite of this drop in grade, the Company might have made a divisible profit had not the price of tin been falling recently. The average price received for concentrate during the half-year was £92 14s., as compared with £134 13s. during the first half of 1913. But it must be remembered that in the years 1895 to 1898 the prices received for concentrate were far lower than have ruled since 1910, the average of the former years being less than £40 per ton. The total sum received from the sale of concentrate during the year was £67,544 or 23s. 7d. per ton. The gross profit was £5013, out of which £4502 went to A. F. Basset, the 'lord' or owner of the mineral rights, so that the Company was left with a nominal profit of £510. No allowance has been made for depreciation. The outlook for the mine is, therefore, desperate. Malcolm Maclaren has been conducting a geological investigation with the object of ascertaining the most promising places for future development. His report has not yet been presented. It is to be hoped that it will be published in full, as it should constitute an important contribution to the study of ore deposits. Nobody can blame the secretary, F. W. Thomas, for accepting a post with Williams, Harvey & Co. at their Liverpool tin-smelting establishment. He has given his best to Dolcoath for 30 years, for he joined the staff in the business department in 1883, and he has been secretary of the present joint-stock company formed in 1895 from the beginning. His acquaintance with the commercial aspect of tin must surely be unrivaled, and his knowledge will be of great advantage to the firm that has now the largest tin-smelting business in England.

GRANTS PASS, OREGON

NEW RAILWAY IMPROVES DEVELOPMENT OF JOSEPHINE COUNTY.—WORK AT THE OLD CHANNEL GRAVEL MINE.—OREGON GOLD MINES CO.'S PROPERTY.

Mining in western and southern Josephine county has been greatly stimulated by the completion of the first 12-mile unit of the municipal railroad being built from Grant's Pass toward Crescent City, California. The copper mines of Waldo, Slate Creek, and Butcher Knife have increased their development crews, and ore is already being hauled from some of these to the end of the line for shipment by rail. Trains are now making regular schedule over this first portion of the line. Ore, logs, and other products of the district are received by the new road at Wilderville for shipment to any point in the United States, the cars being transferred at Grant's Pass to the main Southern Pacific line. Mining men have found that they can save considerable in both time and money by hauling by wagon to Wilderville only and making rail shipment from this point rather than at Grant's Pass. From the amount of shipments promised, it appears that the new line will be kept in active operation while awaiting the building of the remaining portion. This 12 miles of the proposed road was built and equipped at the expense of the people of Grant's Pass, who voted bonds for the purpose to the amount of $200,000. With this much built, the city hopes to meet no great difficulty in securing capital for completing the remaining part to Crescent City, thus giving a direct route to San Francisco.

Extensive improvements have been made this summer on

the Old Channel hydraulic mines, of Galice district, for the purpose of operating the properties on a large scale the coming season. The mines have been virtually idle during the past two years, owing to legal difficulties. But this trouble is now removed, and the recent improvements will allow the operation of the extensive diggings to their full capacity. Water is available by two long ditches from Tom East and Galice creeks for three 6-in monitors working under 450 and 500-ft gravity head. The banks are from 180 to 300 ft. high on Slate bedrock, with coarse gold on the lower strata and finer gold above. The properties are heavily timbered, and the natural dumping facilities are of the best.

James O'Grady, manager for the Oregon Gold Mines Co., states that he is meeting excellent success in the reduction of the upper level ores lately uncovered on the Granite Hill and from the Ida claim on the same property. Ten stamps of the mill will be kept in continuous operation on this low-grade though free-milling ore. In the meantime the large hoist is operating a double skip day and night in removing the water from the mine, and the level is being steadily lowered.

SILVER CITY, NEW MEXICO

CHINO COPPER OPERATIONS.—FLOTATION AT BURRO MOUNTAIN.—RICH GOLD AND SILVER ORES OPENED.—EMPIRE ZINC CO.'S WORK.—WHITE OAKS DISTRICT.—ASSESSMENT WORK EXEMPTION.—MOLYBDENUM ORES.

The concentrator of the Chino Copper Co. at Hurley is treating ore from Santa Rita 5½ days per week instead of 4 days as was the schedule during the beginning of the European war. Several buildings are being erected in Hurley by the Company, and extensive road improvement south to Whitewater is under way. The newly erected ore-crusher at Santa Rita, which prepares all ore from pits for grizzlies at the mill, is in operation and is giving satisfaction.

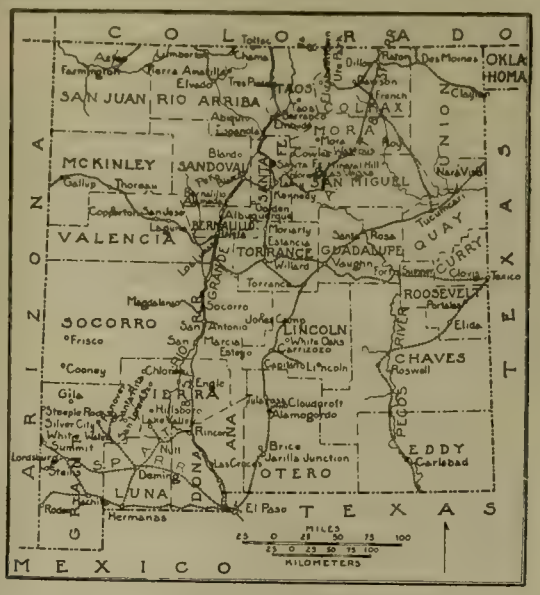
A new flotation unit has been ordered for the experimental mill of the Burro Mountain Copper Co. (subsidiary of Phelps, Dodge & Co.) at Tyrone, and is expected to arrive this week. It is claimed that flotation experimenting in the past has been unsatisfactory, but complete demonstration will be made before the process is discarded. A Hardinge conical mill is giving satisfaction in the experimental plant. The plant is expected to commence operation in a few days and will treat ore from the Chemung dump, which is the same character as all ore developed in the mines. The Diesel engine being installed in the power plant is nearly finished.

Five sacks of high-grade gold ore, averaging $60,000 per ton, have been taken from a pocket in the Pacific vein by Wright and Stauber, lessees of the Savannah Copper Co.'s property. Shipment will be made from the bank to a San Francisco refinery. Operators of the Silver Cell mine, in the same district, are contemplating the installation of a compressor and air-drills. They have cut a vein of high-grade silver ore lost on account of faulting some years ago. Beautiful specimens of native silver are being shown by operators at Pinos Altos.

A tramway from the Cleveland mine of the Empire Zinc Co. to the Santa Fe railroad at Silver City, New Mexico, is under consideration by the Company. Title of the ground is being investigated for right-of-way purposes. The tram will be 10 miles long. Men in a position to know think the Company will erect a mill for concentration of its zinc sulphide ores within a short time. Many road improvements have been made by operators.

The annual meeting of the stockholders of the Parsons Mining Co., operating at Nogal, Lincoln county, and with Eastern offices at Mishawaka, Indiana, was held September 20 and the following officers elected: J. H. Fulmer, Jr., president; George H. Fuller, vice-president; A. G. Graham, secretary; and A. H. Graham, treasurer. The Company has entered into a contract with the Wild Cat Leasing Co., of White Oaks, whereby it will be supplied with electric power by the latter Company for the operation of its mines and mill. The Wild Cat Leasing Co. has ordered a 500-kw. steam turbo-generator from the Westinghouse company which will be ready for operation by January 1. The Parsons Mining Co. will commence the installation of the power transmission line at once and will overhaul its mill so as to be ready when power is turned on the first of the year. A. T. Anderson is superintendent of work. The Wild Cat Leasing Co. has made remarkable progress in the White Oaks region, and is now dropping 15 stamps, 20 hours per day, on ore from North and South Homestake mines. The Yellow Jacket iron mines at White Oaks are under lease to Swoyer and Evans. Preliminary work has been done and shipments are being made to the Pueblo smelter, Colorado.

Prospects for reconstruction of roads to Red River, Taos county, are brighter than they have been for years, and a party of government surveyors is laying out the new grade. Concentrating tables are to be added to the June Bug mill



MAP OF NEW MEXICO.

equipment at once, necessitated by the recent find on the Silver Queen vein which has revealed a good grade of ore. No attempt will be made at cyaniding. Concentrate will be shipped to Pueblo, Colorado.

The exemption of mines from annual assessment work for the year 1914 is meeting with a hard struggle in materializing, and the issue has not seemed to awaken favorable sentiment. Harvey B. Fergusson, congressman from New Mexico, introduced the bill giving the demoralization of the mining industry on account of the European crisis as the cause for the act. The Silver City Chamber of Commerce has sent out resolutions and copies of the bill to all similar bodies throughout the Rocky Mountain states, with an effort to create widespread interest in the proposed relief to mine-owners. Many are in favor of its passage, and many are not. The lawmakers at Washington are desirous of hearing from the field regarding the attitude toward the bill.

Molybdenum ore in commercial quantities is being mined and milled in San Miguel county, 16 miles northeast of Las Vegas, in El Porvenir Mountain mining district. There are sixteen claims in the group.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

A report has been recently issued by the U. S. Geological Survey, summarizing its investigations in the Ruby-Innoko-Iditarod gold districts, and this is illustrated by both topographic and geologic maps. The results therein presented indicate that these districts lie in an important gold belt which has already produced gold and silver to the value of nearly $10,000,000. The region is now very inaccessible, and operating costs have therefore been necessarily high. For this reason but little attention has been paid to the gold-bearing quartz veins of the region, some of which give promise of having commercial importance. When the district has been opened up by railroads and wagon-roads, some development of quartz veins will undoubtedly take place, and the gold-bearing gravels of lesser tenor can then be mined at a profit.

Cordova

Accompanied by Caleb Corser, superintendent of the Copper River railroad, Frederick Mears and Thomas Riggs, Jr., members of the Alaska Engineering Commission, have left Cordova for Katalla. From the latter place they will go to the Bering River coalfields, and probably over the proposed lines *via* Lake Charlotte to Mile 38 on the railroad. A survey is under way from this point to a place 10 miles distant, to connect with the surveyed line from Miles glacier *via* Lake Charlotte to the coalfields. The Copper River railroad has already made two surveys to the fields, one from Cordova and the other from Miles glacier or Mile 49.

Fairbanks

Cross-cutting is under way at 150 ft. in the Newsboy quartz mine, and it is hoped to cut the vein in 70 feet.

Juneau

A bonus dividend, No. 109, of 75c. per share, was paid by the Alaska Treadwell company on September 28.——During August the Mexican mill crushed 20,202 tons of ore, and 359 tons of concentrate was treated, for a total yield of $32,984, or $1.63 per ton. The net profit was $7532.——The United mills crushed 39,585 tons and treated 894 tons of concentrate for a total of $83,020. The net profit was $20,358. Development amounted to 1171 feet.

ARIZONA

Cochise County

According to Walter Douglas, general manager for the firm, Phelps, Dodge & Co. has decided to start a profit-sharing scheme whereby employees will participate in profits of the mercantile company under certain conditions.

Gila County

For the first half of 1914 the Miami Copper Co. reports as follows:

Development feet	20,688
Ore treated, tons	638,456
Average copper content, per cent	2.275
Concentrate produced, tons	25,668
Copper output, pounds	19,078,942
Extraction, per cent	69.14
Revenue	$2,716,681
Profit	963,968
Dividends	746,877

All ore was extracted from above the 420-ft. level, that at 570 ft. not having been touched. Mining costs were reduced from $1.46 to $1.17 per ton. This was due to completion of the shrinkage stopes; also by forced ventilation, compressed air consumption was reduced from 9,000,000 to 5,000,000 cu. ft. per month. Since No. 6 unit of the mill was remodeled the residue is reduced to 0.65% copper, and the other five units will be altered similarly. Experiments are being made on flotation and leaching. Milling costs were lowered from 53 to 44c. per ton, due largely to improvements in the coarse-crushing plant.

Humboldt County

At 1200 ft. in the United Verde Extension mine, 14 ft. of chalcocite ore has been opened, 7 ft. of which assays $7 per ton. The formation is favorable for extension, and is similar to that in the United Verde adjoining. According to J. S. Douglas, president of the Company, $225,000 has been spent on the property. The British shaft is to be sunk 200 ft. farther to cut the new orebody at 1400 ft. This and other work will require about $50,000, which will be subscribed for by stockholders.

Mohave County

The Copper Giant mine, eight miles east of Hackberry, which was taken under option a year ago by the United Verde Copper Co., has now been acquired by the Company at $30,000. Under management of William Neagle, $110,000 has been spent in development, resulting in opening $600,000 of high-grade gold-copper ore to 550 ft. depth. Eleven miners share in the proceeds of the sale.——At the Yucca Mining Co.'s property, a good tonnage of gold ore has been opened, and the 10-stamp mill is to start this week.——Six feet of copper ore is showing in the Whale mine in Copper cañon, and on the foot-wall is some rich molybdenum ore.——At 250 ft. in an adit of the Rainbow mine, at Chloride, there has been cut 28 in. of gold ore, with a little lead and iron sulphide. ——The Cyclopic mine is opening satisfactorily for the owner, S. C. Bagg.

Pinal County

At Ray, on September 20, a cloudburst did damage amounting to about $100,000.

CALIFORNIA

Nevada County

(Special Correspondence.)—The Union Hill mine at Grass Valley has been acquired by G. S. Johnson and associates of San Francisco, who have organized a company, called Union Hill Mines, to operate the property. A. D. Cox, formerly of Rochester, Nevada, has been appointed superintendent, and started sinking the shaft from the 600 to the 900-ft. level on October 1. A cross-cut is being driven on the 300-ft. level to open the Georgia vein, which produced a good grade of ore on the upper levels, where the management hopes to develop enough ore to start the mill and keep it running until sinking has been finished. The mine is credited with a production of $2,000,000 above the 600-ft. level. It is equipped with a 20-stamp mill.

San Francisco, September 25.

Dividends of 20c. and 6c. per share, equal to $50,000 and $18,000, respectively, have been declared by the North Star and Brunswick Consolidated companies.

Placer County

Complaints have been made by residents of Fairoaks and

Orangevale that water from the north fork of the American river is being polluted by dredges near Auburn, and the dredging companies will probably be prosecuted.

SHASTA COUNTY

Development of the manganese deposit near Heroult proceeds, and it is 20 ft. wide of good value. Officials of the Noble Electric Steel Co. have been sampling the ore.——A 6 75-ton tumbler for the Trinity Dredging Co.'s dredge at Lewiston is being hauled from Redding to Lewiston, Trinity county.——After a 12-day shut-down for repairs, two blast-furnaces of the Mammoth Copper Co. have been blown in.

SIERRA COUNTY

A power dam is being constructed by the Monarch Consolidated company. Under D. McGonigal a good number of men are employed at the mine, formerly known as the Lee.——The Colombo claims have been examined by Eastern people.

TRINITY COUNTY

The Trinity Asbestos Mining Co. has been incorporated at Weaverville with a capital of $500,000, Oakland people owning all shares. H. T. Mecums is general manager. About $50,000 has been spent on the property, and production may start before winter. A road 25 miles long will be constructed from Castella to the asbestos camp.

COLORADO

LAKE COUNTY (LEADVILLE)

Another lot of gold ore from the Pat Connors lease on the Jonny mine has been sent to smelters. The two tons will yield about $30,000. In the Sinclair lease the average is 3 oz. gold per ton.——Rich gold-silver ore is coming from the Big Five mine, a new shoot being cut last week.——Mining men

JONNY HILL AND MOSQUITO RANGE, LEADVILLE DISTRICT.

are interested in the sinking of the Davis shaft on the North Side claim on Fryer hill.——The face of the Walker adit in the Mosquito range is nearing the vein, the present length being 512 ft. This ground is a new area in the district to be prospected.——The new Candish mill awaits some special machinery. The zinc smelter is closed indefinitely.——The district generally is in normal operation.

TELLER COUNTY (CRIPPLE CREEK)

At a depth of 1942 ft. the Vindicator company has stopped sinking its main shaft, and will open out at No. 19 level, 1907 ft., or 8302 ft. above sea-level.——The Golden Cycle shaft is down 1925 ft., or 8141 ft. above sea-level; Blue Bird shaft, on Bull hill, 1875 ft. deep; and Portland No. 2 shaft, 1750 ft. ——The Vindicator concentrating plant is nearly completed. ——The United Gold Mines' W. P. H. mine has been leased for three years to Oscar Fogleman of Cripple Creek. Past gold output is over $500,000. W. Stewart has leased the Hardwood mine belonging to the same Company.

Extension of the Roosevelt drainage tunnel is to be continued by the tunnel company for 30 days, when it will call for bids to complete the work, as it will be in a better position to pass on the prices offered. The daily advance in solid formation is six feet. No timbering is necessary, and the frequent caving of dike matter does not hinder mining.

Four-ounce gold ore has been cut at depth near the Lee shaft of the Isabella Mines Company.

IDAHO

BLAINE COUNTY

Gold ore worth $33 per ton has been opened in the El Oro mine in the Skeleton district.——The Santa Clara claims of H. M. Bell are showing good ore in an adit. He will erect a small stamp-mill next summer.——The district is fairly active just now.

CUSTER COUNTY

Colorado people, developing the Charles Raine property in the Yankee Fork district, have cut the General Custer lode, which has produced several millions in gold and silver in the past. On driving through the Custer fault good ore was exposed.——In this district are working the Wall Street and Bonanza properties, the former working by sluicing, and the latter having fair gold ore opened and a 40-ton mill ready for work.

SHOSHONE COUNTY

The Hecla Mining Co.'s mill capacity at Gem has been increased from 300 to 400 tons per day, while several other improvements were made.——In 11 months the H. E. M. company has driven an adit 2276 ft., and has cut the vein.——In No. 2 adit of the Silver Cable, near Mullan, the ore-shoot is 250 ft. long and from 12 to 30 ft. wide, and for 150 ft. there is 5 ft. averaging 40% zinc.——At the Monitor, near Adair and the summit of the divide between Idaho and Montana, an adit has been started to cut a vein at a vertical depth of about 1500 feet.

It is expected that the past summer's mining activity in the Pine Creek district will be continued during the winter. A large tonnage of lead-zinc ore is developed at the Douglas. Work at the Rosie Ann and Liberal King claims is promising. Two prospectors, George Miner and Jack Martin, returned two weeks ago from a three months' trip to the area lying between the St. Joe river and the north fork of the Clearwater. While the mineral prospects are not very encouraging, the country has an abundance of timber.

The Caledonia Mining Co., of Wallace, will pay a dividend of 1c. per share, or $26,000, on October 5. On October 5 the Bunker Hill & Sullivan paid dividend No. 205 of $81,750, making $15,546,750 to date.

MONTANA

SILVERBOW COUNTY

The Bullwhacker Copper Co. is being reorganized, and an assessment of 15c. per share is to be made on 1,000,000 shares to liquidate a $125,000 judgment against the Company.

The Davis-Daly Copper Co. reports, for the year ended June 30, 1914, show a total income of $271,973, charges $379,993, making a deficit of $108,020. There was shipped 52,198 tons of dry ore, compared with 33,352 for the previous year. Since April 1, 1914, operations have been confined wholly to development on the 1400 and 1700-ft. levels, and in sinking the Colorado shaft.

MISSOURI

JASPER COUNTY

A sludge plant and a tailing mill are being built by the National Concentrator Co. on the W. E. Johnson land west of Joplin, and on the United Zinc Co.'s land at Chitwood, respectively. A portable separator, which will remove the barren tailing before it reaches the mill, is to be installed. This is an innovation for this district. It is 8 ft. diameter,

fitted with a funnel shaped screen, sloping to the centre, which works up and down at a rapid rate, like a jig. At the tailing dump this machine will be worked, so reducing the quantity of tailing being re-treated.

NEW MEXICO

Sandoval County

The Bland gold mining district, which has been neglected for years, is again active. A 100-ton mill was recently started by the Cossack Mining Co., which will receive custom ores.

NEVADA

Esmeralda County

The Goldfield Consolidated company's mill treated 27,211 tons of ore in August, yielding a net profit of $128,135. The total cost was $6.24 per ton. In the mine, 2254 ft. of development was done at $7.24 per foot. Lessees produced 1192 tons, worth $21,056, of which the Company received $10,935, less cost of transport and milling.

Housing for the 10 stamps, two 6-ft. Huntington mills, 100-hp. gasoline engine, and other equipment for the Golden Arrow mine, 47 miles northeast of Goldfield, is finished. It is hoped to start the plant on December 15.

Humboldt County

On September 17 the offices of the Codd and Big Four leases were set on fire by incendiaries, as oil-soaked cotton waste was found in the Big Four office.

Lyon County

The Nevada-Douglas mine has been closed temporarily, but construction work on the leaching plant will not be stopped. ——The Mason Valley smelter received 3200 tons of ore last week, and the shutting down of the Nevada-Douglas will mean a considerable decrease to the plant.

Mineral County

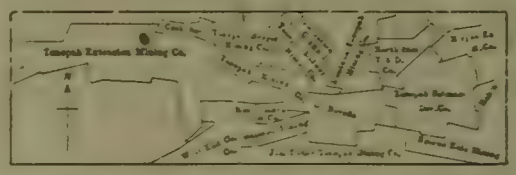
(Special Correspondence.)—The district embracing Luning and its copper prospects continues to be developed even though the present war has had a tendency to demoralize the copper market. This development is due to the perfecting of the leaching system which will treat the ores of this area by this cheap process. Luning is particularly well situated for the leaching process, not only for the oxide ores, but also sulphides, and at the same time is in a position to save gold and silver content economically. Salt is procured at a moderate figure at Sodaville, 12 miles distant, and for fuel for roasting, the coal at Coaldale can be utilized, and obtained at a low price. From the sulphide ores which would necessarily have to be roasted, undoubtedly sufficient sulphuric acid could be obtained to carry on the leaching process. Thus the essentials for this process can be procured very economically at this point. There is water in abundance at Luning. At the plant for leaching copper ore, installed by the Wagner-Azurite company, has been overcome the neutralization of the acid through the lime content of its ore, and is more than a success from the point of saving the metal. This Company is still sinking and is in high-grade sulphide ore that will average 4½% copper, and is 43 ft. wide. The Luning, Idaho, Mining Co. is continuing the working adit and has just cut some stringers, which indicates they are about to intersect the ore on which the shaft is sunk. Last month 18 ft. of high-grade copper ore was cut in this adit carrying some silver, probably the best showing in the camp at this depth. The Alameda mines, controlled by Spokane capitalists, are getting ready to begin work on the large holdings to the south of Luning.

Luning, September 5.

Nye County

Seven mines at Tonopah produced 10,789 tons of ore, worth $220,170, during the week ended September 26.

The Tonopah Mining Co. has made application for a temporary restraining order against the Tonopah Extension Mining Co. from working in or extracting ore from the Sand Grass claim. Suit is also filed for the recovery of the value of 12,000 tons of ore extracted and valued at $200,000. Judgment is asked for this amount, and that the said judgment be



CLAIM MAP OF TONOPAH.

trebled, making $600,000. This makes two extralateral right suits now pending in Tonopah, the other being the Jim Butler and West End case.

White Pine County

(Special Correspondence.)—The Nevada Consolidated continues to run half time, many of the men working 5 to 6 days per week. At the concentrator the Company has installed 12 tables of local manufacture, similar to those being used by the Utah Copper for concentration. More are being made, their results having been satisfactory. The Company is using its own method of oil flotation. It is said that experiments have been made with the oil of the plant called 'rabbit's-foot,' that grows in this country in low ground. The plant burns quickly when green, as it contains so much oil. The staff is trying to find a denser oil. G. L. Sheldon and partners recently located a 100-ft. lode of antimony ore near the old camp of Taylor. It is exposed on the surface for 700 to 800 ft. in length. General samples show 16% antimony, 20c. gold, 30c. silver, and traces of lead and arsenic. It occurs in a hard, dense quartz, in lime-shale formation, with porphyry near, and appears to be disseminated all through with bunches of rich ore.

Ely, September 18.

UTAH

Settlements for copper ore with the American Smelting & Refining Co. have been on a provisional basis, but the Company made the following statement last week: "From July 31 up to and including September 14, 1914, copper was sold by the American Smelting & Refining Co. to cover purchases of copper as made by them during the month of August, and final settlements will be made immediately for the August copper purchased on the average sales price received by them for this copper, which was 12.34c. in New York. For copper purchases subsequent to August 31, provisional settlements will be made as heretofore, with final settlements to follow."

Carbon and Sanpete Counties

Owing to the stoppage of shipments of ozocerite from Austria, the deposits in these counties are attracting attention, and David T. Day and T. Robinson of the U. S. Geological Survey, have been examining them at Colton and Soldier Summit in Spanish Fork cañon.

Juab County

Only one man of the twelve caught by a cave-in at the Centennial Eureka mine has been rescued alive. Recovery of the bodies is difficult. It is thought by J. Fewson Smith, of the United States company, that there was a thick false roof or shell to the stope, which fell upon the timber and crushed it and the men at work. J. T. Moore and J. C. Roberts, of the Denver rescue-car, went to Tintic.

Diamond-drilling is under way from the 1400-ft. level of the Chief Consolidated.——Development at 1900 ft. in the Iron Blossom is promising.——About 100 tons of ore is coming daily from the new shoot at 600 ft. in the Mammoth.

SALT LAKE COUNTY

Word from Salt Lake City indicates that the Ohio Copper Co's affairs will be settled, and operations will be continued soon.——The Riverside Dairy & Stock Farm has filed suit for $28,000 against the American Smelting & Refining Co., on account of fume from the Murray smelter poisoning grass, resulting in sickness of cows and the milk being of an inferior quality.——At the Alta Consolidated the adit is in 3650 ft. and is now in a contact of lime and porphyry. It will be driven about 300 ft. farther where this contact cuts quartzite and the southwest fissure, and the Skipper orebody should be cut in about seven weeks. At 1030 ft. above this adit, the orebody contains lead and silver. A. O. Jacobson is manager.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—Mining in and around the Republic district has been dull for some time, but there are signs of improvement. Ore shipments in July and August over the Great Northern line to British Columbia smelters were as follows:

Mine.	Tonnage.	Smelter or mill.
Ben Hur	3386	Anyox, Greenwood, Trail
Rathfon Reduction Works.	264	Grand Forks, Trail
Knob Hill	468	Greenwood, San Poil mill at Republic
Lone Pine	154	San Poil mill at Republic

The Hall Creek Mining Co., in the Enterprise district, east of the Sherman range in the eastern part of the county, has completed its mill. It will be driven by electric power, generated from the Company's own water-power.

The equalized valuation of the principal (28) mining properties of the county for 1914, on which taxes will become due next February, amounts to $425,794. Of this amount, $378,250 is for the Republic district.

Republic, September 20.

STEVENS COUNTY

Ore from the United Copper mine at Chewelah is now being sent to the Trail smelter, British Columbia, a two years' contract having been arranged with the Consolidated Mining & Smelting Co. The Great Northern railroad has reduced the freight on ore by 25c. per ton. At a vertical depth of 1000 ft. in the lower adit, there is 9 ft. of shipping ore. With 75 men the output will be 225 tons per day, 100 tons being shipped and the balance treated at the mine concentrator.

WYOMING

FREMONT AND HOT SPRINGS COUNTIES

Gold placers on Wind and Big Horn rivers are described by Frank C. Schrader in *Bulletin* 580-G of the U. S. Geological Survey. Deposits of gold-bearing gravel occur in many formations up to 15 miles back from the river. Along the main streams the average thickness is 12 to 14 ft. Two dredges have not made profitable recoveries. As a conclusion to the report, the geologist states that a small area at Neble possibly contains placer gold in valuable amounts, but outside of this ground the average is less than 6c. per yard. A large percentage of heavy sand interferes with gold recovery.

CANADA

BRITISH COLUMBIA

In the long adit being driven by the Portland Canal Tunnel Co. a wide vein of $11 silver-lead ore has been cut.

ONTARIO

The lowering of Cobalt lake is to be started at once, according to M. B. R. Gordon, manager for the Cobalt Lake Mining Co., but it will not be drained until next spring.——On October 20, La Rose Consolidated will pay a dividend of 2.5%, equal to $187,328, making a total of $4,825,135.

YUKON

No. 2 dredge of the Canadian Klondyke Co. had the following record for the week ended September 12:

Operating time, hours (168 hours possible)	161.52
Average depth of gravel, feet	43.1
Gravel handled, cubic yards	102,285
Gravel handled per hour, cubic yards	632
Power used, kilowatt-hours	94,550
Power used per cubic yard, kilowatt-hours	0.92

Water shortage is curtailing work at Mayo. At the Silver King mine, Harry McWhorter states that 59 tons of ore sent to Trail yielded 4.73 oz. gold, 26,752 oz. silver, and 53,244 lb. lead, valued at $15,969, or $269.90 per ton. The total cost was $100 per ton. About 1000 tons is to be mined for next spring. At 108 ft. depth the lode is 5 ft. wide with 34 in. of good smelting ore. Other silver-lead claims are promising. Gold has been found on Kirkman creek, 27 miles above Stewart creek, and 100 miles upstream from Dawson, where some work was done from 1898 to 1900. Bedrock is from 8 to 20 ft., it being a schist.——According to the *Dawson Daily News*, over 1500 ft. of work has been done in the Lone Star quartz mine near Dawson. A 4-stamp Joshua Hendy mill was erected in 1911, and a complete equipment is driven by electric power. A concentrator was added early in 1914. To the end of 1913 the output was $24,081. The Company has spent over $70,000 on the property.——All the Canadian Klondyke company's dredges are busy. No. 1 started on May 6, No. 2 on March 4, No. 3 on May 3, and No. 4, the 'flagship,' on March 30. In August the latter boat handled 102,030 cu. yd. during one week, a world's record. The Company is digging a 5.5-mile ditch for conducting water to Last Chance for hydraulicking. At Hunker the water will be raised 600 ft. by a 16-in. three-stage centrifugal pump driven by a 1200-hp. motor.

COLOMBIA

The Pato dredge of the Oroville Dredging Co. recovered gold worth $17,500 from 32,400 cu. yd. during the week ended August 25.

KOREA

June and July gold returns of the Oriental Consolidated are as follows: 240 stamps worked 22.9 days, crushing 23,932 tons of ore, yielding from all sources $125,880. The 'operating profit' was $52,959, of which $13,695 was spent in development, etc., leaving a net profit of $39,263. The Kuk San Dong 40-stamp mill was hung up for the full month of June on account of shortage of ore; the Candlestick 10-stamp mill was closed for 10 days for the same reason; and the Maibong 30-stamp mill was down for 7 days on account of repairs. In July the eight plants treated 23,158 tons for $124,735. Recovery at the Taracol cyanide plant was 82%. The Kuk San Dong stamp-mill is again at work. On July 4 all mills were closed for the usual celebrations. Rainfall was 22.56 in., and there were heavy rains up to August 6. The hydro-electric plant is furnishing 400 hp. for the Taracol mine. The August clean-up should be an increase on July.

MEXICO

(Special Correspondence.)—Railway officials report that train service as far as Torreon is being maintained regularly with occasional trains through to Mexico City, but they undertook to make no guarantees as to service. Constitutionalist soldiers were expecting to be ordered south at any moment. It is felt here that the fundamental difficulty between Villa and Carranza is over the land question. Carranza, it is said, purposes to compensate the large land-owners for the estates that are to be divided, while Villa insists that the lands were originally stolen and should be returned to the people without compensation. Others say it is a mere matter of who shall be boss.

Juarez, September 24.

Official advices from Mexico City to the State Department at Washington on September 30 announced the issuance of a decree annulling all mine titles granted during the Huerta administration. The department issued this statement: "Sixty days from the date of the decree annulling the titles are allowed mining agents to make applications for the renewal of all procedure previously taken. All payments required in connection with mining titles or mining claims must be made again to the present central administration."

Full details of the deaths of the late president Madero and vice-president Suarez have been published in Mexico City. A description of the incident was given by Mexican chauffeurs who drove the automobiles at the time. The men are said to have been killed by Major Francisco Cardenas and three officers of *rurales*, the chauffeurs being shot at also, but escaping under dire threats.

COAHUILA

The eight groups of coal mines in the northern part of this state, which prior to the revolution produced all the coal used in Mexico, are being drained and reopened, according to the *Mexican Herald* of September 19. The Palau mines are yielding 10,000 to 12,000 tons per month, which is being used by the Constitutionalists. The Escondida and Agujita mines are producing 6000 tons between them. Considerable damage has been done to the Esperanza, Rosita, Lampacitos, Cleote, and Menor coal mines, most of them being full of water. The Rosita belonged to the Madero family, and was dynamited during the trouble. There is a large shortage of labor for the mines, as the 7000 or 8000 men previously employed joined the Constitutionalist army. The National railways are using 800 tons of coal per day in the southern division, also 5000 bbl. of oil. The latter fuel is used on the Interoceanic line, while the Pan-American line uses 3000 cords of wood per month.

Shipments of crude oil from Tampico to the United States during June 1914 totaled 1,062,062 bbl., or 86,156 bbl. less than in June of last year. The decline is the result of disturbed political conditions. Of the shipments during June this year, 238,841 bbl. went to Galveston, 165,385 to Port Aranzas, 141,577 to New York, 113,363 to Sabine, 89,000 to Baltimore, 84,000 to Port Arthur, 69,249 to New Orleans, 59,319 to Tampa, 56,328 to Perth Amboy, and 55,000 to Wilmington, Delaware.

SONORA

(Special Correspondence.)—At San Javier, work at the lixiviation plant and refinery at the Wyman mine, operated by W. C. Laughlin Co., has been stopped. With the exception of pumping at the Animas shaft, all work has stopped at both coal and metal mines; this also applies to concentrator construction. On June 26, in defending the bullion truck against robbers, the mill superintendent, Thomas Farrell, was killed. On August 6, the Yaqui Indians held up a bullion train, killing Arthur Squires, an employee, and several Mexicans, securing 36 bars of silver. Since this time they have destroyed considerable supplies en route to the mine and have made it impossible to secure provisions and supplies for operation. Due to political troubles, the Company has not been able to secure protection.

Nogales, September 21.

(Special Correspondence.)—In spite of war conditions and many hardships in the country, development of the San Manuel, San Jose, and Cacharamba mines has been kept on with few interruptions during the past two years. Work done amounts to 600, 1200, and 1100 ft. respectively. The San Jose has a new 6 by 8-in. hoist, and a new one is to be installed on the Cacharamba in October. The latter mine is the most promising one in the district, and produces ore assaying 85 oz. silver and second-class of 23 oz. per ton. Several arrastres have been worked at the San Manuel, which is owned by Don Rafael Ibarra. Work has been resumed at the Claraboya mine.

Tempe, Arizona, September 24.

PERSONAL

CHARLES C. SEIBIE has returned from Korea.

J. E. CLENNELL has returned to Oakland from Cobalt.

CHARLES G. YALE is confined to his home by sickness.

W. J. LORING sailed for China on the *Manchuria* Saturday last.

ROBERT HOLMES returned to St. Louis from California this week.

JAMES W. MALCOLMSON and LESTER R. BUDROW were in San Francisco this week.

J. PARKE CHANNING is making a good recovery from an operation for appendicitis.

Death of E. B. PRESTON last Saturday is announced. An obituary will appear later.

J. A. BURGESS, superintendent for the Nevada Wonder Mining Co., was in San Francisco this week.

E. F. BURCHARD is working in the Southern Appalachian ironfields. Later he will go to eastern Texas.

CHARLES SMITH, president of the Old Dominion Copper Co., is at Globe, Arizona, on an official inspection trip.

C. A. BOTSFORD has accepted the position of mining engineer for the Ernestine Mining Co. at Mogollon, New Mexico.

CUTLER B. WHITWELL is at Forbestown, Butte county, California, on examination work. He will be at that place for the next six weeks.

After long illness and tedious convalescence, F. H. MASON has resumed work and is attached to the mineral staff of the Canadian Commission for the Panama-Pacific International Exposition.

S. H. BROCKUNIER has just completed an examination of the property of the Jardine Gold M. & M. Co., at Jardine, Montana, and of the property of the Yellowstone Cement Co. near Gardiner, Montana.

OTTO RUHL, in charge of the mining exhibit from Jasper county, Missouri, for the Panama-Pacific International Exposition, has many attractive exhibits promised from the operators of that district.

JOHN W. MOGINE, who resigned last January as superintendent of surface plants for the Goldfield Consolidated Mines Co., and as manager for the Goldfield Merger Mines Co., to become general manager for the National Copper Mining Co. property at Mullan, Idaho, has returned to Goldfield to again hold the position of superintendent of surface plants for the Goldfield Consolidated Mines Co., succeeding JOSEPH K. POE.

SCHOOLS AND SOCIETIES

The secretary of the CANADIAN MINING INSTITUTE has received a letter from G. C. Lloyd, general secretary of the Sixth International Congress of Mining, Metallurgy and Applied Geology, stating that in consequence of the war, the meeting that was to have been held in London during July 1915 will be postponed indefinitely and all preliminary arrangements have been canceled.

The Utah local section of the AMERICAN INSTITUTE OF MINING ENGINEERS will hold its first annual meeting at the Commercial Club, Salt Lake City, Utah, on October 10. The principal business before the meeting will be the election of officers for the ensuing year. The committee appointed to nominate candidates for the offices has submitted the names of R. C. Gemmell for chairman, C. W. Whitley for vice-chairman, and Ernest Gayford for secretary-treasurer.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, October 1.

Antimony	15 - 15¾
Electrolytic copper	13⅝ 13⅞
Pig lead	4.00 4.25
Quicksilver (flask)	$50- 60
Tin	36 37½
Spelter	6½ 6¾
Zinc dust, 100-kg. zinc-lined cases	15

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, October 1.—All metals are weak. Lead is quoted at 3.75c. and spelter 4.88c. per pound.

On September 24 the Bank of England reported that its gold reserve amounted to £51,673,000 ($258,300,000), the largest amount ever held by the institution.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

No average for September can be given yet, but it should be around 54c. Prices in New York and London on October 1 were 52¾c. and 24d. respectively. Some mining men look for a rise in the metal for the following reason: India has large reserves of gold, and England needs this for war. This metal may be drawn on to a great extent, necessitating imports of silver to take its place, so opening a good market. Writing on September 17, Samuel Montagu & Co. reported that the trend of prices in London was downward, notwithstanding that supplies were not plentiful. There was a continued absence of support from the East (India and China). On account of the war a large demand for silver coin is likely to continue for some time to come. One thing is plain, the character of the market is such that any real competition can hardly fail to cause upward movements as pronounced as those which take place in a downward direction. The Tonopah Mining Co., which produces about 250,000 oz. silver per month, will pay a dividend amounting to $250,000 on October 8.

COPPER

Regular quotations have been suspended since the opening of the war, the action being similar to that of the Stock Exchange in suspending quotations on securities in general. The matter is discussed editorially in this issue. We present below the prices at which the large companies have been settling for copper in New York since suspension of quotations, and the usual monthly summaries. The average for August is that at which the A. S. & R. Co. made settlements for copper purchased from July 31 to September 14 inclusive. These prices are, as usual, for electrolytic copper and are stated in cents per pound.

Aug. 27	12.12	Sept. 14	11.94
Sept. 1	12.12	" 17	11.94
" 3	12.17	" 21	11.87
" 8	12.25	" 24	11.62
" 10	11.94	Oct. 1	11.91

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
Sept. 3	75.00-85.00	Sept. 17	75.00
" 10	75.00	" 24	75.00
		Oct. 1	75.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mch.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

Quicksilver has had a considerable fall in price. The market is unsettled, and for carlond lots the quotation is $50, and for small orders $60 per flask.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Sept. 24	3.75	Aug. 19	3.88
" 25	3.75	" 26	3.87
" 26	3.75	Sept. 2	3.90
" 27 Sunday		" 9	3.85
" 28	3.75	" 16	3.85
" 29	3.75	" 23	3.85
" 30	3.75	" 30	3.75

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Sept. 24	4.88	Aug. 19	5.60
" 25	4.88	" 26	5.77
" 26	4.88	Sept. 2	5.75
" 27 Sunday		" 9	5.50
" 28	4.88	" 16	5.25
" 29	4.88	" 23	5.00
" 30	4.88	" 30	4.88

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

St. Louis wires that immediate demands seem satisfied and the market is dull. Ore, basis of 60% metal, is down to $44 per ton. Buyers' orders are easily filled. Exports from New York since August 18, when the movement started, total 11,000 tons.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

The month has shown a drop from 38 to 31c. per pound. There has been little demand for the metal. Only 250 tons arrived at New York during the two weeks ended September 25, against 1575 tons in the previous fortnight. This will be felt before long. A decreased production is reported from Nigeria, Bolivia, and the Straits. Tin in London is about £135 per ton.

New York Metal Review

The general dullness of trade continues and all quotations are lower. European war influences have brought about some unusual situations. Copper has been dull for both home and foreign consumption and exports will be further curtailed by Great Britain's desire to keep copper out of Germany. Lead has been without feature except for dullness and declining prices. Spelter, for which a fair demand came from England in August, declined sharply when foreign buying fell off. Tin, which has been arriving heavily from London, is selling lower than it did before the war, and despite the low price and uncertainty as to the future supply, consumers have stayed out of the market to a remarkable degree. Antimony has been dull and prices are considerably nearer a normal basis. Aluminum has declined, partly because of offering of metal from England.

COPPER

Recent events brought about in Europe by the desire of Great Britain to cut off Germany's supply of copper will further curtail exports from the United States. The British government has placed copper on the conditional contraband list, and the metal is to be seized unless it can be shown clearly that its ultimate destination is a neutral country. In line with this policy, the government has taken over the stock which was carried in Rotterdam by the United Metals Selling Co. The warrants which covered this metal in the name of a British corporation, C. S. Henry & Co., were taken by the government, the copper paid for and removed to London. Subsequently the government stated that it would seize copper cargoes en route to Holland and not pay for them unless the copper stored in Rotterdam was sent to London, where it would be paid for, or stored for the consignor until the end of the war. Three Dutch vessels with copper aboard are understood to have been held up already. As a result of this situation, war risk underwriters in New York have stated that they do not care to insure copper shipments to Holland. At the outset of September, a dull market prevailed. Sellers were trying to get higher prices, but there were enough holders willing to let go at 12.37½c. cash, New York, to keep electrolytic at that level. About this time there came into vogue the making of special deals and these comprised what activity there was at the time. Some transactions in spot at 12.25c. cash, were recorded on September 8. In the second week small and scattered lots were all that could be traced as sold, some of them at 12.12½c. cash. From the middle of the month on, sales were a little more numerous, but at lower prices, it being easy to find metal at 11.87½c. cash, New York, equal to 12c. delivered, 30 days. While these sales in the aggregate would be considered but a drop in the bucket in normal times, they were encouraging in that they broke the inactivity which had prevailed. Lake declined also in the month, although it was relatively higher than electrolytic. Prime Lake was quoted September 1 at about 13c., cash, but could be had toward the close of the month at around 12.50c., despite the fact that it had been supported by some good buying by ammunition makers. At no time in September were any London quotations available, as the metal exchanges in that city and in New York remained closed. Exportations to September 22, mostly to Great Britain, totaled 11,897 tons. The August exports amounted to 19,676 tons. The Waterbury average for August was 13c. On September 1, the price of hot-rolled sheet copper was reduced ½c. per pound, making the new base 17½ cents.

LEAD

Throughout September the demand was light. Until about the middle of the month the New York quotation was stationary at 3.87½c. About September 9, the St. Louis price, which had been 3.72½c. weakened to 3.70c. and a few days later dropped to 3.67½c. The New York quotation responded to this decline and became 3.85c., on September 16. The American Smelting & Refining Co., on September 24, reduced its quotation to 3.60c., St. Louis, and 3.75c., New York. In the early part of the month there were some exports, but not enough to offset the slack demand from domestic consumers. London quotations declined steadily, the market being adversely affected by the diverting to England of metal originally consigned to Continental Europe.

SPELTER

Prices pursued a steady downward course in September, although the month opened with a rather good demand from England, some of it coming by way of Canada. It was estimated that about 2500 tons was sent abroad in August. Authorities explained the decline in prices by saying that the advance had been too rapid. The high point was 6.05c., New York, and 5.90c., St. Louis, at the end of August. The higher prices which came with the exports caused the makers of sheet zinc to advance their prices on August 29, 25c. per 100 lb., the new base being $7.50 per 100 lb., less 8% discount, f.o.b. cars, Peru, Illinois. On August 21, the same makers withdrew prices altogether. By September 15, the New York quotation for spelter was 5.45c., and by September 24, 5.30c., with St. Louis correspondingly lower at 5.15c. With the lower prices, inquiry from abroad revived and some buying followed.

TIN

In the last few days of August a moderate business was done, but this tapered off, principally because of the desire of dealers to sell, which frightened consumers off. The figures of the New York Metal Exchange, which appeared on August 31, showing that domestic deliveries in that month had been but 2900 tons, while there was on hand some 1077 tons, both surprised and disappointed the trade. Total deliveries for eight months of this year showed a decrease of 1300 tons as compared with the same time last year. The arrivals in August were 2680 tons and there was afloat at the end of the month 1930 tons. The market lost strength almost constantly in September, a chief cause being the heavy arrivals, some of which were 750 tons on the steamer *Minnehaha*, 435 tons on the *Minnetonka*, 120 tons on the *Celtic*, 850 on the *Menominee*, and 725 tons on the *Minnewaska*. Most of this tin was out of warehouses in London and the arrivals were explained by the fact that America was the chief consuming market and holders abroad sought to realize. When the London stocks are depleted, or nearly so, it remains to be seen just what will ensue, inasmuch as production may be lessened and probably has been already. Only meagre information is coming from the Straits. Another influence which may yet be felt is that of still higher freights and war insurance in view of the activity of German ships in Indian waters. The New York quotation at the beginning of September was 38c. The extent to which consumers held off was remarkable, and by the end of the first week the price was down to 33.75c. for spot metal. Sellers took the course of asking for bids instead of naming their price. By September 15 the quotation was down to 31.35c. From September 9 to 15, consumers continued to feel secure in the knowledge that about 3500 tons would be available for the deliveries of the month. Then there came a flurry in futures, some of which ran ahead to January. The price on September 22 was 31.60c., and on September 24, 31.12½c. The arrivals up to September 22 were 3703 tons, and there was afloat on that date 1165 tons. At the Banca sale held in Amsterdam, September 3, only about 900 tons was sold, the selling limit being 95 florins, equal to about £158, London basis. About 1400 tons was withdrawn from the sale. The Pacific Coast imports in June were 252,030 lb. in the San Francisco district, and 73,241 lb. in the Washington district. The total visible supply August 31, 1914, was 14,452 tons, against 14,167 tons a year ago.

ANTIMONY

Demand was light and this with the large supply on hand brought the war prices down steadily. Cookson's was quoted September 1 at about 15c. Hallett's at 14 to 15c. and Chinese and Hungarian grades at 12.50 to 14c. while on September 23 the quotations were 11c. for Cookson's, 12c. for Hallett's, and 9 to 10c. for the other grades, these prices being about 1c. below the import cost. In bonded warehouses, September 1, there was 1,190,356 lb., against 3,001,910 lb. September 1, 1913.

ALUMINUM

The only features that appear are dullness and offerings of aluminum from England at 19c., which did not find takers, but served to make prices decline. At the middle of September, 19c. to 19.50c. was quoted for 98 to 99% pure metal. The English aluminum appeared on the 18th and prices dropped to 18.50 to 19c., and by the 24th were down to 18.25 to 18.75 cents.

The Cyanide Situation

Cyanide shipments from Germany to the United States are to be resumed immediately and 1000 tons is believed to be available for transport. An American ship is to be sent to Antwerp to bring back dye-stuffs and cyanide. It will be financed by the men in the dyeing industry and will go under the patronage of the United States government. So much was determined Wednesday at a conference held at Washington, on the invitation of Mr. Bryan as Secretary of State, acting in conjunction with Mr. Redfield, Secretary of Commerce. This conference, as told in our editorial columns, followed an exchange of telegrams between Washington and Berlin over the shortage in cyanide, dye-stuffs, and chemicals in this country resulting from the war. It was attended by about fifty representative men, including Thomas T. Read, our New York editor. A general committee was formed to arrange details, and on that committee the mining men are represented by Carlos Van Law, of the U. S. Smelting, Refining & Mining Co., and Paul Mosoiff, of the Roessler & Hasslacher Chemical Co. While the German government has made it a condition that the cyanide is not to be re-exported, it is believed that this will not prevent shipments to Mexico and South American countries, and the State Department has cabled the American ambassador to request that Latin America be included. He has also been instructed to ascertain the form of guarantee demanded. The Roessler & Hasslacher plant at Perth Amboy is running at full capacity, and so far the shortage has been more apparent that real, though stocks have been disappearing rapidly. If necessary this firm will send a ship for the cyanide.

It will be remembered that Roessler & Hasslacher, the principal dealers in America, closed the New Jersey plant when the new tariff law went into effect, and has been depending upon imports entirely. In view of the uncertainty as to the future this firm and others have, naturally, hesitated to plan for extensive manufacturing in the United States to meet the present emergency. The American Cyanamide Co. plans to be in the market by January with American made cyanide. In the meantime that firm refuses to sell cyanamide for metallurgical purposes, as the efficiency of the unconverted material is so low that such sales would probably react to injure the business it is expecting later to build up.

Prices of cyanide have gone up much less than might have been anticipated in view of the shortage. Roessler & Hasslacher has taken care of all regular customers and has done what it could for others. Second-hand lots have been reported bought in various parts of the country at prices ranging from 20 to 30c. per pound, but the regular trade has been at about 15c. The Nevada Mine Operators Association has contracted for the next year's supply at 15½c., which is only one cent more than the price for the current year.

Current Prices for Oils and Candles

(Corrected monthly by Standard Oil Co., California.)

All prices are f.o.b. San Francisco except where otherwise specified and are subject to change without notice.

Granite Mining Candles.	Per set, cents.	Granite Mining Candles.	Per set, cents.
6s-12 oz.-10s	8¾	6s-14 oz.-20s	9½
6s-12 oz.-20s	9	6s-16 oz.-10s	10
6s-14 oz.-10s	9¼	6s-16 oz.-20s	10¼

Extra hard 1c. per set higher than the above.

The following prices are for oils (Calol) in wood barrels, cases (2-5 gal.) 3c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Compressor oil	40	Light gas engine oil	28
Amber gas engine oil	40	Red compressor oil	26
Castor machine oil	20	Red engine oil	17
Dynamo and motor oil	24	Turbine oil	35
Engine oil	24	Turbine oil, heavy	35
Gas engine oil	26	Diesel engine oil	40
Heavy gas engine oil	45	Cylinder oil	37
Heavy red engine oil	19	High-pressure cylinder oil	50
Heavy red journal oil	21	Low-pressure cylinder oil	37
Ice machine oil	28	Valve oil	50

The following prices are for oils in iron barrels, cases (2-5 gal.) 7c. per gallon higher, except on Eocene, which is 8c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Pearl oil	9	Red Crown gasoline	13½
Headlight oil	10	Engine distillate	7
Eocene oil	11	Aroturps	23

	Per bbl.
Star fuel oil, f.o.b. Richmond Refinery	$0.90

	Per ton.
Petrolastic cement X	$12 00
Petrolastic cement XX	11.00
Asphaltum	$5.50 to 12.50

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, per ton	$19.00	$21.00
Arsenic, white, refined, per lb.	0.05	0.06
Arsenic, red, refined, per lb.	0.12	0.15
Asbestos, chrysotile	100.00	350.00
Asbestos, amphibole	5.00	10.00
Asphaltum, refined, per ton	11.50	20.00
Barium chloride, commercial, per ton	50.00	60.00
Barium sulphate (barytes), prepared, per ton	20.00	30.00
Bismuth ore, 15%, per ton	*250.00	upward
China clay, English, levigated, per ton	15.00	20.00
Chrome ore, according to quality, per ton	10.00	12.50
Cobalt metal, refined, f. o. b. London, per lb.	2.50	....
Coke, foundry, per 2240 lb.	12.00	15.00
Diamonds (according to size and quality):		
Borts, per carat	2.00	15.00
Carbons, per carat	55.00	80.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Silica, per M	50.00	55.00
Snowball, per M	40.00	45.00
Flint pebbles for tube-mills, Danish, per 2240 lb.	26.00	30.00
Fluorspar, per ton	10.00	15.00
Fullers earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	40.00
Graphite:		
Amorphous, per lb.	0.01½	0.02½
Crystalline, per lb.	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Iridium	55.00	....
Magnesite, crude, per ton	5.00	7.50
Magnesite, dead calcined, per ton	20.00	25.00
Manganese ore, oxide, crude, per ton	10.00	15.00

Manganese, prepared, according to quality, per ton	30.00	70.00
Mica, according to size and quality, per lb	0.05	1.00
Molybdenite, 95% MoS_2, per ton	1000.00	1500.00
Monazite sand (5% thoria), per ton	150.00	200.00
Nickel metal, refined, per lb	0.45	0.60
Ochre, extra strength, levigated, per 100 lb	2.00	3.00
Osmiridium, per oz	30.00	....
Platinum, native, crude, per oz	30.00	45.00
Silex lining for tube-mills, per 2240 lb	35.00	45.00
Sulphur, crude, per ton	25.00	30.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	425.00	450.00
Tungsten ore, 65%	400.00	425.00
Uranium ore, 10% min	25.00 per unit	
Vanadium ore, 15% V_2O_5, per ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are f.o.b. San Francisco and subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, per 100 lb.	$ 0.80	$ 1.10
Acid, sulphuric, com'l, 66°, carboy, per 100 lb.	1.25	2.00
Acid, sulphuric, C. P., 9-lb. bottle, bbl., per lb.	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, per lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, per 100 lb.	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., per lb.	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, per lb.	0.10½	0.15
Acid, nitric, com'l, carboy, per 100 lb.	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., per lb.	0.16	0.22
Acid, nitric, C. P., bulk, carboy, per lb*	0.12½	0.15
Argols, ground, bbl., per lb.	0.10	0.20
Borax, cryst. and conc., bags, per 100 lb.	3.00	4.35
Borax, powdered, bbl., per 100 lb.	3.38	4.50
Borax glass, gd. 30 mesh, cases, tin lined, per 100 lb.	10.50	14.00
Bone ash, 60 to 80 mesh, bbl., per 100 lb.	0.50	6.50
Bromine, 1-lb. bottle, per lb.	0.55	0.65
Clay, domestic fire, sack, per 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, per lb.	No quotes	
Cyanide, 98 to 100%, 200-lb. case, per lb.	"	"
Cyanide, 129%, 100-lb. case, per lb.	"	"
Cyanide, 129%, 200-lb. case, per lb.	"	"
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white broken, casks, per 100 lb.	10.50	10.75
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white, crystals, per 100 lb.	12.50	13.25
Lead, C. P., test., gran., per 100 lb.	13.00	15.00
Lead, C. P., sheet, per 100 lb.	15.00	18.00
Litharge, C. P., silver free, per 100 lb.	11.50	13.50
Litharge, com'l, per 100 lb.	8.00	9.50
Manganese ox., blk., dom. in bags, per ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, per ton (85% MnO_2—3¾% Fe)	85.00	140.00
Nitre, double ref'd., small cryst., bbl., per 100 lb.	10.75	12.00
Nitre, double ref'd., granular, bbl., per 100 lb.	9.75	11.75
Nitre, double ref'd., powdered, bbl., per 100 lb.	11.00	13.00
Potassium bicarbonate, cryst., per 100 lb.	14.00	16.00
Potassium carbonate, calcined, per 100 lb.	25.00	40.00
Potassium permanganate, drum, per lb.	0.50	0.60
Silica, powdered, bags, per lb.	0.03	0.05
	Min.	Max.
Soda, carbonate (ash), bbl., per 100 lb.	1.45	1.75
Soda, bicarbonate, bbl., per 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., per 100 lb.	2.75	3.25
Soda, caustic, solid, 98%, drums, per 100 lb.	2.50	2.75
Zinc shavings, 850 fine, bbl., per 100 lb.	17.00	20.00
Zinc sheet, No. 9—18 by 84, drum, per 100 lb.	No quotes	

*Extra charge for packing nitric acid for shipment to conform to regulations.

The Roessler & Hasslacher Chemical Co. of New York, in its chemical list of September 16, stated that the excitement of the chemical market has to some extent subsided. Buyers are beginning to realize that their excited rush for goods has only led to unreasonable prices. Some chemicals cannot be supplied for some time to come.

INDUSTRIAL PROGRESS

Combination Pocket Rule and Level

The Lufkin Rule Co. is offering a 2-ft. folding boxwood rule fitted with a spirit level. The three 8-in. rule-sections are each 1 in. wide, ⅜-in. thick, and united by substantial brass joints. The rule is fully graduated the entire length on both sides, one side inches to eighths, the other side to sixteenths. The spirit level is neatly set into and flush with the upper edge of the middle section of the rule where most convenient for use and securely protected by the two outer sections of the rule, which fold against it on either side when closed for carrying in the pocket. The rule is but 8 in. long when folded, and may be conveniently carried in the pocket. Closing pins especially designed for the purpose hold the sections of the rule in proper alignment, insuring a perfect bearing surface.

Commercial Paragraphs

Sprague conduit boxes and fittings are described in pamphlet 442, issued by the SPRAGUE ELECTRIC WORKS.

The MARK MFG. CO. is distributing a descriptive booklet covering the methods of making the Mark cold-drawn steel union.

The CHICAGO PNEUMATIC TOOL CO. is now marketing the Ruby all steel sectional buildings designed for railroad and general engineering purposes.

The SENN CONCENTRATOR CO. now has ready an attractive bulletin giving details of the Senn system of concentration without classification and the Senn pan-motion amalgamator.

The WESTERN ELECTRIC CO. is distributing a new publication called 'Home Talk,' in which the availability of intercommunicating phones in the home is discussed. Another illustrated folder on 'Profitable Electrical Merchandise' catalogues dealers' helps of various sorts.

'Core Drilling by Contract' is the title of a well printed small booklet issued by the SULLIVAN MACHINERY CO., and describing one of the oldest phases of the work of this Company. Sullivan diamond-drills have been used in all parts of the world and the Company has done notable work in contract drilling.

The CEMENT-GUN CONSTRUCTION CO., of Chicago, announces that it has closed a contract with the Odanah Iron Co. at Hurley, Wisconsin, for lining one of the iron ore mine shafts with gunite, protecting the steel sets against corrosion, and protecting the wood lagging against decay and fire, making the shaft fire and waterproof.

The WELLMAN-SEAVER-MORGAN CO. has recently issued an attractive catalogue covering the Hughes mechanical gas-producer made by that firm and largely used by zinc smelters, and a smaller but well illustrated booklet showing ore and coal handling machinery, cranes, hoists, and steel and coke making machinery made by that firm.

'How to Roof Your Buildings Permanently,' is the title of a little pamphlet issued by the H. W. JOHNS-MANVILLE CO., calling attention to the J-M asbestos roofing which is made of all mineral materials. The great fires at Salem and Paterson have called attention to the necessity of having non-inflammable roofing materials. Indeed at Paterson an ordinance has been passed requiring the use of such material. Since then over 2000 roofs have been covered there with asbestos shingles or asbestos ready roofing.

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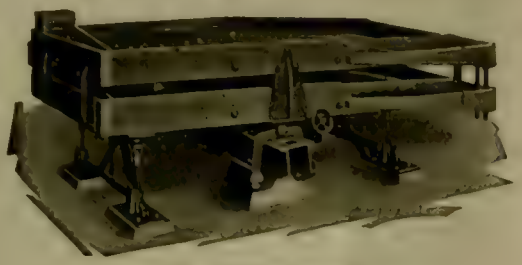

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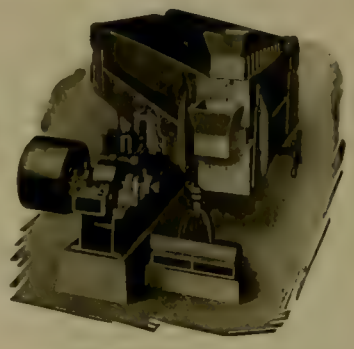

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EDITORIAL

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EVEN the Emperor of Germany had to drop to the bottom of the front page when news of the passage of the Alaska coal-land leasing bill reached the *Cordova Daily Alaskan.*

DYES are mostly reduced from coal-tars, and Germany has led the world in their manufacture. Yet, out of the annual consumption of $25,000,000 of dyestuffs in the United States, the domestic production is about 70 per cent of this total, showing that the chemical industries of the country are not lagging behind.

COPPER producers are much disturbed by the interference of Great Britain with shipments to Holland, and there has been talk, both at Washington and London, of strong protests being made. So far as the copper is for genuine use in Holland there is a clear right to make the shipments; the difficulty lies in assuring that it will not find its way into Germany. In peaceful times there are large shipments through Rotterdam.

TECHNICAL journalism in Germany has its difficulties to face this year, but we are glad to note that interest in the war has not entirely prevented attention to matters of peace and of permanent interest. *Metall und Erz,* for August, reaches us with fewer pages than usual, but including, as always, material of real merit. Among things too good, evidently, to be omitted are reviews of Mr. F. H. Dakin's paper on the Gray Eagle mine, and Mr. James M. Hyde's on the Murex process, published in the *Mining and Scientific Press.* Our cordial sympathy goes out to the editor, Mr. Karl Nugel, and his staff, in these trying times.

MODERN industrial chemistry had its beginnings in the wars of France following the revolution, especially those waged by Napoleon. Cut off from international commerce by the Continental blockade, the nation offered prizes and rewards for the discovery of processes which would make her more self-dependent, and, stimulated by these as well as the compelling force of 'must,' French chemists and engineers made tremendous advances in knowledge that were later adopted and developed by Germany and England, much to their economic advantage. It is too early yet to perceive what effects the present European war will have on international economics, but it is safe to assume that they will be noteworthy.

FURTHER correspondence from Australia, dated September 9, shows that mining generally in the Commonwealth is very dull, principally due to the war. The tendency will be for assessment-paying companies to shut down altogether, and base-metal producers of any description will find it difficult to keep going at all by reason of the suspension of their ore-buying contracts. Broken Hill is working on half time or less. The governments of South Australia and Tasmania, particularly, have made proposals to mining companies in an effort to keep the mines in operation. In general, these are that the governments will advance 50 per cent against the value of production. A somewhat similar arrangement has been made between the Hampden-Cloncurry Copper Company and the Commonwealth Bank. The latter will advance a certain percentage against copper, and the Company has concluded an arrangement with the employees by which they will be paid only half their wages until the copper is sold. There has been a drought in parts of some states, and unless rain falls soon, the harvest will be considerably below that of last season.

MANY lessons can be drawn from the present war in Europe, varying according to the preconceived opinions of the one who draws them. There is a general tendency, apparently, to blame the debacle upon the bad habit of European nations of having kings; more especially the unwisdom of Germany in supporting Wilhelm II as her war lord. Machiavelli once remarked that war ought to be the only study of a prince, who should consider peace only as a breathing time which gives him leisure to contrive and furnishes ability to execute military plans. When it was constantly necessary for peoples to protect themselves by force of arms, this was good logic, but it must be remembered that princes can not fight unless their people are willing to do the fighting. The Servian peasants are certainly quite as willing to fight for what they consider their rights as the Kaiser is to have the Germans fight for what he considers the rights of the Teutons. The advocates of monarchism have at least as good a case in pointing out the inefficiency of a republican form of government. There is a good deal to be said for kings and princes, since many of them work for the advantage of their country as a whole, instead of devoting themselves to petty politics in order to secure their reëlection.

IN taking charge of the Homestake mine in succession to T. J. Grier, Mr. Richard Blackstone has issued a letter to employees in which we note with especial interest that he promises particular attention to safety and purposes to use his best endeavors "to promote the things that make for a happy and contented people." This frank acceptance of the social responsibility of a mine manager is in accord with the traditions at Lead and the best thought of the times.

THE NORTH STAR, GRASS VALLEY

In this issue we are enabled to publish an interesting review of the operations of a famous old mine: the North Star, at Grass Valley. The account is written by Mr. William Hague, a director of the company and son of the late James D. Hague, to whom this enterprise and the American mining industry in general owes a debt it is a pleasure to acknowledge; for, among other services, was he not the earliest sponsor, if not discoverer, of the Calumet & Hecla? With Mr. William Hague in the authorship of this valuable contribution to the records of Californian mining enterprise is Mr. W. D. Pagan, the faithful and efficient secretary of the North Star Mines Company. It is rarely that technical literature is enriched by testimony so satisfactory as to the operations of an individual enterprise. The North Star is a remarkable example of the rewards that follow upon sagacity, energy, and sane optimism. More than once in its history, and especially in 1875, the end seemed plainly in sight, but by dint of further exploratory work, intelligently planned and economically performed, the enterprise was put on its feet again, and since then there has been no looking backward. Besides the Hagues, father and son, we may mention the two generations of Foote, Mr. Arthur De W. Foote, who was resident superintendent from 1896, and is now succeeded by his son, Mr. Arthur B. Foote. The average man outlives the average gold mine, but the North Star is characterized by unusual persistence, and will, we hope, test the vital powers of the present generation.

The North Star vein is in a fracture traversing diabase; the walls are well defined, three to four feet apart, the space between being occupied by a variable thickness of quartz, together with country rock, which is crushed and impregnated with pyrite. The ore consists predominantly of quartz, containing 2½ per cent iron pyrite, a little galena, and native gold. The vein dips flatly, at 23 degrees, so that the maximum depth of 5390 feet represents a vertical distance of a little more than 2000 feet. The most productive level has been the 3700. By dividing the workings into an upper and lower portion, in accord with the actual history of the undertaking, it is shown that the profit per ton has been practically the same for the two physical and chronological divisions, being $5.40 and $5.48 respectively. This equality of result is due to the fact that the declining yield per ton has been exactly compensated by a diminution of cost, the yield of $18.30 and $11.87, respectively, per ton being subject to a cost of $12.90 and $6.38, respectively. This, of course, is a highly creditable performance and indicates consistent improvement in the technical operations. As to the application of these figures on the interesting question of persistence in depth, that is, the enrichment, impoverishment, or uniformity of the ore as the mine workings gain in distance from the surface, it is not easy to generalize. The profit has been maintained practically without change, but this, as we have seen, does not mean that the yield of the ore has been unvarying; moreover, the yield is not the same thing as the gold content. In the one case the cost and in the other the extraction are crucial factors. What amount of sorting has been done? In other words, has the grade benefited or suffered by selection?

In most mining operations, the separation of waste from ore, of wall-rock from vein-filling, is an important operation. This feature is occasionally overlooked by those that sample mines; they make insufficient allowance for the relative cleanness of sampling; so that mines usually yield a bigger tonnage at a lower average metal content than the reports of engineers have predicted. Between the 3000 and the 4000-ft. levels, I am informed by Mr. Hague, the vein is divided into more stringers than in the upper part of the mine, so that the ore sent to the mill is not as clean. In the upper workings the vein, and the quartz of which it is mainly composed, was narrower, so that the yield per ton has declined, but the yield per unit-width has increased. Moreover, the deeper operations gain from a higher extraction in the mill. Joshua E. Clayton, in the report made in 1869, estimated the yield to be $25 and the loss in milling at $3 to $4 per ton, indicating an extraction of 85 per cent. In those days the sampling of the ore and the measurements of the loss in tailing usually erred a little on the pleasant side, so that we are justified in estimating an extraction slightly less than 85 per cent. In the early days of the mine the milling was crude, so that, despite the simple character of the ore, the metallurgical work was even less effective. In 1913 the metallurgical treatment, by aid of cyanidation and filter-pressing, had reached so high a state of efficiency as to extract 97½ per cent of the gold in the ore. This increase of extraction, as between the upper and lower workings, equal to about 15 per cent, is a factor in contributing to the maintenance of profit, despite a decrease in the yield of gold per ton of ore milled. However, it would appear that the maintenance of the profit at a nearly fixed amount per ton is due mainly to the decrease in cost—from $12.90 to $6.38—so that, on the evidence, we must conclude that the question of richness is to be answered by saying that the ore is poorer in depth, although the impoverishment, from an economic standpoint, is compensated by the joint effect of three factors: the increased width of ore, the lessened cost of exploitation, and the notably improved metallurgical treatment.

At the end of 1913 the North Star workings were 5850 feet deep on the dip, or 2200 feet vertically. Sinking is to be continued to 6300 feet, and levels will be extended at 5700 and 6000 feet. While the length of the shaft on the incline is impressive, the North Star cannot be regarded as a deep mine, in the modern sense, nor from a geological point of view. Whatever may be the chemical and physical conditions that modify the precipitation and concentration of gold in a vein, it may be assumed that any change is measurable in vertical depth, not along the dip of the vein, unless that should involve a change of angle. As the North Star vein is traversing a crystalline rock and is only about 2200 feet deep, the chances of further persistence on the part of the main orebody are still good, more particularly in view of the good behavior of the Empire vein, in the vicinity. But the persistence already proved in the cases of these two famous mines at Grass Valley must be considered exceptional, in the light, for example, of the half-a-dozen other local ventures made by the North Star company itself, as recorded on another page. Such persistence as that of the North Star orebody is unusual, and whether it may be maintained further can be ascertained only by digging. In any event, the North Star will have furnished a splendid example of intelligent mining and skillful enterprise.

T. A. Rickard.

FLOTATION OF THE ELM ORLU ORES

Adoption of the Minerals Separation froth-flotation treatment for Elm Orlu ores attracted much attention when first announced by the *Mining and Scientific Press* in May 1913. Interest was all the more keen since it was known that the engineers of Mr. W. A. Clark's staff had carried on exhaustive tests through nearly a year and had tried virtually all competing processes. The mill went into commission last June and has now settled down to regular work. Designed to handle 300 tons per 24 hours, it is regularly exceeding that capacity, treating in fact about 450 tons per day. The recovery effected has been equally satisfactory, the total ranging from 94 to 98 per cent, with the average of approximately 96. The flotation department, handling as it does the leaner and usually less easily saved mineral, falls a little below this total. The daily figures range from 85 to 97 per cent, the average falling perhaps near 94.

The ore from the Elm Orlu mine is a mixture of zinc, lead, and copper sulphides in a silicious gangue. About 75% of the metal content is freed by crushing to 40 mesh, but it is necessary to grind to 150 mesh to free the remainder. The ore assays between 17 and 22 per cent zinc, with an average of a trifle above 19. It was to recover this zinc, especially, that flotation was adopted. The mill in which the ore is treated belongs to the Timber Butte Milling Company, of which the superintendent is Mr. W. N. Rossberg. He, with Mr. E. H. Nutter, of the Minerals Separation staff, is responsible for the flow-sheet and general arrangement of the mill. Minerals Separation, Limited, is directly represented in Montana by Mr. G. A. Chapman, at Anaconda, and Mr. T. M. Owen at the Timber Butte mill. Mr. Joseph Pyle is the general representative in Montana of Mr. W. A. Clark, main owner of both mine and mill.

The mill includes both wet-concentration and flotation departments. The ore as received from the mine is crushed by means of a rock-breaker and rolls, screened with impact screens, and delivered to Wilfley tables for a rough separation. Some clean zinc is taken off here, and a zinc-iron concentrate is made which is sent to a jigging and table department, being joined at the elevator to the classifier by a lead product derived from the tailing from the roughing Wilfley tables through regrinding in a Hardinge mill and treatment on James tables. A second zinc product is taken from the James tables, and a tailing which by-passes the jig and second set of Wilfleys, going direct to the flotation department. Overflow from the classifier feeding the jig and tables mentioned goes to Dorr settlers later to be noted. The flotation department includes both primary and secondary flotation machines, with Hardinge mills for regrinding, Akins classifiers ahead of the flotation machines, and an Avoca below. The first flotation produces a concentrate for further treatment and a tailing which is split in Akins classifiers into a sand (returned to the system for regrinding) and a slime which goes, through Dorr settlers, to waste. It is to be noted that all material, save the coarse concentrate, is crushed to 150 mesh and treated by flotation. The secondary flotation produces a middling (returned for regrinding) and a concentrate which goes through the Avoca classifier and settling boxes to James tables for cleaning. The tailing and middling produced are returned to the system in appropriate places for regrinding, while the lead and zinc concentrates go to bins. The fine concentrate from the overflow from classifiers is thickened in Dorr thickeners and filtered in a Kelley press. Water is, as usual, returned to the circuit from various appropriate points. The only point at which waste is eliminated from the mill is through the Dorr settlers below the primary flotation.

The success of the system adopted has been marked. Starting with an ore containing 19 per cent plus of zinc, a final mill tailing is made assaying 0.7 to 2 and averaging about 1⅓ per cent. The concentrate delivered to the bin from the flotation department assays about 53 per cent zinc, 4.2 iron, and 3 to 4 insoluble. Concentrate from tables prior to flotation assays about 48 per cent zinc, 8 per cent iron, and 4½ per cent insoluble. The lead-iron concentrate ranges from 18 to 28 per cent zinc, 18 to 22 iron, and 10 to 35 lead. The jig concentrate assays 40 to 48 per cent zinc, 8 to 12 per cent iron, and 3 to 4 insoluble. For one period of six days the total mill recovery averaged 95.7 per cent. For the same period the average recovery by flotation, from the leaner ore, was 93.7 per cent. In treating nearly 11,000 tons, 24.6 per cent of the zinc was saved in the coarse

concentrate and 69.4 in the fine. In the lead-iron concentrate 0.6 per cent of the zinc was lost, while 5.1 went into the tailing, and 0.3 per cent was unaccounted for. We extend congratulations upon these excellent results to the engineers concerned.

A MAN AND HIS JOB

The natural effect of the great growth of industrialism during the past half century has been a corresponding increase in the complexity of its structure. Long ago the frequent lack of adjustment between the capabilities of a man and the requirements of his situation was so evident as to give rise to the expressive phrase of 'a square peg in a round hole.' Nowadays the characteristics of men and the demands of work have become so varied that, to preserve the simile, we now have triangular, octagonal, elliptical, or other forms of pegs, and an equal variety of holes. The chances that a square peg will find its way into a square hole are even, the chances that a triangular peg will encounter a triangular hole out of all the variety of forms are decidedly small. In other words, it is now much less likely than ever before that a man will be perfectly adapted to the work he is called on to perform. It is only of recent years, though, that this acute problem of making sure that the man and the job fit each other has received any careful attention. Mr. Herman Schneider, dean of the College of Engineering of the University of Cincinnati, who has had unusual facilities for studying the characteristics of young men averaging 20 years of age, as exhibited both in classrooms and workshops, has recently made an interesting analysis of these characteristics and their effect on the work which the individual is capable of doing.

Unless a man gets, from doing his work, mental and physical development and discipline, some measure of satisfaction, and a decent living he can never be a really efficient workman. Until recently inquiry has rarely concerned itself with other than the third of these, but the importance of the other two is obvious. A manager who is particular as to whether his workmen use a round pointed or square ended shovel will often exhibit indifference as to whether the man using the shovel is of the requisite strength to do such work efficiently. A 130-pound man should not be put at work which requires heavy lifting, nor is a 225-pound man employed to best advantage at bookkeeping. Similarly, some men are skillful with their fingers while others are skillful with their heads; the one would be a good draftsman for routine work and the other for designing. Some men prefer a steady routine, others are driven to distraction by the monotony of fixed tasks; thus of two such carpenters, the one would do better on steady shop work and the other on odd jobs. Some men like to be indoors, others are restless except in the open; some like to work underground, others prefer surface work. In such cases the man only does his best work when he is in the environment which he prefers.

More important than these characteristics is the tendency of some men to assume responsibility and of others to evade it. The best workman rarely makes the best boss, and it is one of the weaknesses of the merit system that it frequently promotes into a position of responsibility a steady-going man who is really a brake on the department of which he has charge. It is likewise necessary to distinguish between the man of originality and the one of constructive ability; the one can imagine some new process or method of procedure, the other can work out the details of successfully performing it. One man may deal only in sketchy outlines, the other concern himself with detail; or one man may be interested only in big scale work like building a railroad, while the other is happiest working over niceties of adjustment, as in watch repairing. Again it may be noticed that one man continues unchanged no matter what his environment, another instantly adapts himself to the circumstances of the moment; one would be a success as a cashier, the other as a salesman. The natural tendency of some men is to think carefully before doing anything; other men act first and think afterward, and in business life this latter characteristic is the least useful of all. In certain occupations a keen sense of color or musical pitch may be extremely useful and its absence a detriment. Some men are naturally accurate; others seem naturally inaccurate, and this observation may apply either to their mental processes or to their manual skill. Often indeed a man who is mentally inaccurate may display surprising skill with his hands. Another mental characteristic is that of concentration; the mental energies of one man are discharged like a shotgun, of another like a rifle. The mental energies of some act slowly, like black powder, of others instantaneously, like dynamite. The hoisting engineer must be able to think and act quickly, but if the mine geologist is slow in formulating his ideas they are the more apt to be right. Finally, some men have staying qualities, others give way under continued strain, just as the man who makes the best showing under favorable circumstances often goes to pieces under the pressure of adversity.

Superimposed on all these varying characteristics is the variation in the weight which each individual places on the relative value of the three rewards of work which we mentioned in beginning. Some men are ambitious to increase their powers and care little about whether their work is pleasant, or whether the financial return for it is adequate. Others like to be comfortable, and having found a satisfactory job want to stick to it. Others are keen to make money and embrace every opportunity to increase their earnings. Thus each man presents himself as a complex bundle of emotions, tendencies, and capabilities. In picking men for the positions under his direction a manager needs to consider all these factors, if he hopes to secure the best results. The old fashioned conservative method of management in which a faithful employee is steadily promoted until he finally reaches the highest position, is obviously a bad method, for it successively places a peg in each hole, only one of which it really fits.

As War Looks in London*

By T. A. RICKARD

A mining man just arrived from Turkey says that the *Goeben* affair has hurt German prestige. This splendid warship was taken around the Mediterranean ports as an exhibit of Germany's latest naval unit. She was shown proudly to the Turks, who were impressed. Now she is interned, having done nothing in the fighting way; so the people at Constantinople make disparaging remarks. But the Turks feel bitterly over England's annexation of the warship and destroyer that were in course of completion for Turkey in British shipyards. This is in accord with international custom, but in this case it hurt intensely because the cost of that warship had been raised by public subscription in Turkey and it was an object of patriotic pride. The money obtained by the compulsory sale will not go to the subscribers, but to a government department, so that it will have failed to achieve its immediate purpose.

The Press Bureau has issued a contradiction of the rumors concerning the Russian contingents from Archangel. The growth of this myth is astonishing. Even now I find as much difficulty in crediting the denial as the affirmation. People claim to have seen trainloads of Russians coming from the north of Scotland to our southeastern ports; they saw them at the London terminal stations; they knew shipping firms that had transported them; indeed a mining engineer called Champion said that he came with 2500 of them on a ship from the White Sea; and so forth. The explanation must be that the war stimulated the study of maps and thus made manifest the fact that oversea communication was possible from Russia to France without passing through the Baltic; then it was known that a good many English and Americans had come from Russia by way of Archangel to Bergen (Norway) and then to Leith (Scotland); it was obvious that Russian soldiers might be transported along the same route. From the question of why not do so to the idea that it had been done there was only a small gap across which the imagination skipped lightly. Moreover, the Russian government notified its nationals in foreign countries that they might enlist with the Allies, and the actual enlistment of some of these Russian refugees may have given further color to the yarn. Even now, many refuse to believe the contradiction and point to the Press Bureau's statement as equivocal. We shall see. Meanwhile, I hope—and therefore am inclined to believe—that a body of troops will be found coming to the reinforcement of the Allies from the northwest of France. Where are the British troops from India, and why should a part of the Paris garrison not be available in the culminating effort to rout the invading armies.

London, September 16.

Last night I went to hear Winston Churchill. Although I had a ticket and went an hour before the proceedings began, the crowd was so big that the police had to come in force in order to prevent a dangerous crush. As it was, I obtained a seat in the upper gallery, but that was all right, for the place—the Opera House, on Kingsway, built by Hammerstein of New York—has good acoustics. It was full to the limit with a serious and intensely patriotic assemblage. The affair had been organized by the two leading political clubs, the National Liberal and the Constitutional, representing the two big parties; and to make it even more national a Labor representative was one of the three speakers, namely, Churchill, a Liberal, F. E. Smith, a Conservative, and Will Crooks, a Laborite. As Churchill entered he received a wonderful demonstration of good will. Then the band played the national anthems of the various Allies: first the gay 'La Brabanconne' of the Belgians, then the sombre Servian and the solemn Russian anthems; the Japanese anthem has the deep chords that characterize the tragic portion of Puccini's 'Madame Butterfly'; finally the 'Marseillaise,' which was vigorously supported by the audience—by note more than by libretto. When Churchill rose to speak there was another demonstration, and in the effort to express their feelings the thousands before him sang "For he's a jolly good fellow," with cheers. Our inability to express emotion save in a conventional way was curiously illustrated, but when you sing with intense vigor in war-time that a man is a jolly good fellow, you mean more than meets the eye in such homely words. The two succeeding speakers received similar musical honors. Our Winston—to distinguish him from yours—is not an orator in the ordinary sense; he lisps; hence he fails to enunciate perfectly; his person is not remarkable save for a fine brow; he has not the gesture of a great speaker; but—and the 'but' is everything—he is a man of powerful intellect and speaks with all the resources of a big mind. What he said, more than how he said it; what he had done, more than what he looked; that was what carried the audience. He spoke first of the improved military position in France, but warned us that the war would be "long and sombre," and needing our united determination "to plough our British way through obstacles of all kinds, and continue to the end of the furrow, whatever the toil and suffering may be." Turning to the navy, he spoke cheerfully. We have "swept German commerce from the seas." Again, "We have searched the so-called German ocean without discovering the German flag." It was reported to him that the health of the sailors of our fleet "has been much better since the declaration of war than it was in time of peace." Another hit that aroused enthusiasm was a reference to that dispensation of Providence whereby "the nose of the bulldog has been

*In this series of war letters, the *Press* will print extracts from Mr. Rickard's personal letters from London, believing that an account of the war as seen by a mining man in that great centre will be of interest to mining men everywhere. Mr. Rickard is an Englishman who was born in Italy, passed his early boyhood in Russia, managed mines in France and Australia, and lived in the United States more than twenty years. His sympathies are naturally with the Allies.

slanted backwards, so that he can breathe with comfort without letting go." Turning to recruiting, he asserted that a million men must be placed, and maintained, on the continent if we meant to bring the war to its proper conclusion. He made an appeal for conducting the war decently, so that when all is done it may be said "They fought like gentlemen." (Loud cheers.) Then came the part of his speech I liked best, for it was statesmanlike. When the war was over, said he, let us not make the same sort of mistake as Germany did when she had France prostrate in 1870. Let us keep before us the principle of nationality. (Round after round of applause.) "Not the conquest and subjugation of any great community or any strong race of men, but the setting free of those races which have been subjugated and conquered, and if doubt arises about disputed areas of country, we should try to settle their ultimate destinations in the reconstruction of Europe with a fair regard to the wishes and feelings of the peoples who live in those countries." He was followed by F. E. Smith, a brilliant advocate, now the head of the Press Bureau. Smith is a belligerent politician, and bitter partisan, but in his first words he acknowledged that however much he may have disagreed with Churchill in the late past he had never had the slightest doubt that he was "a great and patriotic Englishman." All the bitterness of political strife has vanished, all the old controversies are dead, we are a united nation. His last point was good: that while he had always advocated compulsory national service, he hoped, now that we found ourselves at war on a voluntary basis, we would "go through it, with whatever forces may be required, as a volunteer nation, and by so doing afford our German critics the supreme proof of our decadence," that decadence of which they had talked so much. Our aim was to extort from this welter of bloodshed "the hope of a more permanent peace, and in the end convincing the world that a proud people may passionately love peace and yet be fit for war." Will Crooks, the Labor representative, was well received. We were fighting for home and liberty—the home and liberty of the whole world. He called it 'ome, but I thought to myself, after all, 'ome means even more than home, for those that say it that way are even deprived of an h, or seriously, that the home of the plain working man means more to him than the mansion of the rich. Where, said Crooks, would the Empire be but for the parish-pump and all the little centres of living that it connoted? The Empire was great because in every corner of the earth plain people could live under the Flag in liberty. Then came the resolution, which is worthy of quotation, although resolutions submitted to public meetings are usually fuller of sound than meaning. This one is tense with significance, for it states the purpose of this war in terms as terse as they are truthful. Here it is: "That this meeting of the citizens of London, profoundly believing that we are fighting in a just cause, for the vindication of the rights of small states and the public law of Europe, pledges itself unswervingly to support the Prime Minister's appeal to the Nation, and all measures necessary for the prosecution of the war to a victorious conclusion, whereby alone the lasting peace of Europe can be assured."

And as I copy these words I hear the patter of horses' hoofs on the road, marking the departure of another detachment of the Scots Greys, the regiment whose cavalry smashed the Imperial Guards of Napoleon at Waterloo, and helped to end the arrogant militarism that tyrannized Europe one hundred years ago. May they hurl themselves into the battle with the same old courage and for the same old cause: the liberty of the people.

London, September 12.

You may have heard how nearly the *Tennessee* fell a victim to a mine. She went to Flushing to perform her mission in aid of American refugees, and, in order to maintain her wireless service, she kept outside the 3-mile limit. D. M. Riordan, of New York, who was specially engaged by the Secretary of the Navy to take charge of the business end of the expedition, went ashore in a Dutch boat, together with other American officials. On returning, they had re-embarked, and were under way, leaving the Dutch boat in their wake, when she came in contact with a mine and was destroyed. If that mine had struck the *Tennessee*, there would have been an explosion of another kind that would have echoed round the word! It might have proved a repetition of "Remember the Maine." A great chapter in history was skipped.

A man named William Clark, from Bootle, near Liverpool, went through the South African war unhurt and then was a fireman on the *Titanic* when she went down. As if that were not enough coquetting with Death, he was on the *Empress of Ireland* when she was sunk; and again escaped unscathed. He has now re-joined the army. Surely he is the man destined to capture the Kaiser or to blow up Krupp's factory—the two feats most to be applauded at this time.

London, September 29.

AS SEEN IN FRANCE

Below is an extract from a letter of an American artist living in northern France. "I think we are not, at the most, 50 miles from the front now and very great possibilities of its enveloping us within a very short period of time. If that comes to pass, we must get out of range as best and as fast as we can as thousands from farther north and east are doing today. Passing here in a continuous stream are women and children, many destitute and on foot carrying their pitiful little bundles and begging for food. We are doing our best to help them until in our turn we have perhaps to do the same thing. Very fortunately for us I was able to get a check for $500 on New York cashed in Paris the other day, so have some funds to carry us over until things change. Otherwise we would have had to ask charity too, for by the law of mortatorium our bank account in a French bank was unavailable except at the rate of 5% per month."

The North Star Mine, Grass Valley

By WILLIAM HAGUE and W. D. PAGAN

The North Star mine, the largest producer of the group of properties owned by the North Star Mines Co., was discovered in 1851, and with the exception of ten years between 1874 and 1884 has been in continuous operation ever since. The mine has thus a career of over fifty years behind it, and a brief history of its varying fortunes, including some account of the other adjoining properties now under the same ownership, may be valuable as a matter of record as well as of interest to stockholders.

Early History

These properties are situated about a mile and a half south of the city of Grass Valley, in Nevada county, California. Grass Valley, about 2400 ft. above sea-level, is connected by a branch railway, 16 miles long, with the Southern Pacific railroad at Colfax, 144 miles northeast of San Francisco. The terminus of the local railway is at Nevada City, five miles beyond Grass Valley.

The first discovery of gold in California, at least of real historical importance, was made at Coloma, in Eldorado county, in 1848, by James W. Marshall, who later in the same year found the metal on Deer creek, within the limits of what is now Nevada City. Since that time, California has produced more than $1,500,000,000 worth of gold, of which the quartz mines of Grass Valley and Nevada City have contributed about $110,000,000, and the properties now owned by the North Star Mines Co. (not including the Champion), $25,000,000 to $27,000,000.

The discovery of what is now known as the North Star vein was made by two Frenchmen, the Lavance brothers, while sluicing on the side of the hill where the North Star mill now stands, probably in the fall of 1851; for on November 10 they recorded the first location. The vein was first known as the French lead, and the hill on which it outcropped was called Lafayette hill. In the next few days nine other Frenchmen recorded their locations, each claim being one hundred feet square. These Frenchmen evidently decided to form a combination in restraint of 'jumping,' as the Helvetia & Lafayette Gold Mining Co. was formed by some of them in the course of a year or two to work their claims. The discovery attracted many prospectors, and the records show several hundred locations made in the next few months, many of which were 'jumped' at various times. Just east of Lafayette hill some of the later owners located the eastern extension of the North Star vein, upon what they called Weimer hill. Whether or not this Teutonic name was chosen to irritate the Frenchmen on Lafayette hill, does not appear. The locations forming the Helvetia & Lafayette property took 480 ft. along the strike of the vein and appear to have been about where the present North Star shaft-house stands. East of the Helvetia & Lafayette for 800 ft. came another consolidated group of claims known as the Independence, and for 800 ft. east of this came the White Rock group. A group of claims known as the North Star was located some time prior to 1860 on a split from the vein in the hanging wall over the Helvetia & Lafayette ground.

In 1858 the Helvetia & Lafayette came to grief and was sold by the sheriff to Edward McLaughlin to satisfy judgments for $8000. In February 1860 McLaughlin sold the property to J. C. Pascoe, Edward Coleman, and others, for $15,000. These men also owned the North Star group, and in 1861 they formed a mining partnership known as the North Star Quartz Mining Co. Between 1861 and 1866 many of the other claims in the neighborhood were bought by this Company. Bean's Directory states that the net profits for the five years ending 1866 were $500,000, or at the rate of $100,000 per annum. The tonnage milled was probably about 7000, and the total outlay about $150,000 per annum. This would mean that the mine produced, say, 35,000 tons, with a gross yield of $1,250,000 during this period—probably too high an estimate. The gross production, therefore, for the five years is assumed at $1,000,000. It is also estimated that for the ten years previous to 1861 the vein produced 25,000 tons, yielding $500,000, making a total from 1851 to 1866 of $1,500,000 from ore averaging $25 per ton.

In 1867 the North Star Gold Mining Co. was incorporated, with a capitalization of $1,000,000. This new Company purchased from the North Star co-partnership the Helvetia & Lafayette, the North Star, the Independence, and other claims on the Weimer and Lafayette hills. These various claims were consolidated as the North Star claim, under United States patent issued on August 11, 1875.

In 1875 the mine was closed down, being then about 1200 ft. deep on the incline, a decrease in the yield of the lode making its operation unprofitable. From a report by Joshua E. Clayton made in 1869, and from figures given in the 'Mineral Resources West of the Rocky Mountains' for the years 1871, 1872, 1873, and 1874, it is estimated that the mine produced between July 1867 and September 1873 some 50,000 tons, yielding $1,125,000 in round numbers. The expenses were in the neighborhood of $150,000 per annum, which would indicate a profit of $225,000.

A New Start

In May 1884 the North Star Mining Co. was incorporated, with a capitalization of $1,000,000, to take over the property of the North Star Gold Mining Co., and the mine was reopened and the shaft sunk. Since that

date the vein has produced continuously, though for several years prior to 1902 in a very limited way.

Between 1884 and 1894 the North Star shaft was sunk to the 2300-ft. level, and the ore-shoot that had been followed from the surface, and which lay for the most part west of the shaft, was stoped. Very rich rock was found on the 1800-ft. level near a displacement in the vein caused by a 'crossing.' Good ore was also extracted between 1900 and 2100 ft., which made the yield in 1893 over $31 per ton. This ore-shoot produced in round numbers 250,000 tons yielding $5,250,000. At the 2300-ft. level, however, the quartz ceased, and the vein below it became small and 'tight.'

The Vertical Shaft

Although the outlook at the time was not particularly encouraging, it was decided to sink a vertical shaft to intersect the vein at a depth of 4000 ft. on the dip, and work was commenced in 1897. To provide funds for the purchase of additional claims and more extensive explorations, the capital of the North Star Mining Co. was increased in 1894 from $1,000,000 to $2,000,000; and in April 1899 the North Star Mines Co. was incorporated under the laws of New Jersey, with an issued capital of $2,500,000, to take over the property of the North Star Mining Co. and to furnish the funds required for the expensive undertaking of sinking the new shaft.

Exploration to the eastward had hitherto disclosed a barren vein, and had never been pushed far. In 1900, after certain adjoining claims had been purchased, the 500-ft. level was extended eastward, and after being driven some distance passed through the top of a narrow shoot of rich ore. Surface indications overhead had never encouraged prospecting in this direction before. Exploration was hastened on the 1100 and 1900 east, because of this discovery, and the downward extension of the shoot was discovered. The ore from this was rich, from one place 18,000 tons yielding an average of $37.50 per ton. Operations in this orebody and in one a few hundred feet east of it, between and including the 1100 and 2700-ft. levels, continued until 1911, and resulted in a total production of about 182,000 tons.

On March 31, 1901, the vertical shaft begun in 1897 cut the North Star vein at a vertical depth of 1630 ft., or a depth of about 4000 ft. on the dip of the vein. Development work was for some time hindered by the heavy flow of water and by the necessary equipment of the shaft for more extensive operations. Levels were, however, started east and west, and a rise was begun to connect with the bottom of the incline-shaft. The rise was carried up on the vein and finally connected with the incline-shaft on November 22, 1903.

Results in Depth

Subsequent developments have proved that the vein in the deep levels is wider and more extensive than in the upper mine, although the yield per ton is lower. The most productive level has been the 3700, which will probably, first and last, yield over 200,000 tons, or four-fifths as much as the ore-shoot that the mine was opened on. This level also has the distinction of having furnished a pocket of high-grade ore, worth $40,000, which was brought to the surface in some 20 candle-boxes.

Since March 1901, to the end of 1912, successful development and profitable operation of the ground worked through the vertical shaft have continued, with levels extended to various lengths, east and west from the shaft, at 3000, 3400, 3700, 3900, 4000, 4400, 4700, 5000, and 5300 ft. In 1906 the shaft, following the vein on the incline, was continued below the 4000-ft. level and had reached a depth of 5390 ft., when work was temporarily suspended in June 1908. The development work in the lower mine amounted, in all, to the end of 1912, to 43,192 feet.

The tonnage of ore hoisted from the shaft and deep levels, up to the end of 1912, was as follows:

Shaft	19,020	4400	11,743
3000	96,544	4700	15,742
3400	181,731	5000	12,087
3700	191,808	5300	4,373
3900	8,577		
4000	93,403	Total	635,028

Of the above tonnage hoisted from the deep levels, 626,509 tons was crushed, of a gross value of $7,496,499.73, compared with an estimated yield from the surface to, and including, the 2700-ft. level of 438,273 tons, of a gross value of $8,019,016, making a total production for the North Star mine to the end of 1912 of 1,064,782 tons, of a gross value of $15,515,515.

The enterprise as now conducted has been practically continuous since 1884, and precise figures can therefore be given for a period of over 28 years. The following comparison may be made between the results of the operation of the upper and lower levels of the mine:

Upper Mine Operations, to and Including 2700-ft. (1200 ft. Vertical) Level

From 1851 to end of 1913.
(Operation of upper levels ceased in 1911).

Production (438,000 tons at $18.308)	$8,019,000.00*
Operating and development expenses (per ton $12.90)	5,650,000.00†
Profit (per ton $5.408)	$2,369,000.00

Vertical Shaft Operations, 3000 to 5300-ft. (2000 ft. Vertical) Level

From 1901 to end of 1913.

Production (732,599 tons at $11.871)	$8,696,596.15
Operating and development expenses (per ton $6.383)	4,676,371.43
Profit (per ton $5.488)	$4,020,224.72

Total North Star Vein (Surface to 5300-ft. Level)

From 1851 to end of 1913.

Production (1,170,000 tons at $14.286)	$16,715,000.00
Operating and development expenses (per ton $8.825)	10,326,000.00
Profit (per ton $5.461)	$ 6,389,000.00

*Includes estimate of 108,000 tons prior to 1884, yielding $2,625,000.

†Includes estimate of expenses prior to 1884, $2,000,000.

Milling

The first mill of the North Star Mining Co. was equipped with 30 stamps. It went into operation in April 1887. Ten additional stamps were added in December 1888. The productive capacity of the mine, greatly increased by the opening of the deep levels through the vertical shaft, justified an addition to the milling equipment, and early in 1903 grading for a new 40-stamp mill was begun. The mill was completed and started crushing in August 1904. The efficiency of the old mill has also been increased and the crushing capacity of the 80 stamps is now about 8500 tons per month.

As an illustration of the increased productivity of the mines and crushing capacity of the mills, it may be said that the tonnage milled during the 9 years ended December 31, 1912, was two and three-quarter times that for the previous 20 years. In 1904 the construction of cyanide plants to treat the tailings from the two mills was begun. This equipment has been enlarged and improved from time to time, at a total cost to the end of 1912 of $99,529. In 1907, at the Central plant, the cyanide process was successfully applied to the treatment of the sulphide product of the mills, yielding better economic results than were previously obtained by chlorination or smelting. The process of recovery, in fact, has been so perfected that the mill-losses which, according to Clayton, amounted in 1869 to $3 or $4 per ton, and which between 1884 and 1900 were probably not less than $1.50 per ton, have now been reduced to about 26c. per ton.

Production and Depth

The tables already given set forth the production of the North Star vein and show a decline in the yield per ton with increased depth; but to offset this it appears that the yield per square foot (horizontal)[1] mined has increased. This may be explained by the fact that in the upper portion of the mine, above the 2700 level, both the vein and the quartz were narrower, with fewer stringers than below, although definite figures on this point cannot now be given. To lose now as few stringers as possible, much waste is unavoidably sent to the mill, thereby reducing the yield per ton from what it would be if only clean quartz were treated. This course seems to be justified by the result, as a greater total yield for the vein as a whole is made available. The North Star vein is now exhausted, so far as is known, above the 3000-ft. level. The total area mined above this level is in round numbers 2,100,000 sq. ft. of a total of 6,000,000 sq. ft. prospected, or, in other words, 35% of the exploited ground has proved profitable.

In the report made by Clayton in 1869 he stated that with good management there was no reason why the cost, at that time of $16 to $20 per ton, should not be reduced to $12 per ton. For the five-year period ended with 1892 the cost, including improvements, was $12.35 per ton. Since then the cost has been dropping until now it is about $5.25 per ton mined. The profit per ton has remained nearly constant since 1884.

[1]That is, the area of the stope projected on a horizontal plane and measured on the map by a planimeter. Owing to the flatness of the vein, the horizontal projection is used instead of the vertical projection. The yield per square foot of vein-area would be about 10% less.

Other Ventures

The North Star companies have devoted considerable effort and money to the exploration of neighboring properties. In 1894 the North Star Mining Co. effected the purchase of the Massachusetts Hill property. The claims comprising this were located prior to 1861, and produced remarkably during the first years after discovery. High-grade ore outeropped on the surface, and for several years the part of the vein worked by William Watt yielded at the rate of $80 per ton. From the areas known to be stoped, it is estimated that this vein prior to 1896 produced 125,000 tons, yielding $4,000,000 to $5,000,000; the orebody upon which the locations were made went down for 600 ft. or so, when the vein became barren, causing the owners to cease operations. Tragedy as well as prosperity befell some of the early owners. Michael Brennan, in sinking a vertical shaft to cut the Massachusetts Hill vein, expended all his own, as well as his partners', money, without reaching the desired goal. One Sunday morning in a fit of despair he killed his wife and his three children and then committed suicide. His creditors took over the prospect and after sinking the shaft a very few feet deeper disclosed the vein that Brennan had just failed to reach.

The mine was re-opened in 1896 by the North Star Mining Co. The shaft was sunk and near the 1200 level another orebody was cut, which yielded $1,000,000 from 68,000 tons. The shaft was continued to the 1800-ft. level, and some driving was done, but no more ore was found. The ore-shoots in this mine seem to be irregular and uncertain; the proportion of profitable ground, when the work on the vein farther north at the Gold Hill, is included, is about 20% of the vein-area opened. The mine was closed down in 1901. The profit from this operation, all told, was not a large one, but the enterprise kept the Company actively engaged during the lean interval encountered about this time in the North Star vein.

New York Hill

In 1894 the New York Hill property was purchased. This vein appears to have been discovered by John Wolf some time in 1852. In May 1868, when the New York Hill Quartz Mining Co. was formed as a co-partnership, a mill was erected and a small tonnage treated. In 1872 the New York Hill Gold Mining Co. was formed; the shaft was sunk to the 1300-ft. level and a considerable production was obtained; but the mine was closed down in 1883. After purchase by the North Star it yielded $60,000 from 6000 tons, but the vein was small and tight and no new shoots were found.

The total estimated production from the New York

Hill is $1,500,000 from 100,000 tons, the proportion of profitable ground being from 20 to 25% of that opened. At the west end of the New York Hill there is a peculiar vein occurrence, known as the 'slap-up.' Here a vein dipping to the north was discovered and was found to turn over and dip to the south without coming to the surface. This vein is estimated to have produced 35,000 tons yielding, say, $500,000, largely in specimen ore.

In April 1903, the Gold Hill property was purchased. This vein was discovered by George Knight in September 1850, and was the first discovery of gold-bearing quartz in the district, if not in California. It is supposed to have produced several million dollars from a body of quartz lying on the surface, a little distance from the outcrop of the vein. The output of gold from this discovery is said to have caused the gold buyers to put down the price of the metal temporarily, for gold apparently was being found as placer deposits in every valley, and if it were going to form the capping of the hills, as well, it looked as though there might be 'too much of a good thing.' The vein itself, which is the northern extension of the Massachusetts Hill vein, has, except close to the surface, proved generally unproductive, although exploration has been extended to a depth of 1200 ft. on the incline and laterally for a thousand feet or so. The early records show that an English concern, called the Agua Fria Co., of London, attempted to work on Gold Hill, but evidently the water was too cold, as it sold out to Melville Atwood, who was operating the property in 1856. The North Star company, after purchase, did a considerable amount of development, but with no successful results.

In 1910 the Cincinnati Hill property was purchased. This vein had been worked in the early days to a depth of about 150 ft. The outcrop showed a small vein of rich quartz. Mining had been abandoned because the quartz vein was too small to work profitably, although old-timers all said the bottom showed a vein of $20 ore (a standard old-timers' statement, by the way, in this district[2]), and that the shut-down was due to a heavy flow of water (also standard). The shaft was continued by the North Star Mines Co. to a depth of 400 ft., and drifts were driven on a large barren vein; although in one place a small pocket, carrying from two to three inches of specimen quartz, was found, from which a few hundred tons of ore was extracted; but prospecting was discontinued in 1912, owing to lack of any encouragement to proceed farther.

From the foregoing history of the ups and downs of the veins now owned by the North Star Mines Co. the following facts seem to be salient: Of the five outcrops that have seemed to justify exploration, two, the Cincinnati Hill and Gold Hill, have proved thus far unproductive a short distance underground, although good on the surface. Two, the Massachusetts Hill and the New York Hill, have thus far disclosed ore-shoots that are comparatively small and irregular, though profitable when found; while the fifth, the North Star, with a cropping of quartz no larger, as far as can be ascertained at this late date, than the New York Hill and the Massachusetts Hill, and far less rich on the surface than the latter, has disclosed ore-shoots the average length of which on the strike is between 400 and 600 ft., and the depth of which along the dip is more than 2000 ft. Furthermore, two, at least, and perhaps three, of the four shoots in the North Star do not outcrop, although the fracture itself has been traced to the surface.

Of the several veins above mentioned, reasonable and encouraging as their further exploration seemed, it must be admitted that, all outlays taken into account, none, except the North Star, has proved itself profitable to the present owners. The North Star, on the other hand, through the opening of the deep levels by the vertical shaft, started on what was practically a new career, with a productive capacity and outlook for persistence equal to any expectation that might have been based on the results obtained in the upper workings; so that the important fact stands out that this vein, which at best is not over 5 ft. wide and at worst pinches to a mere seam, has been profitably developed for a mile on the dip and half a mile on the strike.

-[And in others.—EDITOR.]

Rand Figures for Six Months

RESULTS of operations on the Rand for the first half of the current year are as follows, according to *The South African Mining Journal*:

	1914.	1913.
Stamps	9,694	9,999
Tube-mills	291	286
Operating, days	151.7	162.6
Duty per stamp, tons	8.78	8.77
Ore milled, tons	12,637,971	13,883,192
Gold output, ounces	4,086,847	4,640,421
Value	£17,359,824	£19,711,256
Value per ton milled	27s. 2d.	28s. 0d.
Total costs	£11,048,887	£12,416,091
Working costs per ton	17s. 6d.	17s. 11d.
Working profit	£5,866,033	£6,762,266
Working profit per ton	9s. 4d.	9s. 9d.
Dividends	£4,215,729	£4,164,143

MINERAL OUTPUT of Ireland in 1913 included the following: The coal production was 82,521 tons, valued at $246,509; iron ore, 60,014 tons, worth $54,943; bauxite, 6055 tons; rock salt, 43,391 tons; and smaller quantities of fireclay, barytes, copper, soapstone, iron pyrite, and ochre and umber. Quarries employed 3540 people, producing 1,295,961 tons, valued at $695,822. Limestone mined was 582,851 tons; basalt, 460,127 tons; granite, 124,862 tons; and clay, shale, flint, slate, gravel, and sand.

IRON-ORE PRODUCTION of Hungary in 1913 was 2,204,000 tons. Government mines supplied 275,500 tons of this total. The state railways bought a mine in northern Servia. The iron deposits of Hungary are estimated to contain 145,000,000 tons of ore.

The Lampa Copper Smelter, Santa Lucia, Puno, Peru

By FRANCIS CHURCH LINCOLN

The Lampa Mining Co., Ltd., is working a number of small mines in the department of Puno, Peru, and is treating the ore in a copper smelter near Santa Lucia. The home office of the Company is in Liverpool, and J. Lionel Barber is president. Claude Barber is local manager, with office at the smelter. The Lampa Mining Co. was organized in 1906 with a capitalization of £50,000 to work the Santa Catalina mine, six miles northwesterly from Santa Lucia. In June, 1913, the capitalization was increased to £100,000, of which about £65,000 is paid up, to enable the Company to take over the mines and smelter belonging to the estate of William Grundy.

Santa Lucia is a station on the Peruvian Southern railroad 133 miles from Arequipa and 68 from Puno, and has an altitude of 14,250 ft. above sea-level. The main Lampa ('Shovel') camp is at the Limon Verde ('Green Lemon') mine, about a mile from the station and just across the Maravillas ('Marvels') river. A spur is soon to be constructed to connect the camp with the railroad. A general view is shown in the illustration, Fig. 1. The smelter may be seen to the left of this picture, while a nearer view is given in Fig. 2.

The copper smelting furnace is an Allis-Chalmers 36-in. circular blast-furnace. As originally set up at Yarabamba, which is 18 miles from the railroad by a bad road, its cost completely equipped, with Pelton water-wheel to run the blower, is said to have been 10,000 Peruvian *soles*, equivalent to $5000. The equipment at Santa Lucia includes a Baker rotary blower of 16-cu. ft. displacement which furnishes 14 oz. blast pressure and is run by steam, which is generated in a 60-hp. boiler burning *taquia* (llama dung). *Taquia* is found to be much cheaper than coal for fuel. Four tons costing $2.50 per ton is consumed in 24 hours. The smelter is also provided with a square lead blast-furnace built by Robey & Co., which is occasionally operated.

The copper blast-furnace was blown in by the Lampa Mining Co. on January 5, 1914. It has an average capacity of 35 tons per day and uses from 7½ to 10% of coke. The coke costs $31.75 at Santa Lucia and contains 34% ash. The charges weigh 1000 lb., including fuel. The following is a typical example.

FIG. 1. LAMPA, NEAR SANTA LUCIA.

FIG. 2. LAMPA SMELTER.

	Pounds.
Coke	79
Limestone	79
Pyrite ore	210
Foul slag	88
Mixed ores	544
	1000

Copper included, 33 pounds.

Single rail lines connect the dumps of charge constituents with the charging floor, and wheelbarrows are employed having wheels with concave rims which fit over these mono-rail tracks. By this means, the exertion of wheeling is greatly reduced. To overcome the effect of altitude on the air supply, it was found necessary to increase the diameters of the tuyere openings to 1 in. greater than that employed at sea-level.

Matte containing from 40 to 55% copper is made. As much as 2½ tons of 42% matte has been made in one day. The slag runs 39% silica, 41% ferrous oxide, and 8% lime. It contains 0.2% copper. It is calculated that from 12 to 15% flue dust is made. A dust chamber is to be built to reduce this loss.

The foregoing notes give a general idea of what can be accomplished by a small copper smelter operating on the high Peruvian plateau. It may be added that the department of Puno is highly mineralized throughout, and that while the veins are commonly small ones they are numerous and occasionally rich. The principal ores are argentiferous pyrite, silver-copper-lead sulphides, and argentiferous galena, and they readily lend themselves to treatment in small lead and copper blast-furnaces.

Operation of the Oliver Filter in the Globe Mill

By H. A. MORRISON and H. G. THOMSON

The last few years have shown a tendency to the displacement of the submerged leaf by the continuous type of slime filter in the cyanide mills of the United States and Mexico. Of the several forms of continuous filter being used, the Oliver is best known and most popular. It is easy to operate, yet success hinges upon various little known minor details, as shown by the following notes on its operation in the Globe mill at Dedrick, California, and elsewhere.

FIG. 1. THE GLOBE MILL AND CYANIDE PLANT

VACUUM

Methods of obtaining vacuum are widely divergent. Good work cannot be done with a vacuum less than 20 in., and 25 in. is better. Wherever sufficient water under high pressure is available, the simple water ejector, used in the Grass Valley mills and elsewhere, is most commendable. Installation and operating costs are slight and a uniformly high vacuum is easily maintained. At the North Star mills, where E. L. Oliver invented and perfected his filter, novel use of an old mine shaft is made to lengthen the draft tube, 60 ft. fall being secured. At the North Star the ejector has both high and low pressure water connections; available water supply determining which shall be used. The Globe Consolidated is using the form of ejector shown in the accompanying figure (Fig. 2). There, water pressure is 200 lb. per square inch and draft tube is 26 ft. long. Average vacuum maintained on the filter is 25 in. of mercury. This approaches perfection as the altitude is 3000 ft. With the ejector, filtered solution is withdrawn

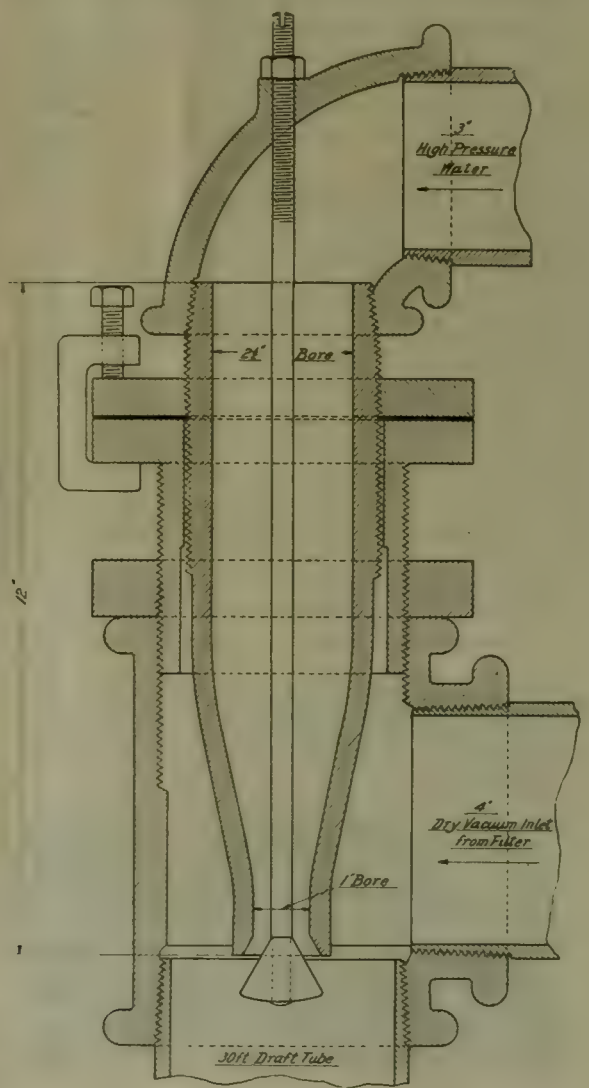


FIG. 2. EJECTOR NOZZLE.

from the vacuum tank by a small centrifugal pump, but when mechanical means are employed to secure vacuum, the centrifugal is, of course, not needed.[1] However, the latter uses but little power, and, since it handles clear solution, repair costs are negligible.

Most plants have to depend upon some form of vacuum-pump because the large amount of high pressure water needed for an ejector is usually not available. C. H. Urquhart[2] described a special pump used very successfully at the Black Oak, Tuolumne county, California. This pump is a modification of one designed by G. D. Kislingsbury at Minas del Tajo, Sinaloa, Mexico. The Oliver plant at the Black Oak, the pioneer all-sliming plant in California, is a notable one in many particulars.

Feed

Pulp is usually fed so as to enter the filter tank at the top centre on the ascending side of the drum. If coarse material results the accumulated material acts as a brake upon the revolving drum and finally throws off the driving belt. When this occurs it is wiser to sluice out the tank than to try to force the drum to revolve.

It is desirable to keep alkalinity of feed as low as other considerations will permit as lime salts are detrimental to the cloth and their precipitation in the canvas will necessitate frequent acid washing.

Agitation of Charge

Methods used to prevent settling of charge in the filter tank are sufficient on the average ore, but in certain cases they are inadequate. Internal air-lifts are being used at the Globe with considerable success. There are two air-lifts on the rear and three on the front side of the 16-ft. filter at this plant. Possibly the addition of two or three more air-lifts would entirely obviate the need of mechanical agitation. The agitator now used consists of a longitudinal shaft, fitted with short paddles, running in stuffing boxes placed midway between the lower side of the drum and the bottom of the filter tank. This shaft is driven at about 20 r.p.m. by sprocket and bevel gears. This apparatus is much more effective when a three-inch angle iron the length of the filter is bolted across the ends of the paddles parallel to the shaft. With the latter arrangement, the shaft need be revolved at much less than the above stated speed. The stuffing boxes of the agitator shaft often give trouble. This may be minimized either by feeding a small stream of solution to each gland, or grease may be automatically forced into them by compression cups. If the agitator shaft is sprung or badly worn or if neither solution nor grease is being regularly fed to the glands, it is well-nigh impossible to prevent serious leaks through the boxes. At the extreme bottom of the tank an air agitator is placed

Fig. 3. Oliver filters at the Commonwealth mine, Arizona, showing sprays.

introduced at one end, an abnormally thick cake results on the adjacent portion of the drum and it is correspondingly thin elsewhere. This is particularly true with fast settling ores and in the case of drums more than 12 ft. long. Generally, for all-sliming mills, pulp feed of not less than 1.45 specific gravity (D-2.7) is recommended. Referring again to Grass Valley practice, the Empire pulp is fed at 1.30 specific gravity with good success. However, separate sand treatment is practised and the filter feed is an impervious slime containing no granular material. It will not settle to a density greater than 1.35. With thin feed—1.30 or less—in the average mill, rapid settling together with segregation of

[1][This is true only with 'wet vacuum system.' With 'dry vacuum system' the centrifugal, we understand, is used.—Editor.]

[2]'Black Oak Mill,' by C. H. Urquhart, *Mining and Scientific Press*, November 30, 1912.

lengthwise of the drum. It consists of a length of perforated canvas-covered one-inch pipe with pressure air connections. It is intended for emergency use, when for any reason the mechanical agitator is out of commission, and no doubt has some value if started before the charge has become packed. The canvas covering of this pipe should be renewed once in six months.

When material is settling, the cake shows irregular 'bunches' of coarse sand. If prompt action is then taken, sluicing and the attendant shut-down may sometimes be avoided. This difficulty may arise from one of several causes: (1) inefficient agitation; (2) carrying pulp level too high; (3) specific gravity too low; or (4) poor work in fine grinding machines or classifier. These may be considered in detail.

1. Prevention of settling is absolutely imperative, and this difficulty would seem to have been mastered particularly at Butte, where the Anaconda company has several Oliver filters dewatering concentrates. Incidentally, this marks a further invasion of cyanide machinery into the field of general metallurgy, the attack having been begun by Dorr and others.

2. The best practice is to carry the pulp level about two feet above the bottom of the drum. With exceptional ores—those colloidal in nature—the charge may be safely carried at much greater depths than above stated. When deep charges are permissible, capacity is increased both by the greater vacuum then secured and because a larger cloth area is constantly submerged.

3. As previously stated under the heading 'Feed,' pulp at from 1.45 to 1.60 specific gravity gives best results. Thinner pulp will usually cause trouble.

4. Screen analyses show that the settled material consists largely of fairly coarse sand. At a certain mill the appearance of coarse segregations in the cake is held to prove that grinding or classification is inefficient. This should not be applied too literally, however, with the idea that careful grinding will make it allowable to ignore other possible causes of settling. The small proportion of moderately granular ore in the ordinary mill circuit sometimes concentrates in the filter tank when the precautions above noted are disregarded.

Washing the Cake

Effective displacement of pregnant solution by wash water is of first importance in slime filtration operations. With the continuous type of filter, the period during which wash may be added is necessarily brief; consequently, thorough displacement can be obtained only by careful arrangement of pipes and sprays, close attention to amount of water, and even distribution of the same. Ordinarily capable operators obtain a tailing with soluble content (both cyanide and dissolved metal) equally low as obtained with submerged leaf or pressure filters. The use of perforated pipes discharging water through small holes upon the cake, has been superseded by one of two forms of spray nozzles. The whirling spray (represented by the Vermorel and others) is rather more effective than the fan-shaped form sometimes employed (such as the Bordeaux). The tendency is toward the use of a comparatively large number of individual sprays, each with a relatively small aperture. In mills where volume of solution is a constant, it is customary to have the rear line of sprays arranged so that either barren solution or water may be used at will. The second spray line is placed lengthwise over the crest of the drum and water only is added through it. Sprays intended to handle solution must, of course, be constructed of some metal not attacked by cyanide. Valves for the rear line must be of the most dependable pattern and locked at all times.

The importance of washing is evidenced by the great amount of experimental work along this line which has been done at various mills. A Nevada plant still uses shaking spray pipes. This plan is said to be especially adapted to ores that form an unusually porous cake; also to cases where a relatively large volume of wash solution is essential. It would seem, however, that the

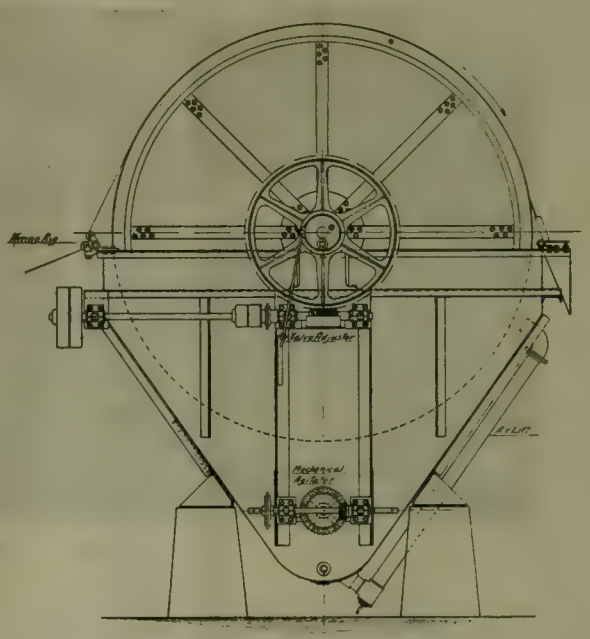


Fig. 4. Cross-section of filter.

atomizing sprays, above noted, would meet either requirement more successfully and would have the additional advantage of effecting a small increase in total extraction. This increase is probably due to the splendid aëration given the cake while being washed with atomizers. Extraction during washing as obtained with the Oliver is certainly less than that secured by filters such as the Butters. In some plants equipped with the latter, this increase is said to approximate 2% of the total recovery. This comparison is hardly fair to the Oliver because the washing period is many times greater in the Butters.

Proper wash water control is facilitated by using a pressure gauge on the spray pipes. When using atom

izers, the minimum permissible working pressure is 25 lb. per square inch; water is not well atomized at less pressure. Average working pressure may be stated at from 35 to 40 lb. Best practice in filter cake washing may be summarized as the even distribution of the greatest permissible amount of wash over the entire exposed cake.

Washing the Cloth

Continuous filter cloths require more frequent acid washing than do those of leaf filters. Scrubbing with 8 or 10-in. ox fibre brushes in a weak hydrochloric acid solution (about 5% HCl) not only restores permeability to the canvas, but also prolongs its life through removal of deleterious lime salts. The benefits of frequent and thorough acid scrubbing are significantly shown at the Black Oak. That mill holds the record for long life of cloth—seventeen months. This cloth was scrubbed weekly with 5% HCl solution.

Lime incrustations render the canvas hard and brittle to such an extent that irregularities of the scrapers may break the cloth or even damage it beyond repair, by catching at those points where rough surface exists. In a certain case, a new filter was operated during two entire months without scrubbing; acid could not be obtained because of inclement weather. The cloth became so impervious that capacity was alarmingly reduced and patching was a daily occurrence. This condition was entirely due to lack of acid treatment; all difficulty immediately vanished when acid was finally applied.

With suitable equipment, three men scrub an 11 ft. 6 in. diam. by 16-ft. filter in one hour. The details of a convenient false valve head to be used while performing the acid washing are shown in Fig. 5. This head confines the vacuum entirely to the three or four sections being treated and pulp level in the tank remains at its normal depth. This ingenious device was originated by Will S. Adams, who is now with the Anaconda company at Butte. For canvas of the size above mentioned, about 20 lb. of commercial HCl is used for each wash, and in some plants this operation need not be performed more often than once a month. As an alternative to scrubbing as above detailed, it is understood that in one case dilute acid is thrown upon the face of the revolving drum. The average cloth life there is stated at five or six months. The inference is that this might be brought up to the general average, namely ten or twelve months, were careful and frequent scrubbing practised.

Sampling and Disposal of Tailing

The scrapers which remove tailing from the face of the drum should have no more than just enough tension to keep them resting lightly against the wires. Under excessive pressure, wear both of scrapers and wires is greatly increased and may even ruin the canvas by tearing it. The scrapers should be filed to a smooth and properly beveled edge once each week. A convenient plan is to have a spare scraper on hand and interchange about once in two months; the one taken off can then be

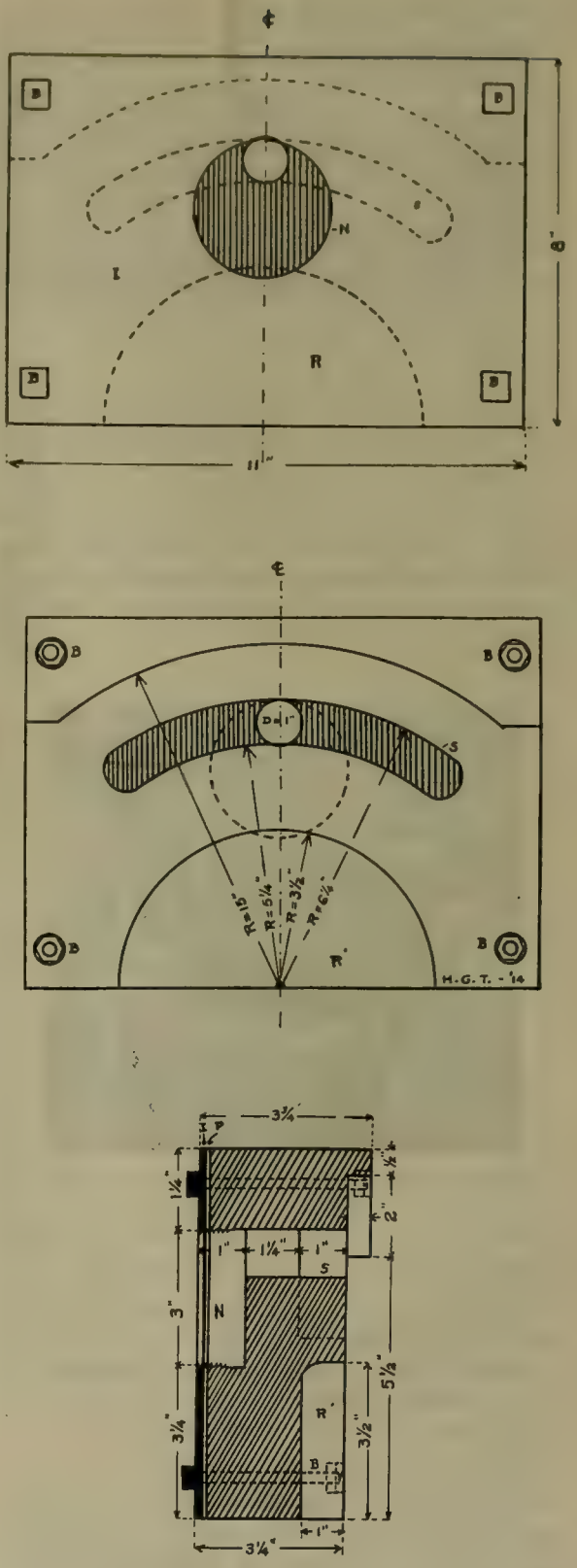


Fig. 5. False head used in the Globe mill; front view, rear view, and cross-section.

dressed at the convenience of the operator, and very little running time is lost. Two men need 15 to 20 minutes to dress the scraper when it is done each week.

Tailing may be taken away from the filter either by belt-conveyor or sluicing. When ample water is available the latter method is, of course, to be preferred. The 'blow' should be only strong enough to slightly loosen the cake, usually under 10 lb. If too much pressure air is admitted, pregnant solution is blown through the cloth and the soluble losses thereby increased. The practice of taking tailing samples at a point above the section being blown off is to be condemned for the above reason, and samples are uniformly slightly lower in value than the actual loss in the material being discharged. Samples should be taken at intervals of not more than one hour, along the edge of the scraper from end to end of the drum. Whenever feasible, particularly where sluicing is practised, occasional check samples should be taken. Such samples are not infrequently higher than the regular ones. This is caused by the very human tendency to secure low assays when such results are desirable, by segregations of concentrate and coarse material, and by momentary variations in vacuum, wash water and 'blow.' Harai R. Layng has recently published some valuable data[3] covering this

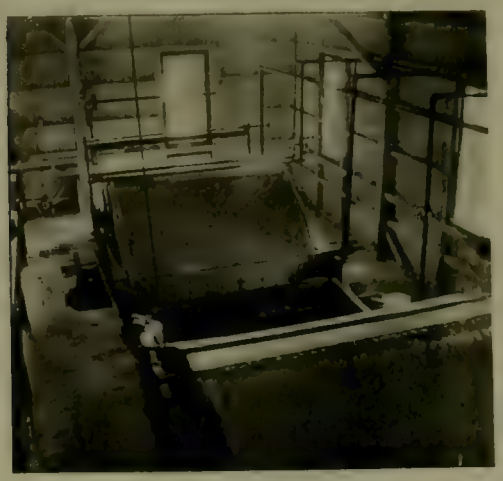


FIG. 6. OLIVER FILTERS IN THE EMPIRE MILL AT GRASS VALLEY.

point in the case of the Butters filter at a well managed Nevada mill. His findings are also applicable to the Oliver.

As in other types of filter, Oliver tailing losses consist, in part, of dissolved metal which the wash has failed to displace. The appended tables are incomplete because comparable figures are hard to get, but they will at least suggest the tenor of such losses.

CONCLUSIONS

It is believed that this filter may be safely recommended as well fitted for general use in dewatering slime of whatever nature with the possible exception of colloids. The latter can be handled only at a greatly reduced capacity; this also applies to filters of other form. We believe the Oliver to be the best machine for general use with average quartz ores.

FILTER DATA, GLOBE CON. MINING CO., DEDRICK, CALIFORNIA

The average vacuum is 25 in., and one line of Vermorel sprays is ordinarily in use. There are 18 sprays in all, but another line of spray for the addition of barren solution wash may be added. The cake contains 20% moisture as discharged into the sluiceway.

	Cents.
With 25-in vacuum-tailing assays	40
With 16-in. vacuum-tailing assays	60
With strong 'blow' tailing assays	60
With weak 'blow' tailing assays	40

SCREEN ANALYSES-FILTER FEED

On 100 per cent.	On 150 per cent.	On 200 per cent.	Through 200 per cent.
2.0	11.9	9.8	76.3
5.7	19.1	9.6	65.6
2.0	15.5	12.6	69.9
1.9	15.5	11.2	71.4
3.2	13.1	10.7	73.0
2.0	8.8	8.9	80.3
1.5	12.1	12.0	75.4
3.0	13.1	9.9	74.0
1.9	10.8	9.4	77.9
2.4	17.1	13.4	67.1

These data may be supplemented by figures from the Empire and Black Oak mills as below:

EMPIRE MILL, GRASS VALLEY[4]

Using front wash only.		Both front and back wash.		Reground concentrates added to filter feed (both front and back wash).	
Feed.	Tailing.	Feed.	Tailing.	Feed.	Tailing.
$1.81	$0.24	$1.95	$0.14	$2.38	$0.17
2.03	0.30	2.11	0.15	2.89	0.22
1.99	0.25	1.65	0.11	2.60	0.20

Each set of assays represent the average for one month.

BLACK OAK MILL, SOULSBYVILLE, CALIFORNIA[5]

Solution to filter.	Soluble losses per ton of ore.	Solution to filter.	Soluble losses per ton of ore.
$3.23	$0.060	$1.64	$0.062
2.53	0.090	2.45	0.037
1.45	0.013	2.29	0.024
1.30	0.015	1.94	0.038
1.09	0.005		

[3] 'Soluble Losses,' *Mining and Scientific Press*, May 30, 1914.

[4] 'Empire Mill,' by F. A. Vestal, *Mining and Scientific Press*, November 9, 1912.

[5] Variations in soluble loss at the Black Oak are partly due to wide fluctuations in value of ore treated. Other causes of non-uniform soluble loss were; filter being operated above rated capacity, shortage of wash water, and low pressure of water. Displacement is usually even more complete than this table indicates.

HOOSAC MOUNTAIN RANGE FROM THE NORTH, SHOWING THE LINE OF THE TUNNEL

Driving the Hoosac Tunnel and the Lessons it Taught

By P. B. McDONALD

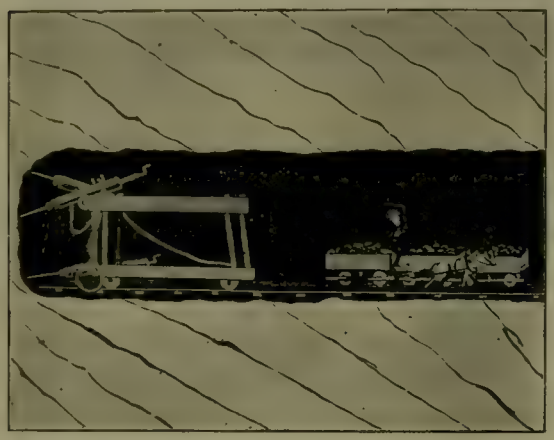
In view of recent improvements in rock-drill practice, and the increased attention paid to underground work generally, it is interesting to compare modern rock excavation with the methods in use fifty years ago. From 1854 to 1875 there was under construction in Massachusetts what is still the longest railroad tunnel in the United States, the famous Hoosac tunnel. This tunnel, $4\frac{3}{4}$ miles in length, which required 21 years and $10,000,000 to complete, has additional interest because in driving it there were used, for the first time in tunneling in America, power rock-drills, air-compressors, nitroglycerine for blasting, and electricity for firing blasts. The modern rock-drill and mine explosives owe a great deal to the Hoosac tunnel, where many of the initial problems connected with their practical use were solved. It is odd that the state of Massachusetts, which has never been a mining state, should bring into use in America such important innovations as power-drills and nitroglycerine. For several years previous to 1875, a force of 800 Cornish, Irish, and French-Canadian miners worked at the tunnel, with its accompanying problems of shaft sinking, and during that period the northwestern corner of Massachusetts resembled a Rocky Mountain mining camp. Altogether, 195 men lost their lives in the 21 years required to make 'the great bore,' as it was called, and this list of fatalities was not considered especially remarkable, as the Mont Cenis tunnel in Europe, completed shortly before, had cost 1000 lives.

Hoosac mountain is part of the Green Mountain range extending through western Massachusetts, and had, up to the opening of the tunnel, formed a natural barrier between the states of Massachusetts and New York. Boston capitalists desired a direct route between Boston and the West, and it was seen that, except for Hoosac mountain, the river valleys made the route a comparatively easy one. One of the important questions which arose when the tunnel was suggested, concerned the geological character of the mountain. Edward Hitchcock, of Amherst College, was consulted and gave his opinion before the Massachusetts legislative committee that the rock to be cut would be micaceous slate with occasional seams of quartz; the ground, he thought, would not be especially hard to drill and but a small part would require arching. This prophecy in most respects proved strikingly correct, the only important variation being at the western end of the tunnel, where much soft rock was found that required careful and expensive arching. However, the rock in general was harder than had been expected, and resembled schist rather than slate.

In 1851, work was begun on the eastern end of the tunnel with a ponderous boring machine weighing 75 tons; cutters or knives were made to revolve in a circle 24 ft. in diameter, and after each short run had been made the machine was backed away, and the centre or core blasted out. After boring 10 ft., the machine struck a quartz seam and refused to bore farther. Discouraged, the company in charge deferred operations, until in 1854 a contract was let to Herman Haupt & Co. Incidentally, Herman Haupt was later a famous general in the Civil War. His company worked on the tunnel until 1862, using hand-drilling and black powder; the progress was at the same time slow and the cost high. So dark did matters look, and so much opposition was encountered in political quarters that in 1862 a pamphlet was published in Boston entitled 'The Road to Ruin, or the Decline and Fall of the Hoosac Tunnel.' At this point, the state of Massachusetts took the matter into its own hands, and investigations were directed into power-drills and air-compressors which were being used in the Mont Cenis tunnel between Italy and France. Finally, in 1868, some contractors were found who gave promise of finishing the work. They were the Shanley brothers of Montreal, and they agreed to complete the tunnel by March 1, 1874, for $4,594,268. At this time, about one-third of the work had been done and many millions had been spent. The Shanley brothers succeeded admirably, and on November 27, 1873 (Thanksgiving Day) the final blast was made that connected the two headings. The first train went through on February 9, 1875.

The first air-compressors used on the Hoosac tunnel

were built by James Hunter & Son of North Adams, Massachusetts. These together with a number of others manufactured by the Burleigh Rock Drill Co., of Fitchburg, Massachusetts, were in operation until the completion of the tunnel. In place of building two or three large compressors such as would be used today, dozens of small ones were constructed; thus at the west shaft plant alone there were 25 compressors. There is, at the



TUNNEL HEADING SHOWING DRILL CARRIAGE.

abandoned Beaufort iron mine near Michigamme, Michigan, an old compressor said to have been used on the Hoosac tunnel, and it looks the part. It has a small vertical engine, and huge flapper valves on the two air-cylinders; the entire construction is especially heavy, but the compressed-air outlet for pipe attachment looks disproportionally small. Air at from 55 to 60 lb. pressure was used in the tunnel.

The first drilling machines were complicated, costly, and failed to do the work; it was difficult to get a drill which would hit hard fast blows and not jar to pieces from the impact. Finally the Burleigh Rock Drill Co perfected a machine which was comparatively light and simple; it struck 300 blows per minute. For use in the tunnel these drills were mounted on drill carriages on wheels, four drills on a carriage. It is interesting to note that modern European practice in rock-drilling (reputed to be superior to American practice) still uses drill carriages; and shorter holes than are common in America are drilled and blasted. The use of drill carriages does away with the slow process of rigging up columns or tripods, and facilitates moving the apparatus back and forth when blasting; they are probably not so flexible for pointing the holes. Records of the rock-drill work in the Hoosac tunnel state that "a hole from 4 to 5 ft. deep could be put down in an hour." The modern reciprocating rock-drill would probably accomplish this in 10 or 15 minutes. It is recorded that the greatest heading advancement in any month of the work was 184 ft., driven from the central shaft in September 1873. As a comparison, the Mount Royal tunnel of the Canadian Northern railway, near Montreal, was driven 810 ft. in one heading through hard limestone during 31 working days in May 1913. Allowance should be made, however, for the fact that although on the Hoosac tunnel there were three 8-hour shifts per day, there was no Sunday work; and that September has one less day than May. In driving the Hoosac tunnel, a heading 8 ft. high by 24 ft. wide was carried ahead, 500 ft. beyond the enlarged part. This heading was in the middle of the enlarged section; that is, to enlarge to the full size, 22x24 ft., a slice was taken off the top, as well as the bottom taken up. Temporary tracks for tram-cars were maintained on the 500-ft. stretch from the end of the heading to the enlarged section, and a light trestle constructed at the bench to facilitate dumping rock from the upper-level cars into the lower-level cars.

There were no high temperatures to contend with in the tunnel, on account of the moderate height of the mountain above: the flow of water was comparatively small and did not give much trouble, although there were one or two bad freshets in spring. Many stories are still told by old residents concerning the odd incidents of these early days of tunneling in America. The city of North Adams, at the western portal of the tunnel, was then a lively place for a New England town, and many a free-for-all fight took place between the 'Cousins Jacks' on one side and the Irish or 'Cork men' on the other, especially after celebrating a 'holing-through' or shaft-sinking exploit.

Early Drill Valves

It has been stated that the history of the Hoosac tunnel is the early history of rock-drill development in America. The drills used in the tunnel were, of course, not nearly as efficient as the modern types. The designers had no precedent to follow as to valves and construction, and the only suggestions available had to be derived from steam-engine practice. Thus the first rock-drills were much too heavy and cumbersome. Lighter, simpler drills were designed later, but with valve motions which, although suitable for steam-engines, did not give satisfactory results for the peculiar functions of a rock-puncher. Most of the early rock-drills had some form of rocker-thrown slide valve. It was not until later that air-thrown valves came into use, and the early types of spool-valve drills had three spools all of the same size.

The modern spool valve and the Butterfly valve represent the best differential air-thrown valves, and it is generally conceded that they are faster and more efficient than the tappet-valve type. Tappet-valve drills had a long run of popularity because, like tappet-valve pumps, they do not easily get out of order, even if they are slower than other types. Air-thrown valve drills are disliked by some miners because of their tendency to freeze; however, later types have remedied this to a large extent.

Until 1865, the principal explosive used was black powder, or 'gun-powder,' as it was called. Now black powder is rarely used in underground rock work, but on account of its slow explosive action is used in open cuts where it is desired not to scatter the débris too

much. In 1867, George Mowbray was requested to come to North Adams, and a contract was made with him to supply glycerine for the tunnel. A factory was completed near the west shaft, and Mr. Mowbray began to manufacture 'tri-nitroglycerine,' his own invention, which proved a success. This was the first time that nitroglycerine was successfully used in important tunneling or mining work in America. The method of blasting was as follows. After the holes were drilled, the liquid glycerine was brought into the tunnel in copper cans from the magazine and poured into tin tubes about 1¼ inches in diameter, varying in length according to the depths of the holes drilled. For a hole 10 ft. deep, a tube or cartridge 3 or 4 ft. long would be necessary, containing 3 lb. of glycerine. Into the end of each cartridge an electric fuse or exploder was inserted, to which were attached connecting wires for electrical firing. A number of accidents occurred, as would be expected in the introduction of a powerful new explosive, but it is stated that there were fewer accidents than with the black powder previously used.

It can be imagined that carrying liquid nitroglycerine around the shafts and tunnels in copper cans, and tamping tin tubes of it into drill-holes for blasting was 'no job for a nervous man.' When black powder was used, 5 pounds per cubic yard of rock broken had been necessary; with nitroglycerine the quantity per cubic yard was about 3 pounds.

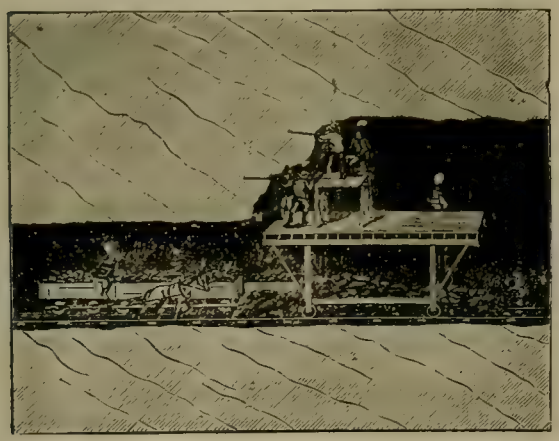
Two shafts were sunk to the tunnel. The west shaft, which is now filled, was sunk for the purpose of affording another heading so that the tunnel could be driven east more rapidly, as at the west end, progress was slow, due to the loose nature of the rock, which required arching with brick 7 to 12 courses thick. The west shaft was 318 ft. deep and was sunk only 3000 ft. from the west portal. The central shaft, 1028 ft. deep, was situated between the two peaks of Hoosac mountain, about 600 ft. west of the centre of the tunnel, on account of a brook at the central point, which it was feared would overflow into the shaft. The central shaft was planned for ventilation purposes, and is still open. It was started in 1864, and was a long time in being sunk on account of the difficulties encountered. A very bad accident occurred in 1865 at the central shaft when gasoline, used in lighting, took fire in the shaft house. Thirteen miners had just been lowered into the shaft, then 583 ft. deep. The fire spread so rapidly that the engineer had no chance to hoist the men. All the buildings at the shaft mouth were soon on fire. Several tons of drill steel was in the shaft-house directly over the shaft, and as the structure burned, a shower of steel and burning timbers fell upon the men below. The following day a miner, Thomas Mallory, was lowered on a rope into the shaft to see if by chance any of the thirteen men were alive; in 40 minutes he pulled the rope to be hoisted and reached the surface just as he fainted. He reported 15 or 20 ft. of water in the shaft, and no trace of the men. The bodies were not recovered until a year afterward, when the shaft was pumped out, and only a few could be identified.

Connecting the Headings

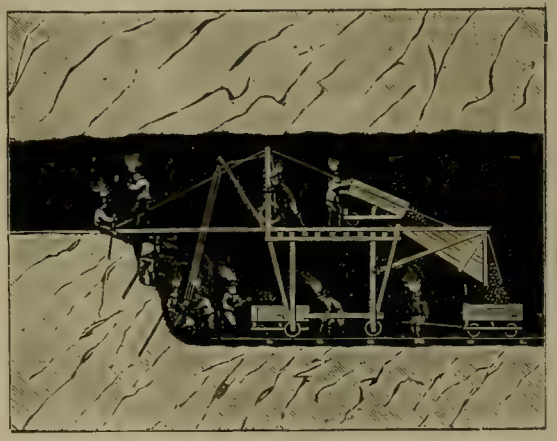
After sinking the central shaft, driving was commenced both to the east and west to meet the tunnel headings, and thus the progress was accelerated. The drift to the west was advanced 2006 ft., that to the east 1563 ft. The surveying for these 'holing-through' problems, where such a long tunnel and such rough surface were concerned, was naturally a difficult job. It was accomplished with remarkable accuracy, the east headings met with an error of $\frac{7}{16}$ of an inch, the west headings with an error of $\frac{5}{16}$ of an inch.

The Mont Cenis tunnel, where there were no shafts, had closed a few years before with an error of about half a yard, which was considered extremely fortunate.

It is evident that the central shaft of the Hoosac tunnel, from which headings were driven in both directions, complicated the surveying a great deal more than would have been the case had there been no shafts. In those days 'plumbing the shaft' problems had not been systematized to the extent that exists now, and the engineer in charge had to figure out methods of his own. The en-



ROOF ENLARGEMENT AT EAST END.



TUNNEL ENLARGEMENT AT WEST END.

gineer was Carl O. Wederkinch, a Dane, who later had charge of the engineering on the Sutro tunnel of the Comstock lode.

In the work of 'plumbing' the central shaft, Mr. Wederkinch used elaborate apparatus at the top of the shaft. Stone piers were built 25 ft. on either side of the shaft, "on each of which was placed and securely fastened an instrument consisting of slides, divided scales, motion-screws, clamps, etc." An average of a great number of lines was taken to establish the true tunnel direction across these piers; two parallel steel wires were stretched close together across the shaft between the piers; the intervening space of about a twentieth of an inch represented the true tunnel line. Exactly between these wires, not touching either, were suspended two plummet wires of copper on each side of the shaft; these wires were 23 ft. apart, that being the maximum distance possible. On the end of each wire, one thousand feet below, was attached a plummet weighing 15 lb.: each wire was encased in a wooden box to protect it from the disturbing effect of dripping water, air currents, etc., and the plummets were immersed in buckets of water. Even with all this protection, the wires at the bottom of the shaft, where sights were taken, had a slight movement, and the engineer took a great number of different observations to determine the true underground line.

Surveying the Tunnel Line

All the surveying methods were similar to those used in modern practice, but, having more precedent to follow and better instruments, the modern engineer would not need to take such elaborate precautions. It happens that Hoosac mountain has two summits over the tunnel, about three miles apart, one near the eastern portal and one near the western (see profile in sketch). Before the tunnel was started, on each summit there was built a signal-house of masonry, the signal-houses being situated on the tunnel line. On top of each signal-house, an iron pole 15 ft. high and of 2-in. diameter, was placed exactly on the true line. Then this true tunnel line was extended eastward several thousand feet beyond the proposed east portal, across Deerfield river to a point on the hill beyond, where another pole was erected. The tunnel line was also extended westward across Hoosac valley to a point on the hill beyond, where a signal-house was erected. Thus a straight line from the flag across Deer river to the flag across Hoosac valley was the true tunnel line, and passed through the poles on the two summits of Hoosac mountain. Each flag across the river valley could be seen from the corresponding portal of the tunnel. It is thus evident that, although the country over the tunnel is rough, the hills were convenient for long sights and rendered the surface surveying simple.

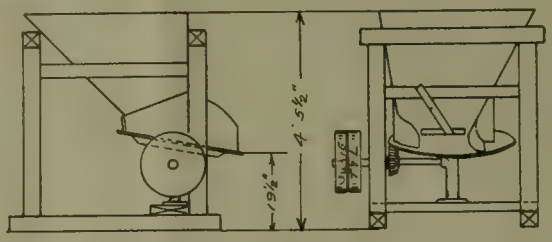
White arsenic produced in the United States in 1913 amounted to 2513 tons, valued at $159,236. There was 4687 tons, worth $570,000, imported, mainly from Europe. The American output is a by-product from smelters.

Improved Ore Feeder

By ULYSSES B. HOUGH

In your issue of May 23 you speak of a new ore feeder similar in design to the well known Challenge feeder, but with fewer parts. In many cases it is found desirable to have a constant flow of ore to rolls and belt-conveyors in lead-silver concentrating plants, where large tonnage is handled, which neither this feeder nor the Challenge will handle, both being limited to 75 to 80 tons in 24 hours and an intermittent discharge.

To meet these requirements, such feeders as the pulley-feeder for constant flow, various plunger feeders, and the Tullock feeders have been brought out. In my work in the Coeur d'Alene, Idaho, mining district, I have succeeded in remodeling the Challenge feeder to meet the requirements as to moving parts, constant flow of ore, and quantity of ore that the machine can be made to feed, beside being noiseless so far as the feeder itself is concerned.



I remove all gearing, aside from the pinion, extend the pinion shaft as shown in the cut, place two pulleys, a tight and a loose, on the extended shaft, and belt to any suitable drive. The feeder plate of this feeder has 56 teeth and the pinion 24; 4⅓ revolutions per minute of the pulley shaft will give two revolutions to the plate. The feeder running at this speed will feed 250 tons of ore crushed to pass a 30 or 36-mm. screen in 24 hours. The same feeder with an increase of speed can be made to feed three or four times as much ore; in fact, any quantity one may wish. A variation as to quantity can be had by regulating the feed-regulator plate in the front part of the machine. A finer and steadier feed could not be desired.

Another improvement is to bolt a false plate on the top of the revolving disk to take the wear. In this way the gear teeth on the lower side of the plate can be preserved for years, by replacing the false plate when worn out. A steel plate ¼ in. thick, cut to shape, serves the purpose well for a false plate. Some dozen or more feeders arranged in this way are used in the Coeur d'Alene mining country and are giving satisfaction.

While such an arrangement of feeder would not appeal to a stamp-mill man who only wants a small tonnage fed to the stamp-mill, it certainly does appeal to a concentrator man who wants a steady flow of ore and large tonnage as in the lead-silver and copper concentrating mills.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Valuation of Dredging Ground

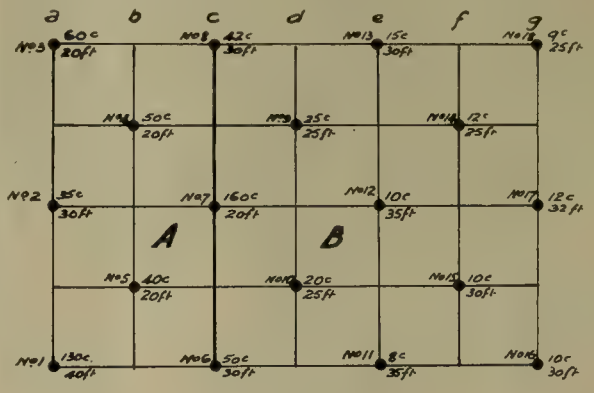
The Editor:

Sir—Mr. Decoto's article in your issue of May 29 is of timely interest, but it would have been of greater value had he based his calculations on a proper interpretation of the drilling results. The ideal he has in view as he expresses it, is one which must commend itself to all engineers as well as to the investing public, and the broad question raised is equally important in any other class of mining. "The relation of the actual recovery" to the average gold content is of the foremost importance in all mining and metallurgical operations on account of its being one of the principal factors measuring the profitableness of the operation, although it is somewhat difficult to discern where the author has touched upon that question. That there has been "a lack of proper understanding of the valuing of a dredging area" is quite apparent to anyone who has followed the results obtained by various dredging companies in different parts of the world and compared these results to the values reported from the drilling operations. It is surprising that one who endeavors to point the way for the guidance of others, possesses such an apparent lack of comprehension of the principles which underlie the estimation of ore in sight, if I may be permitted to use that expression in this case, because the principles underlying the estimation of quantities and gold content of dredging ground are the same as apply in hard rock. It is a little unfortunate that the author should use the expression 'valuing' as applied to finding the average of the results of certain drill holes. The valuing of the ground comes later and must include the various factors that contribute to the cost plus the recovery that may be expected.

In order to make what follows clearer, I reproduce herewith Mr. Decoto's diagram, except that I have put in the correct value of hole No. 7 as 160c., which is the figure taken in his subsequent calculations, and further have lettered the lines of holes *a* to *g*, as shown.

The first thing that strikes one on examining this assay plan is the existence of two erratic high results, No. 1, 130c., and No. 7, 160c. It seems to me that in ordinary practice these erratic high results would be eliminated or reduced to the general average of the block or of the holes in the immediate vicinity. The method to be adopted, would of course depend upon circumstances and the judgment of the engineer; but that they should be reduced, there can be no doubt. However, in order not to complicate the discussion, the original figures will be used in the following calculations.

Mr. Decoto states "obviously to obtain value of gold content per cubic yard for the entire area, it would be necessary to multiply the gold content of each hole by the depth of the hole, add the total of these products, and divide this sum by the total of depths of the holes." *Obviously* this is *not* the way to secure the average value of the ground in question, and as a rule for universal application it is entirely false, although it may serve under one particular set of conditions. The usual method of placing drill holes is as shown in the diagram, namely, at the intersection of coördinates. If instead of this the holes were spaced at the apices of equilateral triangles so that any hole was equi-distant from any adjoining hole, a much simpler method of calculation could be adopted and the rule given by Mr. Decoto used.



MAP OF DRILL HOLES.

It is of course sometimes impossible to space holes at regular intervals, much less at equal distances from each other, and any rule to be of universal application must give a correct result regardless of the distance between the holes. In my book, 'Mine Sampling and Valuing,' on page 101, an illustration is given of an error amounting to 10% that may arise from incorrectly averaging the results of irregularly spaced drill holes in a copper deposit. The same principle applies in the present case. By reference to Mr. Decoto's diagram, it will be seen that weighting each sample equally, as he does, the varying distance between the holes is entirely disregarded, and therefore the result cannot possibly be correct.

The chief error, however, is not on that account because in this particular case the distance between the

holes does not affect the result to any very marked extent. The principle which underlies the averaging of samples is that "a sample is supposed to represent the ore half way between it and the next sample; with the terminal samples, ore only on one side is taken into the calculation."[1] This definition applies equally to alluvial ground and if we gauge Mr. Decoto's calculations according to this rule, it is apparent that the results of the individual holes are not weighted proportionally to the volume of ground they represent. For example, in area A the terminal samples 1, 3, 8, and 6, are given double the weight to which they are entitled, as also are samples 11, 13, 18, and 16 in area B. Mr. Decoto calculates the average of the whole area and then divides the ground into two "one bounded by the test holes 1, 3, 8, and 6, calling it area A and the other bounded by No. 9, 10, 16, and 18, calling it area B." That the results he obtains are incorrect is demonstrated by combining his averages of areas A and B, allowing for the proportional volume of ground which each represents, and the result secured is different from his original average value for the whole area. I will show how this is arrived at a little later.

It is sought to obtain the average value of the ground *within* the drill holes, as shown in the diagram. The proper method of procedure is first to find the average of the results of each line of drill holes as representing a particular cross-section of the area and then to combine these, proportioning each to its area and assay value. The factor of the distance between the individual intervals can be disregarded because it is the same in each case. In making the calculations, whether for an interval or for a block, proper allowance must be made for the terminal holes, or terminal intervals.

I therefore submit the following calculations:

AREA A

LINE *a*.

Hole No.	c.		ft.		ft. c.
1	130	×	40	=	2600
2	35	×	30	=	1050
3	60	×	20	=	600
		2			
			2)60		)4250 ft. c.
			30		70.8 c. for average depth of 30 ft.

LINE *b*.

Hole No.	c.		ft.		ft. c.
4	50	×	20	=	1000
5	40	×	20	=	800
			2)40		)1800
			20		45.0 c. for average depth of 20 ft.

LINE *c*.

Hole No.	c.		ft.		ft. c.
6	50	×	30	=	750
		2			
7	160	×	20	=	3200
8	42	×	30	=	630
		2			
			2)50		)4580
			25		91.6 c. for average depth of 25 ft.

[1] 'Mine Sampling and Valuing,' page 93.

AREA B

LINE *d*.

Hole No.	c.		ft.		ft. c.
9	25	×	25	=	625
10	20	×	25	=	500
			50)		1125
					22.5 c. for average depth of 20 ft.

LINE *e*.

Hole No.	c.		ft.		ft. c.
11	8	×	35	=	140
		2			
12	10	×	35	=	350
13	15	×	30	=	225
		2			
			2)67.5		)715
			33.75		10.6 c. for aver. depth of 33.75 ft.

LINE *f*.

Hole No.	c.		ft.		ft. c.
14	12	×	25	=	300
15	10	×	30	=	300
			2)55		)600
			27.5		10.9 c. for aver. depth of 27.5 ft.

LINE *g*.

Hole No.	c.		ft.		ft. c.
16	10	×	30	=	150
		2			
17	12	×	32	=	384
18	9	×	25	=	112
		2			
			2)59.5		)646
			29.75		10.9 c. for aver. depth of 29.75 ft.

To get the average of the whole block weighting the terminals, or in this case lines *a* and *g*, at one-half, calculate as below:

Line.	Cents.		Feet.		
a	70.8	×	30	=	1062
		2			
b	45	×	20	=	900
c	91.6	×	25	=	2290
d	22.5	×	25	=	562
e	10.6	×	33.75	=	358
f	10.9	×	27.5	=	300
g	10.9	×	29.75	=	162
		2			
			161.15)		5634
					34.96 c. for aver. depth of 26.9 ft.
					say 35 cents

which is the correct calculation based on the figures given, but is still too high on account of the inclusion of the two erratic high results noted at holes No. 1 and No. 7.

In calculating the average of the areas A and B, Mr. Decoto omits a portion of the results which obviously must be included in finding the average value of the block of ground. In the calculations for area A, the terminal lines *a* and *c* should only be weighted one-half, and in securing the average in area B, line *c* should be taken into the calculations and weighted one-half, just the same as line *g*. Mr. Decoto omits entirely from his calculations the results obtained along line *c*, so that the block of ground between lines *c* and *d* is not included in the result he obtains.

The proper results are found as follows:

Again weighting terminals at half

AREA A

Line.	Cents.		Feet.		ft.	c.
a	70.8	×	30	=	1062	
		2				
b	45	×	20	=	900	
c	91.6	×	25	=	1145	
		2				
					47.5	3107

65.4 c. aver. value for a depth of 23.7 ft.

AREA B

Line.	Cents.		Feet.		ft.	c.
c	91.6	×	25	=	1145	
		2				
d	22.5	×	25	=	562	
e	10.6	×	33.7	=	359	
f	10.9	×	27.5	=	300	
g	10.9	×	29.7	=	162	
		2				
					113.65	2526

22.2 c. aver. value for a depth of 28.4 ft.

The difference between these results and those given by Mr. Decoto are quite startling, and in the case of area B amounts to approximately 75 per cent.

I do not wish to lengthen this discussion unnecessarily, but I will show that if the results of holes No. 1 and 7 are reduced to their proper figure, the difference is still more startling. In order to prove that Mr. Decoto's method of calculation is incorrect, I will check his results.

Take his figures for the average value of area A at 72.42c., and the average value of area B at 12.72c. It is obvious that the average of the two blocks is proportional to the cubic contents of each block and its average value. Therefore, if we assume the area of

Area A = 2,
then Area B = 4.

The area multiplied by the average depth gives the cubic content, and multiplied by the assay value gives the gold content of each.

In order to find the average of these two blocks, make the following calculations, taking average depths from his figures:

Area.	Depth.		Area.		Volume.		Cents.		vol. c.
A	26.2	×	2	=	52.4	×	72.42	=	3795
B	29.2	×	4	=	116.8	×	12.72	=	1484
			6		169.3				169.3)5279

31.2 c. aver. value for a depth of 28.2 ft.

The resultant average as shown, 31.2c. per cubic yard, compares with 37.69c., Mr. Decoto's original figure. *Both are wrong.* To check the averages I have found, calculate as below:

Area.	Depth.		Area.		Volume.		Cents.		vol. c.
A	23.7	×	2	=	47.4	×	65.4	=	3100
B	28.4	×	4	=	113.6	×	22.2	=	2522
					161.0				161)5622

34.92 c. aver. value for a depth of 26.9 ft.

This figure checks the previous calculation.

Let us go one step further and calculate the average value of the ground with reduced assays for holes No. 1 and No. 7. Taking the diagram as a guide, it seems to me that it will be fair to give No. 1 a value equal to the average of the three holes adjacent to it, namely, No. 2, 5, and 6. Thus 35 + 40 + 50 = 125, divided by 3, gives 42c. as the reduced assay for hole No. 1. Likewise, give No. 7 a value equal to the average of the four holes surrounding it, namely, No. 4, 5, 10, and 9. Thus 50 + 40 + 20 + 25 = 135, divided by 4 = 34c. as the reduced value of hole No. 7.

The following calculation may then be made to secure the average value of area A:

AREA A

Line *a*.	Cents.		Feet.		ft.	c.
1	42	×	40	=	840	
		2				
2	35	×	30	=	1050	
3	60	×	20	=	600	
		2				
					60	2490

41.5 c. aver. value for a depth of 30 ft.

Line *b* from preceding calculation gives 45c. for an average depth of 20 feet.

Line c.	Cents.		Feet.		ft.	c.
6	50	×	30	=	750	
		2				
7	34	×	20	=	680	
8	42	×	30	=	630	
		2				
					50	2060

41.2 c. aver. value for a depth of 25 ft.

Combining these,

AREA A

Line.	Cents.		Feet.		ft.	c.
a	41.5	×	30	=	622.5	
		2				
b	45	×	20	=	900	
c	41.2	×	25	=	515	
					47.5	2037.5

42.9 c. aver. value for a depth of 23.7 ft.

To get the average of area B:

AREA B

Line.	Cents.		Feet.		ft.	c.
c	41.2	×	25	=	515	
		2				
d	22.5	×	25	=	562	
e	10.6	×	33.7	=	357	
f	10.9	×	27.5	=	300	
g	10.9	×	29.7	=	162	
		2				
					113.65	1896

16.7 c. aver. value for a depth of 28.4 ft.

Combining these results gives the average for the whole block.

Area A	23.7	×	2	=	47.4	×	42.9	= 2033.5
Area B	28.4	×	4	=	113.6	×	16.7	= 1897.1
					161.0			161)3930.6

24.4 c. aver. value for a depth of 26.9 ft.

This result of 24.4c. compares with that of 35c. where the erratic results of holes No. 1 and 7 are included and Mr. Decoto's original figure of 37.69c. which is 54.4% too high.

It is a pity Mr. Decoto did not use his data more advantageously. His failure to arrive at a proper conclusion is not uncommon among men who should know better. It indicates a failure to grasp the basic principles underlying mine sampling and valuing. There are still too many rule-of-thumb methods in vogue, and many of the failures of mining companies to realize estimates are due largely to "a lack of the proper understanding" (as Mr. Decoto puts it) of the essential principles of the business.

In conclusion, I would like to suggest the advisability where possible of placing holes equidistant from one another in every direction, so that any three will form an equilateral triangle. In such a case the volumetric average of any group of holes will give the average of the ground, assuming the values to extend half the unit distance outside the holes.

C. S. HERZIG.

London, June 18.

True Fissure Veins

The Editor:

Sir—Referring to 'true fissure' veins in your issue of September 19, I believe the matter is timely and that the discussion of this time worn and much commercialized term is worthy of some space in your columns.

That the 'true fissure' vein as described in the textbooks is principally idealistic in its nature, is a conclusion soon reached by those having the opportunity of studying the veins of many mining districts. But, to the prospector, the promoter, and the layman this nomenclature has a particular significance. The prospector's vein must be a 'true fissure' because he has been led to believe that all such veins have extensive orebodies which go down to great depths. The promoter uses the appellation to influence the layman (who conceives in his mind a deep fissure or cavity in the earth's crust which was subsequently filled with ore) to invest in his venture. However, for mining engineers the term 'true fissure' should have but little application.

In the majority of cases it is found, upon close examination, that the so-called 'true fissure' veins are probably due to metasomatic filling rather than to direct precipitation on the walls of open fissures, strong evidence of the ore and vein material having been the result of the mutual exchange of minerals between the country rock and the circulating solutions, being detected. Veins of this kind always have at least one wall which is formed by the fissure or fracture through which the mineral-bearing solutions circulated while exchanging minerals with the adjacent formations.

Often such replacement mineralization takes place only on one side of the fissure or fracture, due probably to some impervious material, as gouge or clay formed by faulting movement; but sometimes it is found to have occurred first on one side and then on the other along the strike, so that the fracture forms the hanging wall of the vein in one place and the foot-wall in another. In other instances the replacement extends across between two parallel fractures, faults, or fissures, whichever they may be or you may wish to call them. In this manner both walls of the vein are developed, and this is probably the nearest approach to the traditional 'true fissure' vein. Often in working veins of this character places are found where replacement has occurred only near one or both wall-forming fractures, and the intervening rock remains partly or wholly unchanged. In the so-called 'true fissure' vein this area of barren country rock between the walls, which is commonly known as a 'horse,' would have to have fallen into the open fissure while the vein was being deposited.

In some instances between the two main fractures, which are the walls for the subsequently formed vein, a series of less extensive fractures are found, and, to the more active replacement along these, the banded structure, which is supposed to be one of the essentials of the 'true fissure' vein, is probably due.

The fissuring or fracturing which permits of the formation of such veins is no doubt deep seated, and whether only one wall or two obtains, to this character of veins could be given the name of 'fissure veins' with some degree of correctness. And, while most of knowledge and opinions of vein deposition is based principally upon comparison to known chemical reactions and to some extent on conjecture, it seems more reasonable to believe that fissure veins are formed by metasomatic replacement along one or between two parallel fractures or fault planes cutting the stratification or foliation of the surrounding formation, rather than by the process of direct precipitation on the walls of a wide fissure or cavity which would probably have to remain open for countless ages for the complete filling to take place. If the latter were true, we would find more fissures partly filled, just as we find areas incompletely replaced in the veins of the former case.

W. PRINCE CATLIN.

Cisco, California, September 24.

[Those interested in the relations of metasomatism to 'fissure veins' will do well to read Waldemar Lindgren's classic paper on 'Metasomatic Deposits in Fissure Veins,' in Volume XXX of the *Trans.* Amer. Inst. Min. Engineers.—EDITOR.]

A SIGNIFICANT FEATURE of the cement industry of the United States is the fact that, though only about 80% of the normal cement-producing capacity of the country is employed at the maximum, there is often an overproduction; yet the exports of hydraulic cement have scarcely exceeded 4,200,000 bbl. in any year, this amount being only about 5% of the total output, not sufficient to take care of the surplus production in a year of great activity.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

COKE MANUFACTURED in the United States in 1913 totaled 46,299,530 tons.

RUTILE, titanium oxide, is mined only in Virginia, the output in 1913 being 305 tons, valued at about $49,000.

CYANIDATION of old tailing in Victoria, Australia, is on the decline, and in 1913, 209 plants treated 692,256 tons, yielding 45,397 oz., worth £163,371.

A NEW BEARING METAL, more durable than phosphor bronze, and consisting of 65 parts of copper, 30 of lead, and 5 of tin, has recently shown excellent results.

TWO OR THREE-KEY single-gib tappets are used with stamps up to about 1400 lb. Beyond this weight of stamp it is advisable to use double-gib four-key tappets.

THE THICKER AND STIFFER A TIRE IS, the more motor energy it takes to run it. With four such power-consuming tires on a car, the car performs poorly and consumes great quantities of gasoline needlessly.

BORAX PRODUCTION of the United States in 1913 was 58,051 short tons worth $1,491,530, against 42,315 tons and $1,127,813 in 1912. This came entirely from California. Imports were valued at $18,434.

FUEL CONSUMPTION in 'burning' lime is 1 lb. coal for 1.5 to 6 lb. of lime, with an average of about 3.6 lb. lime. With 1 lb. of coke 4.2 lb. of lime is burned; and with 1 cord of wood approximately 4000 lb. of lime is burned, depending on the kind of wood used.

POTASSIUM CYANIDE worth $81,836 was exported to the United States from Magdeburg, Germany, near where are the great potash deposits of Stassfurt, in 1913, against $146,296 in 1912. The value of potash sold in this district in 1913 was approximately $45,500,000.

SALINITY of Great Salt Lake, Utah, varies from 13.79 to 27.72%; and analyses show 55.99% chlorine, 33.15% sodium, 6.57% SO_4, 1.60% potassium, 0.17% lime, and 2.52% magnesia. Compared with sea water the sodium is higher, but lime and magnesia, especially the former, are much lower.

CAM-SHAFT BEARINGS are generally provided with dust covers to take the place of caps. White metal, or babbit, is also sometimes dispensed with when the vibrations cause fracture of this material. In the latter case the casting is turned to take the cam-shaft, and no anti-friction metal is used.

MAPLE-COG BEVEL-GEARS are used in the Hollinger mill, Ontario, according to H. C. Parmelee. The substitution of these for steel has effected a great saving in cost; whereas the steel costs $105 per set and lasts six months, the wood gear costs $25 and lasts the same time. It is silent in operation.

MODERN CLASSIFICATION METHODS are almost confined to the successful issue which has resulted from the adoption of the gravitational plus mechanical, as opposed to the purely gravitational, separation of sand from slime. The former method of classification is especially adapted to tube-mill work, where it is essential that a low and definite percentage of moisture should be maintained in the feed.

ALL COAL contains some sulphur, generally in the form of iron pyrite, from a very small amount to 2 or 4%. When damp, sulphurous acid is formed, which is corrosive to the steel bins which the coal may be kept in at tipples, power plants, or even railroad cars. Where such trouble is experienced, it is found best to line bins or bunkers with a few inches of concrete or cement, the latter put on with a cement-gun.

DYES imported into the United States in the fiscal year ended June 30, 1914, were valued at $9,403,819, of which $7,940,061 came from Germany in the shape of alizarin colors (carmine, green, red, and yellow hues), aniline salts, indigo, and coal-tar colors. The consumption of dyestuffs in the United States is about $25,000,000 per year, and in 1909 the domestic production was $16,428,676, against $10,912,224 in 1904. In this industry is a form of poisoning known as anilisin, caused by fume from aniline dyes.

MINE SAMPLING has been discussed vigorously from time to time. In the *Transactions* of the Canadian Mining Institute, Volume XVI, G. C. Bateman's notes contain the following pertinent remarks: "A number of small samples are better than a few large ones;" "The sample taken over too large an area tends to obscure the mistakes;" "In a multiplicity of samples lies the engineer's safeguard;" "The writer believes in cutting short sections in preference to long ones * * * the slight objection of extra cost for assaying counts for little." The want of consideration of these particulars has long seemed to Victor G. Hills of Denver, Colorado, the weakest point shown in the average mine sampler's practice, according to the Institute's *Monthly Bulletin* for September.

MINING IN THE FAR NORTH*

Operations of Yukon Gold Company

By EMIL EDWARD HURJA

The Yukon Gold Co. operates nine dredges and from 15 to 18 fully equipped hydraulic plants in Alaska and the Klondike. Expectations of Company engineers are that last year's output of $4,427,579 will be materially increased, with working costs much lower than before. Eight of the dredges and all the hydraulic operations are in the Klondike district; one dredge is being operated in the Iditarod district on Flat creek.

Dredge No. 1, a Bucyrus 5-ft., is operating on 96 Below, Bonanza creek; No. 2 and 3, of similar make, on 50 and 67 Below, Bonanza, respectively. Dredge No. 4, a Marion 7-ft., is on 42 Below, Hunker creek; No. 5, a 7-ft. Bucyrus, on 8 Below, Bonanza; No. 6, a 7-ft. Bucyrus, on 12 Below, Gold Run; No. 8, a 7-ft. Bucyrus, on 16 Above, Bonanza; and No. 9, a 7-ft. Bucyrus, on 16, Eldorado creek. No. 7, a 7-ft. Marion, operates in the Iditarod district. Equipment of the 7-ft. boats has been standardized during the past two years, so that buckets, pins and all wearing parts of both the 5 and 7-ft. dredges are now alike. No. 8 and 9 are the only boats having steel hulls.

The Season for 1914

Operation began in 1914 on May 12, and within the week following, all but one of the Klondike dredges began digging. Dredge No. 6, which was dismantled and moved during the winter from Bonanza creek, where the block of ground assigned to it had been worked out, was in operation June 1, on Gold Run creek. The hull was lengthened, as was the ladder and bucket line, because of the greater depth of the ground. On the lower end of Gold Run, where the dredge has started operations, the depth to bedrock is from 35 to 40 ft., becoming shallower farther upstream. The removal of the dredge to Gold Run meant a haul of 55 miles, part by railroad and the rest by sleighs; as well as the construction of 32 miles of high tension transmission line, three miles of secondary line and a sub-station. It is estimated the three miles of Gold Run creek available for dredging contains 4,500,000 cu. yd. of gravel. No. 4 was rebuilt this spring on 42 Below, Hunker creek, after working out the Anderson concession on the same stream. Power was obtained by continuing the lines already on the creek farther downstream.

At the close of the 1913 season the power contract with the Granville Power Co. was canceled, and all the power this season has been obtained from the Yukon Gold Co.'s own power-house at Twelvemile, 30 miles from Dawson. The plant started operation May 9, and the first dredge a few days later. Up to August 4 the operation during 1914 had been perfect, not a single minute's delay being occasioned by any cause. The plant supplies 2000 kw. It was built in 1906. The dredging season will be a few weeks shorter at each end, because the Twelvemile plant closes down during the winter time.

In 1913, the Yukon Gold Co. dredges at Dawson operated 79.6% of a possible dredging season of 184 days. The yardage totaled 5,133,575 cu. yd., which produced $3,343,667 or an average of 65.13c. per cubic yard. The average cost, including depreciation, was 29.53c. per yard. The proportion of frozen ground this year will be considerably less than last year, when 68.4% of the ground worked had to be thawed by steam.

The Iditarod dredge started operating in 1914 on May 1, and since that time, has made good progress. It has worked out the upper end of the Wildcat Association claim and is now digging on the Chicago Association on Flat creek, the suit touching on the ownership of that claim having been decided in favor of the Yukon Gold Co. Water conditions this year have been particularly good; the grade has been reduced from 6 to 2% and the layer of gumbo clay gives no more trouble. Last year the dredge established a world's record. In three days it took out $86,000, with dirt averaging $8.60 per yard. The operation so far this season has shown some four and five-dollar dirt. Power for the dredge is obtained from a 300-kw. steam turbine power plant, which is to be replaced next season by a permanent plant on Iditarod river, 20 miles above the town of Iditarod. Workmen are now preparing the foundations and installing boilers, etc. Only the electric generating equipment of the present plant will be used. The new site for the power plant gives a cheaper price for wood and will reduce the cost of power. Last year the Iditarod dredge worked from May 8 to November 25, handling 496,756 cu. yd., which produced $827,420 in gross gold, at an average value of $1.67 per cubic yard. The cost, which includes depreciation due to the power plant installation, etc., was 64.33c. per cubic yard.

Hydraulic operations of the Yukon Gold Co. in the Klondike are being conducted with from 15 to 18 plants on Lovett, Trail, King Solomon, Monte Cristo, Magnet, and American gulches, as well as Bunker Hill. Sluices with manganese steel riffle bars are used. Giants with either four or six-inch nozzles are used, with the exception of Bunker Hill, where a smaller plant is in operation. Water conditions this season have been particularly good. In 1913, a total of 2,875,952 cu. yd. was handled, producing $256,491 in gross gold. The cost was $278,917, the loss being due to the fact that considerable waste gravel was removed to prepare ground for the present season's work. By the end of the present season, Dredge No. 3 will have completed its work on Bonanza creek, and plans for its dismantling and removal to another part of the Company's holdings are now being considered by engineers. Prospecting work by the Company is conducted with a special drill, the work of the engineering corps, and three Keystones. They are kept at work continually ahead of the dredges, proving up the ground and laying out the course for the boats.

Experimental Work on Thawing

Of special interest are the experiments being conducted by the Company with a view to deep thawing. Thawing has been necessary to keep ground opened up ahead of the dredge, but previous attempts have been confined to gravel deposits not exceeding 40 ft. in depth. About June 15, work was started on the lower end of Gold Run creek, where the Company owns considerable ground, to determine whether deep thawing would be feasible. A special drill, used without casing, is in service. Special points also are being tested, and it is expected that before the end of the season the results of the experiments will be known. The ground is over 50 ft. deep, contains gold

*[Previous articles in this series by Mr. Hurja on mining in Alaska and the Yukon have been 'Mining Revival in the Ketchikan District, Alaska,' July 4; 'Wrangell, Alaska,' special correspondence, July 11; 'Developments of the Alaska Gold Mines Co.,' July 18; 'Juneau, Alaska,' special correspondence, July 25; 'Cordova, Alaska,' special correspondence, August 8; 'Valdez and Prince William Sound,' August 15; 'Seward and the Kenai Peninsula,' August 29; 'The Koyukuk Mining District,' September 12. Mr. Hurja in subsequent letters will give full accounts of present conditions in each of the great producing districts of the Far North.—Editor.]

FOUR HENDY GIANTS AT WORK, LOVETT GULCH.

DREDGE No. 3, A BUCYRUS BOAT, ON 67 BONANZA CREEK.

in workable quantities, but because of the inability to thaw it properly, is being left unworked. If the deep thawing proves feasible, immense bodies of dredgable gravel will be opened.

Engineers of the Yukon Gold Co. are investigating properties in different parts of Alaska. Several parties are in the field continually. Options taken on the entire length of Sixtymile creek will expire next spring. A preliminary examination was made last winter; work being discontinued with the arrival of spring. It is probable that more prospecting will be done next winter.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

MANILA, PHILIPPINE ISLANDS

THE DREDGING INDUSTRY. NOTES ON THE MALAGUIT, MAXIMELO, PHILIPPINE DREDGES, GUMAOS, AND UMARI GOLD COMPANIES. —BINABAY GRAVELS.—MINES IN MASBATE.—LARGE DEPOSIT OF IRON ORE UNDER EXAMINATION.—OIL, COPPER, LUMBER, AND REVENUES.

Gold dredging at Paracale, Camarines province, continues with unabated activity.——The Malaguit Dredging Co., with its new Yuba Construction Co. dredge, which began operation on Malaguit river in March 1914, has declared an initial dividend of 2½%. Two of the Australian companies have declared small dividends during the last month. The Maximelo Dredging Co., which took over the property of the old Stanley-Paracale company at the head of Paracale river, is said to have paid 30% in dividends within the past 18 months. Frank D. Ingersoll, managing director of the Malaguit Dredging Co., has sailed for the United States in the interests of his Company. A. F. Shores, a mining engineer from Melbourne, Australia, is at Paracale at present, going over the holdings of the Philippine Dredges, Ltd., of which he is secretary. J. V. Lafferty, to whom the success of the Maximelo dredge is due in large measure, is in active charge of operations as dredgemaster.

The Gumaos Placer Co., operating a single dredge, recovered 1679 oz. of bullion during July. This is one of the best runs the boat has made, the record monthly run of something over a year ago having been 2085 oz. The gold from the Gumaos claim is about 875 fine. The extension for the Gumaos digging ladder, sent out several months ago by the New York Engineering Co., which built the dredge, has not yet been put in place, although it is stored on the claim. Soon after beginning work, the dredge got into ground where it could not reach bedrock, and it was decided to extend the digging-ladder. Subsequent operation has shown, however, that over the larger part of the claim, the present ladder, dredging to a depth of 52 ft., is adequate, and as the work is planned it will be some months, according to Mr. Kane, the dredgemaster, before deep ground is again encountered. Until it is needed, therefore, the extension to the ladder will not be added.

The Umari Gold, Ltd., an Australian company, which has leased ten 64-hectare (160 acres) claims on the Umari river, in a little-known region on the eastern coast of Luzon, well to the north of Paracale, has begun the process of dredging up the river to the first claim, a distance of about one mile. The dredge is of Australian design, with a steel hull and 7-cu. ft. close-connected buckets. According to the prospectus of the Company, 11 three-inch test-holes were put down on the claims which it is proposed to dredge, by its engineers, H. Hardman and Herbert Park. Depths ranged from 8 to 26 ft. (bedrock was apparently not reached in all the holes), and assays were from 20c. to $1.09, averaging about 75c., per cubic yard. A considerable quantity of black sand is obtained, which, after panning, is said still to be worth about $60 per ton. The test-holes appear to have been put down over an area only large enough to insure returns on the investment required, but the examining engineers believe them to be representative of practically the whole area of the lease, about 1600 acres.

R. H. Humphreys, a mining engineer from Berkeley, California, who is in the Philippines in the interest of A. Heise, a locally well known mining man, recently went to Umari to test some claims adjacent to those held by the Umari Gold, Limited.

Renewed interest has been awakened in Mindoro placers by the discoveries of prospectors on the Binabay river, in the northern part of the island. For several weeks immediately before the rainy season started, there was quite a rush to the new district, and numerous claims have been staked. Baco river, into which the Binabay empties, has been explored previously below the mouth of the latter stream, with only fair results; but the promising new finds were made in a less accessible country farther inland. The gold from Binabay river is coarse and well rounded, the latter characteristic being in marked contrast to the sharpness and frequent crystallinity of the Paracale gold. Some of the Binabay nuggets weigh as much as 10 grams, worth about $5.

MAP OF NORTHERN PART OF THE PHILIPPINES

J. L. Jeffcoate, an Australian capitalist, who is inquiring into possible mining investments in the Philippines, is said to have become interested in the Binabay field, and an engineer will probably be sent in to test some of the claims as soon as the rains will permit, about October. It appears that where the richest finds were obtained, the deposits may be worked by hydraulicking rather than by dredging, because of the steep gradient and small volume of the streams.

It may be noted that the vicinity of Binabay river is not a great distance from the intersection of two prominent tectonic lines in the Philippine geologic structure. One of these lines runs west-northwest along the north coast of Mindoro and through Lubang islands, which have long been known to consist in large part of schist and quartz. The other line, trending southwest from Taal volcano on Luzon, passes through northeastern Mindoro and is continued to the southwest in the axis of the island of Palauan. The established gold-producing district at Aroroy, Masbate, it has been pointed out, is similarly situated near the intersection of two main tectonic lines.

Three lode-gold properties are now operating in Masbate with a combined milling capacity of nearly 300 tons per day; the average ore is reported to run from $10 to $15 per ton. The Colorado mine has been in uninterrupted operation for nearly three years, while the Syndicate and the Keystone began treating ore since the first of the current year.

The Headwaters mine near Baguio, Benguet, has passed into the hands of Mr. Noble and associates of Hong Kong, and M. Eissler, a French mining engineer, who is well known in the Orient, has been engaged to determine the advisability of undertaking the development work which is required to secure an adequate supply of ore for the mill.——The Benguet Consolidated property, also near Baguio, has acquired sufficient capital to erect a small mill to replace the one which was destroyed by floods several years ago. C. M. Eye, who built the old Consolidated mill, as well as the present mill at the Colorado mine in Masbate, has been retained for the design and erection of the new mill, and construction will be started immediately. [Mr. Eye left San Francisco for the Philippines two weeks ago.—EDITOR.] The Benguet Consolidated is generally considered to be one of the best properties in the Philippines, and much interest attaches to the news that it will renew operations. A. W. Beam, the secretary of the old Company, has been active in effecting its reorganization.

An apparently large and hitherto unrecognized deposit of iron ore in Surigao province, Mindanao, has been brought to the notice of the mining public by H. F. Cameron, department engineer for Mindanao and Sulu. The extremely red soil along the eastern coast of Mindanao attracted the attention of Mr. Cameron because of the striking resemblance it bore to the Nipe bay, Cuba, iron ore, with which he had become familiar several years ago. He took several samples and submitted them officially to the Bureau of Science for analysis. The analyses showed that the ore was indeed very similar in composition to the Cuban ores. The Surigao ore is a clayey red limonite containing about 59% of iron when dry; no sulphur or phosphorus, but like the Mayari and Nipe Bay ores, it carries small percentages of chromium. Some agglomerating or nodulizing process will be required as a preliminary to smelting, since the ore in its natural state is very fine. It appears that the ore occurs as a surface decomposition product of basic rocks, and, according to Mr. Cameron's estimates, it covers an area of about 40 square miles, varying in depth up to about 40 ft. Owing to the industrial importance of so vast a deposit of iron ore as this one appears to be, the area over which it extends has been reserved by executive order from mineral location, until the government can be informed through surveys by the Bureau of Science as to its actual extent and value.

Copper ore containing a considerable proportion of metallic copper has recently been found by prospectors in Zambales province. Although a good deal of copper has been brought in from Zambales, no metallic copper had previously been noted in the specimens.

A trace of petroleum was encountered at a depth of about 1100 ft. in drilling an artesian well at Anda, Pangasinan. The well went deeper into salt water. Anda is in a region from which oil has been reported several times, but this is the first authentic verification of its occurrence there.

Number 3 of Section A of the current volume of *The Philippine Journal of Science* contains a paper on the iron ores of Bulacan province by F. A. Dalburg and Wallace E. Pratt, with a microscopic study of the ores by F. T. Eddingfield. The Bulacan ores are hematite and magnetite in intimate mixture with quartz as the typical gangue material. They are found in proximity to limestone usually, and rarely veins of the ore occur in limestone. The deposits form detached lenses along the base of Miocene sedimentaries and the underlying older igneous base. The walls are replaced in part by ore and consist of a decomposed green aggregate of complex basic silicate minerals, a material probably somewhat analogous to the *skarn* of the Scandinavian geologists. The Bulacan ores are considered to be the result of contact mineralization following the intrusion of igneous dike rocks; much of the ore appears to be a replacement of limestone and other intruded rocks. There is no development work which affords a basis for estimating the quantity of ore available. Purely upon outcrop measurements it is estimated that at least one million tons is contained in the largest orebody.

In response to the advertisement of the United States Navy Department for 1,500,000 teak decking logs, a local lumber firm has submitted an offer of 500,000 ft. of *yacal*, a Philippine wood resembling teak, which is regarded as the equal of teak for construction purposes. This is the first time that such offers of Philippine woods have been made to the navy, according to a *Daily Consular Report* from Washington, D. C.

A *cadastral* (property valuation) survey of the land within the city of Manila has been started under the direction of the Bureau of Lands. The cost is estimated at $83,000 and time to be taken at 30 months.

Total customs revenues of the Philippine government for the six months ended June 30, 1914, were $3,169,761, against $3,448,670 in the same period of 1913. The decrease is due to the removal of the export tax.

WASHINGTON, D. C.

BILLS IN CONGRESS TO SUSPEND ASSESSMENT WORK ON MINING CLAIMS.—ALASKA COAL BILLS.

New mining legislation in Congress to meet a purported urgency growing out of the European war would suspend the requirements of $100 worth of labor upon all mining claims of whatever nature. There are two such resolutions, one by Senator Thomas of Colorado, and the other by Senator Smoot of Utah. A third is by Senator Shafroth of Colorado, which would suspend the requirements of $100 worth of labor upon each mining claim bearing carnotite ore, from which radium is derived. The suspension is applicable only for the year 1914. The preamble asserts that this relief ought to be shown to radium miners, whose ores have been greatly reduced in selling value through the restriction and limitation of the market for carnotite ore because of the European war. A proviso in the resolution is that the claimants of carnotite mining locations shall file for record in the office of the county clerk and recorder of the county in which the mine is situated, on or before December 31, 1914, a notice that he, or she, or they claim the benefit of this act and in good faith intend to hold and work the claim. The Thomas and Smoot resolutions are being opposed on the ground that to grant the suspension would greatly injure many miners who are employed by claimants, by depriving them of work. Thus more would be injured than benefited. This point is not thought to apply to radium mining, as the market for radium has practically disappeared.

The Senate, on September 26, passed the Alaska coal leasing bill, and as there have been amendments to the House bill,

the bill goes into conference, from whence it may come out in some new form, probably with modifications of both bills as they passed the respective houses. There was no roll-call on the vote taken to pass the bill, a call being omitted for fear a quorum might not develop. In the opinion of Senator Borah, of Idaho, who was opposed to the bill, the stipulations in it are such that Alaska will be no nearer development in its coal resources twenty years hence than it is today. Private capital will not care to enlist in the enterprise. The Secretary of the Interior, Franklin K. Lane, is quoted as having said that he is willing to try the leasing system "on the dog," to see how it will work out. The House also has passed the bill for the exploration of coal, etc., which now goes to the Senate.

NEW YORK

COBALT NOTES, KERR LAKE REPORT, NIPISSING AND CROWN RESERVE OPTIONS.—COPPER BUSINESS AND EXPORTS.—COPPER DIVIDENDS.—INSPIRATION AND ALASKA GOLD MILLS.

The Kerr Lake Mining Co. has made its report for the year ended August 31 and shows a net profit of $620,786, as compared to $769,176 for the preceding year. The output of silver was a little less, being 1,828,424 oz., compared with 1,855,495 oz. in the preceding year. The average cost of production, however, showed a marked increase, being 24.86c. per ounce, against 18.30c., the difference being due to the increased cost of shipment and treatment, this being 11.61c. per ounce, compared with 5.55c. in 1913. Ore reserves remain practically the same. The manager, Robert Livermore, estimated them at about 5,698,700 oz, and then stated that the appearance of the bottom of Kerr lake in the vicinity of the Maine East and Fleming veins, indicates that a large tonnage of milling ore can be obtained there, though this is not included in the estimate of ore reserves. Of the total silver production, approximately one-third was recovered from low-grade ores averaging 33.83 oz. per ton milled by the Dominion Reduction Co., Ltd., at Cobalt. The Kerr Lake company had no difficulty in earning the $614,000 which it paid in dividends last year, and its position seems to be excellent.——The Nipissing will not exercise its option on the stock of the McIntyre mine, the reason being that a careful study of the records of the McIntyre indicated to the Nipissing management that they would not be justified in paying the price demanded. The estimated net profits of the Nipissing Mines Co. for August are given as $136,778, against $131,847 in July.——The Crown Reserve interests have taken an option on the North Thompson claim at Porcupine. This lies between the Vipond and the Porcupine Crown, and it is calculated that one of the veins of the Porcupine Crown dips into this ground. The Crown Reserve once before had an option on this claim, but allowed it to pass into the hands of the Von Polenz syndicate, instead of taking it up.

The copper market after being fairly strong last week became dull again, and there is little buying at present. Domestic consumption seems to be fairly satisfactory, and the treasurer of the Rome Wire Co. is quoted as saying that the Company's orders during August were good, and that in most departments the plant is running full time. It is characteristic of the copper market that buying is somewhat spasmodic, so there is hope that it will soon strengthen again. Shipments abroad are markedly restrained by the action of the Allies, who have declared that copper is a conditional contraband, and that shipments to Holland are undoubtedly in large part destined to pass on to Krupp's gun factory at Essen. Some copper at Rotterdam has already been transferred to England, and the Holland America Steamship Co. now refuses to take shipments of copper consigned to Holland. There is no ground for protest on the part of the United States government, as the British government has paid for the copper which it diverted from Holland to England. The result of the situation will be, though, that about the only copper that will be shipped abroad is that consigned to England and France. As considerable amounts have been going to Rotterdam, this will have a marked effect on export movements. It may be that the producers here will have to reduce their output even more. The Shattuck Arizona Mining Co. has deferred its October dividend, recent payments having been at the rate of $1.50 per year.—The Calumet & Arizona and the Superior & Pittsburgh have also suspended payment of their dividends.—— Within a fortnight the Miami company will have to consider the dividend question also.——The management of the Inspiration reports that the mill will not be started until the first of February, and then only at half capacity. It was originally expected to have the full 10,000-ton mill in operation before the end of this year, but with the present condition of the copper market it is not wise to produce at full capacity.

The Alaska Gold Mines Co. announces that the milling plant will be operating by the first of January, and it is hoped to have it going before Christmas. This is the first 1000-ton unit, and its contribution to the gold output of the country will be very welcome just at this time.

Columbia University started its academic year on September 23. A record registration is announced in spite of fewer foreign students. The New York University has opened for the year with a total of about 7000 students. Princeton University's 168th year commenced on September 25.

BUTTE, MONTANA

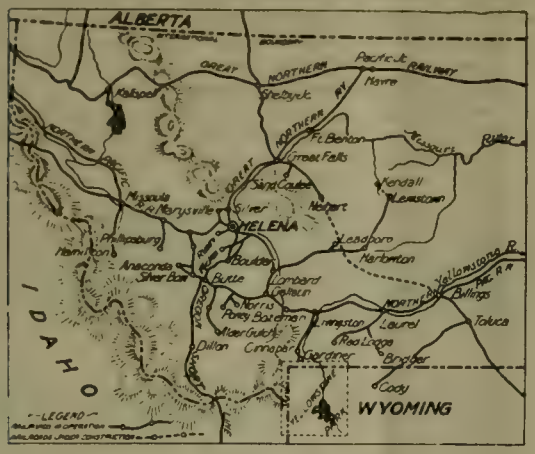
UNDER MILITARY RULE BUTTE IS QUIET, NOW THAT THE LABOR AGITATORS HAVE FELT THE ARM OF THE LAW.—POSITION OF THE MINING COMPANIES AND THE WHOLE STATE.

About the only evidence that a stranger in Butte would have that conditions were not normal would be the presence of the militia. No crowds gather on the streets; there is a pleasing absence of soap-box oratory; and business is carried on as usual. But about the county court-house a decidedly military atmosphere prevails. Numerous sentinels guard the approaches of the building on each side, and no one is permitted within that block without a pass granted by the military authorities. Rapid-fire machine-guns are stationed in front of the court-house, back of the court-house, and at the head of Montana street, and possibly at other points not known to the general public. Squads of militia may be seen at almost any time of the day performing their evolutions or *en route* to the target-practice grounds below the city. Military courts have been active in suppressing disturbers and violators of the law. The judgments of these courts are prompt and severe, much to the satisfaction of the law-abiding members of the community. Many agitators from other mining districts throughout the West have been congregating in Butte during the past year, openly insulting the flag, and defying the law. All unpatriotic action and talk by these men are receiving summary punishment at the hands of the military tribunals. A barber who refused to shave a soldier was promptly thrown into jail; a ruffian who abused a citizen who was associating with soldiers off duty was given a severe jail sentence; a city socialist official who showed open disrespect for the soldiers and their uniforms was also sent to jail; a man who was carrying concealed weapons without permission, and who was assisting a law-breaker to escape, has been sentenced to 4½ years in the state penitentiary. The socialist mayor of the city and the county sheriff are under trial for failure to utilize the city and county peace officers in quelling the riots last June. The immediate effects of these attempts to restore order and lawfulness are good, but notwithstanding, the thinking men of the community are inclined to believe that Butte is now

resting on a sleeping volcano which may break out at any time and throw things again into turmoil.

The mining companies have been endeavoring to avoid becoming involved in these difficulties as much as possible. They are working all the men which market conditions will justify, and are showing their employees all possible consideration. It would seem the agitators have chosen a very unpropitious time to create these unsettled conditions, as the copper mining companies are working under great disadvantage anyway, because of the European war. If the local labor situation becomes any more strained than it is now, no one could blame the copper companies for closing down the mines entirely until the I. W. W. and other agitators should be starved out of the place. The mining companies in Butte are still employing about 8000 men, giving a preference to married men and older employees, and giving nearly all of them an opportunity to work five shifts per week.

Because of fear of explosions and other violence at night, the military authorities have established searchlights on various high buildings which play their rays throughout the city all night. Saloons were closed entirely for a while, but as quiet continued to prevail, and as conditions became ap-



MAP OF SOUTHWEST MONTANA

parently more normal, they have been given longer and longer hours of opening, until now they close at midnight and reopen at 7 o'clock in the morning. Several saloonmen, who have attempted to keep open in violation of the law, have suffered summary punishment. Their saloons have been entered by the militia, and their liquors have been carried into the street, kegs burst open, bottles broken, and the 'fiery liquid' allowed to flow down the gutters into the sewers. In addition to having their property destroyed, some of the more open violators of the closing law have been either fined heavily or sentenced to prison. It is a relief to the law-abiding people of the community to find that the laws can thus be really enforced, and that summary justice is being dealt out to the criminals.

Of course, the general panicky situation throughout the country because of the European war has reflected harmfully on the mining districts of the state, many properties which required the expenditure of further money before becoming self-supporting, have been closed down, and many other properties which were dependent upon smelters which have been closed, have had to suspend also. Taking it all in all, however, Montana seems to be standing up under these troublous conditions as well as, if not better than, most of the Western states. The state's crops are exceptionally large, and are bringing high prices, and the demand for its horses and cattle is unabated.

TORONTO, ONTARIO

OPERATION OF THE ACME, HOLLINGER, JUPITER, SCHUMACHER, VIPOND, AND NORTH THOMPSON AT PORCUPINE.—LA ROSE TO BE FURTHER PROSPECTED.—COBALT LAKE MINE.—RICE LAKE GOLDFIELD.—ALBERTA COAL MINES.

A large six-compartment shaft is being sunk at the Acme property at Porcupine, owned by the Canadian Mining & Finance Corporation. It will be used for hoisting ore from the Hollinger, Acme, and Miller-Middleton mines, and is expected to effect marked economies. The shaft, which is about 1000 ft. from the present Hollinger shaft, will be put down to 1300 ft., with levels at 425 and 800 ft. The Hollinger is now employing 900 men, and the number will be largely increased when the additions to the mill are completed, and in operation.

The option held by the McKinley-Darragh company of Cobalt, on the Jupiter mine, which expired September 18, has been extended for a term of three months, the prospective purchasers having been encouraged by the later results of development. Operations by the McKinley-Darragh are to be continued. S. W. Schumacher, the owner of the Schumacher mine, announces that he will soon erect a mill. Sinking has been suspended, but the veins opened above the 300-ft. level will be developed. The scheme adopted some months ago for financing the Vipond has fallen through, but the mine has been placed on a paying basis with funds raised on the guarantee of Henry H. Ward, president of the Porcupine Vipond company.

The Little Pet recently produced gold to the value of about $4000 as the result of a 20-day run of a 2-stamp mill. A short but rich ore-shoot has been opened on the 50-ft. level.

The La Rose directorate has decided to make an effort to secure a new lease of life for the property, which has nearly ceased to be productive. Instead of abandoning further operations, and distributing the large surplus among the shareholders as was proposed, extensive exploration work is being undertaken in the hope of discovering new deposits. The force has been increased by 40 men for this purpose. This course was recommended by Rolla B. Watson, the general manager, and Percy A. Robins, manager of the Hollinger, after a close examination of the property. At the Cobalt Lake some good ore has been found in the conglomerate at 390 ft., in a winze put down from the 226-ft. level. The mill has been running to capacity all the year, and the production for 1914 will exceed that of last year.

The Rice Lake gold area of Manitoba is attracting renewed attention on account of recent rich finds, and prospectors from Ontario and the Western states are flocking in. The Independence Mining Co. has bought a rich claim on Gold Lake, 1½ tons of ore from which yielded $260 in gold, with a low recovery. The Company is arranging for the erection of a 5-stamp mill with a cyanide plant. In the meantime it will ship picked high-grade ore to Montana for treatment.

The coal mining industry of Alberta has been benefited by new railroad rates and regulations which went into force on September 1. The Canadian Coal & Coke Co., controlling several Alberta collieries, is preparing to enter the Winnipeg market, and supply the country to the west as far as Prince Rupert. The Pacific Pass colliery, owned by this Company, has an output of 700 tons per day, its capacity being 2000 tons. The present force of 150 men is to be at least doubled during the winter. The staff of the St. Albert mine is also to be increased as the demand warrants. The Yellowhead Pass Coal Co., which has been producing 200 tons per day, will increase its output to 600 tons for the supply of the domestic market in Edmonton.

The Canadian government has extended all oil and gas leases for one year without rentals, on account of the depression due to the war.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ARIZONA

Mine taxation and mining investments will be the principal subjects discussed at the meeting of the American Mining Congress at Phoenix, on December 7 to 11, according to the announcements of the secretary. Invitations have been sent to 4000 Western mine operators.

A fine exhibit of mine ores and products is to be shown at the Arizona State Fair at Phoenix on November 9. J. C. Goodwin is in charge of the mining department. The Copper Queen, Calumet & Arizona, and United Verde have sent excellent samples.

Cochise County

The new experimental plant of the Copper Queen company is working at one-fifth capacity, or 30 tons per day. The concentrate output from this is six tons, and the recovery is 75%. As the vanners are only saving about 25% of the metal in the slime, tests are to be made to improve this department. Oil flotation is being tried in the plant. At 800 ft. in the Gardner shaft of the Copper Queen mine; a good body of lead-silver-gold ore has been opened, galena predominating. The new central tool-sharpening shop and sawmill at this shaft are nearing completion. Two Leyner drill-sharpening machines are to be used. The Company is making a collection of ores of the district for the exposition at San Francisco. Albert Watkins, thoroughly conversant with the ores, is in charge of this work.

Gila County

Very rich silver ore has been opened near Globe by William Pohl.

Mohave County

The Cedar district is said to be one of the promising fields of northern Arizona, and prospecting has shown good deposits of copper-gold-silver, and molybdenum ores. Here the Arizona-Venture Corporation owns five groups of claims, and good ore has been opened.——Near the Grand Cañon, and 90 miles northeast of Hackberry, is the copper mine of W. B. Ridenour of that place, and which is producing over 50% ore from a narrow vein.——Lessees at the Grand Gulch mine recently shipped a carload of 43.2% copper ore to Salt Lake City. This ore was from a raise above the 200-ft. level. The deposit in this mine is circular in form.

CALIFORNIA

The magnesite production of this state should be increased, according to the U. S. Geological Survey. Imports into the United States in 1913 were 172,591 short tons, of which 163,715 tons came from Austria-Hungary, the balance from Greece. The ore was calcined at Hamburg and Rotterdam before shipment to this country. There are numerous extensive and high-grade deposits in California, especially in Santa Clara and San Benito counties. Most of them are somewhat remote from railroads, so only the small deposits near the lines are being worked.

The following circular has been sent to a number of mine operators in the United States: It is planned to hold a national mine rescue and first-aid contest in San Francisco some time during the spring or summer of 1915. This contest will be conducted under the auspices of the U. S. Bureau of Mines, with the coöperation of the American Mine Safety Association. Assurances have been received that teams from a number of the Western states will enter for the meet. The department will be glad to know whether it is probable that a team from your mine or from your district can enter. There will be no expense connected with the entrance of a team, except for first-aid supplies, and for traveling expenses of the men. Replies or inquiries should be directed to H. M. Wilson, Bureau of Mines, Pittsburgh, Pennsylvania, or to H. M. Wolfiin, Underwood Building, San Francisco, California.

The tentative itinerary for rescue-car No. 5 in California is as follows: September 28 to October 5, Jamestown; October 6 to 20, Stanford University; October 21 to November 4, Berkeley; and November 5 to 15, Kennett, all in California.

Amador County

The first return from the Plymouth Consolidated has been published in London as follows: stamp-mill operating in August, 696 hours; ore crushed, 9157 tons; value of gold and concentrate, $30,750. The feed was partly from low-grade dumps, and a good deal of gold was absorbed in the plant. W. J. Loring states that everything is satisfactory.

Improvements are to be made to the Original Amador mill at Amador City, and two 8-ft. by 36-in. Hardinge mills have been ordered to increase the tonnage and recovery.

Nevada County

In the Phoenix mine adjoining the Oustomah, a rich shoot of ore 6 in. wide has been cut. It is probably an extension of the Oustomah vein.——The North Star company is actively working its Champion mine and mill.——At the Union Hill mine, recently acquired by a new company, the shaft is to be sunk much lower. A. D. Cox, of Goldfield, is in charge.

Shasta County

The Heroult electric smelter started making ferro-manganese on September 30.——Los Angeles people have taken the Dry Slide gold mine under a bond for $25,000, and will start considerable new work. The Mammoth Copper Co. is now employing from 400 to 450 men.—On October 1 a fire destroyed property at Kennett worth $80,000, covered by $30,000 insurance.

Siskiyou County

(Special Correspondence.)—Work has been resumed at the Oom Paul mine, near Oro Fino, recently taken under lease by A. C. Renfrew. A new shoot has been opened, reported to assay about $20 in gold per ton.——Ore has been opened in the Little Maggie mine, near Grouse creek. The discovery was made in a rise from the lower adit, and the small mill will start crushing as soon as a concentrator has been provided to handle the sulphides. Simon Barrendun is managing owner.——The Siskiyou Mines Co. is arranging to install new flumes and sluices at its hydraulic mines at South Fork. Considerable prospecting has been done the past summer, and the outlook is favorable for a good season.——Several placer mining companies in the western part of the county are preparing for the next season, and are awaiting a heavy rain to start preliminary work. Stoping of good ore is going on at the quartz property of Cory & Messner on Sugar creek. The shoot was discovered a few weeks ago, and the mill will start operations as soon as sufficient water is available.——San Francisco people, headed by J. M. Schuman, a mining engineer, are examining claims in the Sawyer's Bar district. Eastern people are said to have taken an option on the Sugar Hill quartz mine on Fox creek. Under the management of Nickerson & Werst the property has recently developed excellently. A promising vein was recently intersected and is

improving.——F. Welch and associates have started work on two quartz claims near Yreka owned by Michael Wacker. A cross-cut adit is being driven to cut the vein which has yielded rich ore.——Work at the Cub Bear mine continues to open good ore, and it is probable a small mill will be erected next spring. The vein has widened from 16 to 20 in. with a good milling grade of quartz. Charles Ritz is superintendent.——Recent work at the Big Cliff mine, near Etna Mills, has been of such encouraging character that a small stamp-mill has been acquired and will be immediately installed. H. B. Wintering is manager.——Lessees are opening good ore in the Osgood property, near Yreka. The mine is equipped with a small mill.

Etna Mills, September 27.

TRINITY COUNTY

The Trinity Consolidated company has been doing a great deal of prospecting and other work during the summer, and preparations are being made to sluice a large gravel deposit near the Union Hill mine.——A Keystone drill is prospecting gravel in ground bonded to T. R. Loubie, at the mouth of Eastman gulch.——Sampling ground on the Paulsen area, west of Lewiston, is nearly finished.

COLORADO

GILPIN COUNTY

The annual meeting of the St. John Mines (Colorado), Ltd., was held in London on September 14. The directors had decided to retain, if possible, the greater part of the Revenue Tunnel properties under option to the Company, selling only tunnel rights and certain of the less accessible claims, and the whole of these arrangements were on the point of completion when the European war upset all finances. All negotiations, both for the necessary funds and for the sale of tunnel rights, have had to be abandoned for the present. The directors, however, had reason to believe that Mr. Platt, the manager at the mines, would be able to make arrangements whereby the benefits of this option would ultimately be secured for the Company, but it was impossible at the moment to assert this definitely. From the St. John mines a shipment of 150 tons of silver-lead ore assaying $6 per ton, was made; but the smelters were unwilling to settle for further shipments until the metal markets were normal. The mine is shut down for the present. The directors recognized the wisdom of this step, but had to bear in mind that, pending the payment of the balance of between $2000 and $3000 of purchase price payable next January, they had contracted with the vendors to work 200 shifts per month at the mines. In order to close down it would be necessary to pay off this balance and all the local expenditure to date. In these altogether exceptional circumstances the directors would be obliged to raise a small temporary loan to enable them to meet current requirements and resume production as soon as possible.

LAKE COUNTY (LEADVILLE)

Apart from the general depression, a great deal of work is being done around the Leadville mines. The Iron Silver, Yak tunnel, Wolftone, Colonel Sellars, New Monarch, Dinero, and others are working full time.

The Down Town Pumping Co. is trying to start its unwatering scheme by the beginning of 1915. On account of the war, the firm of Sulzer Bros. in Switzerland is unable to supply the pumps contracted for, so bids are being taken from American machinery people. Work will soon be started on buildings for the equipment.

The Western Zinc Mining & Reducing Co., which controls the new zinc smelter here, has decided to resume operations. E. J. Jones is now in charge, replacing A. B. Augustine who has left the Company.

The Connors lease is producing 50 tons of 7 to 10-oz. gold ore per month, and shows no sign of cutting out.——Lessees at the Kyle portion of No. 7 level of the Jonny have opened another shoot.——The Big Four is producing good ore steadily.

TELLER COUNTY (CRIPPLE CREEK)

According to estimates of *The Cripple Creek Times*, the September output of the district was as follows:

Plants.	Tons treated.	Average value.	Gross value.
Golden Cycle	28,000	$20.00	$560,000
Portland (Colorado City)	11,000	19.50	214,500
Smelters	3,860	55.00	212,300
Portland (Cripple Creek)	18,960	2.05	38,680
Stratton's Independence	11,868	2.00	23,736
Colburn-Ajax	4,450	6.50	28,925
Wild Horse	1,250	3.10	3,875
Kavanagh-Jo Dandy	1,700	2.15	3,655
Gaylord-Dante	1,100	2.00	2,200
Isabella	1,000	2.00	2,000
Neville-Free Coinage	200	6.00	1,200
Total	83,388		$1,091,071

Dividends have been paid by the Golden Cycle and Portland, the former the regular monthly of 3c., and an extra one of 2c. per share, totaling $75,000; and the latter 3c. per share, equal to $45,000. A new club-house and locker room for Portland miners is being erected. It will consist of lounging rooms and complete changing facilities.

The new mill of the Vindicator Consolidated is nearly finished. It is to treat ore from the mine. Dumps on the surface containing about 1,000,000 tons will be held in reserve.——A cyanide plant of 50-ton capacity has been planned for the Jerry Johnson mine by the lessee, Frank Caley. He has a lease up to January 1, 1919.

IDAHO

LEMHI COUNTY

(Special Correspondence.)—The Rabbit Foot Mining Co.'s gold mine and stamp-mill resumed work on September 1. They are on Silver creek, and prospects are good.——Work at the Musgrove mine and mill is at full capacity. All machinery is driven by the Company's water-power. R. L. Edwards is manager.——On gold claims owned by J. B. Hastings and others at Yellow Jacket, 50 miles west of Salmon, two shifts of miners have been started. Winter supplies are being taken into the camp.

CYANIDE MILL OF MUSGROVE MINING CO., NEAR SALMON, IDAHO.

Salmon, September 12.

SHOSHONE COUNTY

It is reported that 3 ft. of galena, containing up to 40% lead and some silver, has been cut at 600 ft. in the National copper-mine at Mullan.——St. Paul and Milwaukee people are advancing money to continue development of the Coeur d'Alene Silver-Lead company's 12 claims near Mullan. Charles J. Heidenreich is general manager.

MICHIGAN

Houghton County

Large shipments of copper are being made from the district by rail and steamer, the Calumet & Hecla sending out 1200, and Copper Range 800 tons last week.

The rock in which the ore is found in the Calumet & Hecla company's White Pine mine is neither an amygdaloid nor a conglomerate, but a gray and brown sandstone of the upper Keweenawan. The copper is in small particles, and fills in the spaces between the sand grains. The structure of the property is complicated, on account of the displacement of the lodes by faults, and new problems in mining are constantly being met. It is reported that the sandstone contains nearly 100 lb. of copper per ton. The average for the Michigan copper district is about 20 lb. Considering the reported richness of the sandstone, and the estimated mill recovery of over 80%, the success of the White Pine appears a certainty.

On account of financial conditions created by the European war, the Cleveland-Cliffs Iron Co. announced further curtailment, beginning October 1. Shipments this year have been low, with the result that the stock-piles are unusually large. The further decrease means the closing of the Salisbury mine at Ishpeming, the Maas at Negaunee, and the new Mackinaw and Gardner in the Gwinn district. About 400 men have been deprived of employment. The construction of the Jones furnace of the New Process Metals Co., at Marquette, is now nearing completion. It is expected that by November 1 the plant will be ready for operation. Low-grade manganese ore from the Cuyuna range of Minnesota will be used to test the furnace.

MISSOURI

Jasper County

The Duenweg Zinc & Lead Co.'s mill is to be moved to the M. R. Tidwell land north of Commerce, Oklahoma. It will have a capacity of 250 tons per day when overhauled. Good zinc-lead ore has been opened in the Tidwell lease. T. F. Lennan is manager.——Drilling has cut lead ore from 70 to 120 ft. depth, on the west side of the Neosho river, northwest of Miami.

MONTANA

Silverbow County

On October 7, at Butte, committees representing the United Mine Workers of America and the Western Federation of Miners, met to discuss plans of amalgamation. Adam Wilkinson of Montana, Robert Harlan of Washington, and Frank Farrington of Illinois, members of the executive board represented the coal miners. Dean W. Selfridge, J. W. Rankin, and Joseph Gorman represented the Federation. The plan most likely to be accepted is the merging of the Western Federation into the United Mine Workers, the Federation giving up its name. The combined membership would be 550,000. It is expected that the conference and its results will have a strong influence on the Butte trouble. The two organizations now have interchangeable cards. If they decide on a plan of amalgamation, it will have to be submitted to a referendum vote of the membership of both unions for ratification. The committees will probably recommend some disposition of the headquarters of the Western Federation at Denver, in case a merger scheme is worked out. A member of the executive board of the Butte Mine Workers Union has stated that the subject of uniting the Western Federation of Miners and the United Mine Workers had been brought to their attention, but that no definite action of any kind had been taken. The question has been agitated among the members of the mine workers, and, according to him, there has been 'wire pulling,' but the matter has never been given any official recognition. A report that arrangements had been made for the executive board to meet with a committee of the United Mine Workers and the Western Federation, on October 6, was denied. Governor Stewart was unable to attend the meeting of the Butte Mine Workers, to deliver his address, but it is hoped that he will be able to talk to them in the near future.

At the Butte-Duluth, another set of 20 by 54-in. Doty rolls is to be installed to crush ore for the leaching plant. This is producing 10 tons of cathode copper per day.——In the suit of the Elm Orlu company *v.* the Butte & Superior, the former claiming $50,000 damages, the latter has started a counter claim for $100,000 of ore taken from the disputed ground by the Clark property. The Butte & Superior also asks for a permanent injunction and decree of ownership of the ore deposits in dispute.

NEVADA

Churchill County

The August output of the Nevada Hills Mining Co. was 5470 tons averaging $7.08 per ton, yielding a net profit of $3497. Development in the mine totaled 531 ft. The financial statement shows resources of $241,827, including silver worth $9396, and concentrate worth $9189. The silver has since been sold at 52⅝c. per ounce.

Clark County

(Special Correspondence.)—As mentioned in the *Press* of September 26, samples of platinum ore sent from here to the U. S. Geological Survey, and forwarded by them to Ledoux & Co. in New York, are reported to have been found to contain platinum to the amount of one ounce and more per ton, in addition to copper and gold. The platinum is in the form of native metal and the occurrence is in limestone connected with dikes from a quartz monzonite intrusion. The Survey will send a field man to investigate the occurrence.

Good Springs, October 1.

According to O. J. Fisk, manager of the Boss mine, a mill run on this ore returned gold 1.84 oz., and platinum, 1.06 oz. per ton. The recovery was 84.08%. Picked samples gave 100 to 575 oz. gold, 125 to 230 oz. platinum, and 30 oz. palladium.

Esmeralda County

The Goldfield Consolidated company's estimated production for September is as follows: Ore mined, 27,846 tons; gross extraction, $302,000; operating expenses, $180,000; and net realization, $122,000.——Net earnings of the Florence mine in August were approximately $15,000.——A rise from 1017 ft. in the Jumbo Extension has opened ore 125 ft. beyond the drifts on the 921-ft. level. Assays vary from $45.26 to $535.80 per ton in gold. Two cars of ore recently settled for by Western Ore Purchasing Co. assayed as follows: gold, 3.45 and 4.14 oz.; silver, 8.35 and 10.10 oz.; and copper 4.10 and 4.50%, worth $83.34 and $98.95 per ton respectively.

Humboldt County

There are only four men left at the new gold district of Haystack.——Quicksilver properties around Imlay and Humboldt are mining as much ore as possible while the price of the metal is high.——At the Antelope Springs mine the adit is in 1300 ft. At 844 ft. a vein was cut, and driven on for 300 ft., showing 4 to 20 ft. of zinc-silver-lead ore. A shipment is to be made soon.——During September the Nevada Packard mine at Rochester produced five carloads of ore, two of which were settled for at $62.41 and $52.22 per ton respectively.

Mineral County

According to John H. Leavell, of Kirk & Leavell, of Salt Lake City, assistant general manager for the Aurora Consolidated, the new mill is treating about 350 tons per day. Remodeling will be finished in a month, and over 500 tons will then be handled. The stamps are crushing 15 tons each per day. About 600,000 tons of $4.81 ore has been exposed above the 300-ft. level. The Company is erecting 30 new 3, 4, 5, and 6-room houses for its employees. There are 175 men working.

(Special Correspondence.)—The Fermina Copper Queen, on

which C. B. James and associates had an option, has been taken up, and men will start work at once in further opening up the many prospects on the St. Patrick and Irma group. This property consists of 44 claims and lies north of Luning, adjoining the Giroux property on the north and the Luning-Idaho property on the south. The surface showing is very promising, one of the best in the district, and its development to date has exposed a large tonnage of 3 to 8% copper ore, with fair silver content. This has been a large producer. ——The Wagner Azurite company is placing two Wilfley tables in the leaching plant recently built here, which, with the new filter being installed, will assure a steady run on a large tonnage of ore that has been opened during the past few months.

The Shipper company and Alameda Mines people are getting ready to begin operations at once. Mr. Quinlan is now in Spokane making final arrangements to start breaking ground for a leaching plant for the Alameda company, at which plant will also be treated ore from the Shipper property.——Reports are current that the Luning Gold Mines Co.'s property has been leased to Sacramento mining men, and that active operations will begin early next month.

Luning, September 25.

Nye County

Seven mines at Tonopah produced 11,460 tons of ore worth $232,240 during the week ended October 3.——For the quarter ended August 31, the Belmont company has published the following data: revenue from ore and bullion, $714,611; mining, milling, and general expenses, $379,564; net, $335,047; total net with other income, $347,453; available resources, including $746,953 cash in bank, total $1,387,061. Dividend No. 21 absorbed $375,000. The mine is developing well. The old 175-ton mill at Millers is being remodeled to an all-sliming process using continuous decantation.——The Wandering Boy shaft of the Jim Butler mine is being enlarged and retimbered, and the output of ore will be reduced to 100 tons per day.——The Extension mill is treating 207 tons per day.

The Tonopah Cash Boy Consolidated Mining Co. has issued a statement as to its affairs. Work in the mine was confined mainly to prospecting for the Extension's Merger or Murray vein. The shaft was sunk 460 ft. to 1260 ft. at a cost of $60 per foot. It is in favorable formation. During development water made in the shaft at the rate of 6000 to 7000 gal. per day. This has decreased to 2000 gal. The Victor, on the north, cut a flow of 170,000 gal. per day in its south cross-cut. Cutting an ore-shoot in the Victor is promising for the Cash Boy, and it may be cut by sinking to 1400 ft. Cross-cutting cost $15 per foot. Owing to financial conditions work has been suspended. Receipts from share sales and cash advanced were $31,554; and expenses $31,493, leaving a balance of $61. Liabilities are $3476. There are 76,870 shares in the treasury. There are now 30 men working in the new gold district north of Tonopah, and prospecting is encouraging.

An attempt was made on September 22 to dynamite the office of the *Tonopah Daily Bonanza*. Labor controversies are supposed to be the cause.

OREGON

Malheur County

It is reported that a large deposit of potash of fair quality has been found near the Oregon-Nevada boundary by W. S. Bretz of Winnemucca, Nevada. All the surrounding area has been staked.

TEXAS

According to W. B. Phillips, director of the University of Texas Bureau of Economic Geology and Technology, during the two years ended September 1, 1914, the Bureau has done considerable field and laboratory work, also extensive investigations on the fuels used in the state. Six bulletins have been published, and there is now on hand and nearly ready for the printer a special bulletin to be used as a mineral reference book for Texas. It will contain statistics of mineral production since the earliest times, the mineral resources of each county, with the area, population, property valuation, railroad mileage, etc.; elevations of cities, towns, villages, mountains and mountain ranges, the text of the new mining law, the latitude and longitude of important places; tables of magnetic declination; and other information.

UTAH

Beaver County

In the Leonora claim in the Star district, there is now opened 38 ft. of ore 2 ft. wide, assaying 58.8% lead and 194.8 oz. silver. This property is near the Hoosier, Moscow, and Red Warrior.——A contract has been let to sink a two-compartment shaft 1000 ft. at the Sheep Rock mine. The owners are extracting gold ore from 300 ft.——The Wilbert lead-silver mine resumed work on September 10, with one shift daily underground and in the mill. About 20 tons of concentrate per day is shipped, also some crude ore, some of which assays 54% lead and 10 oz. silver. This is from the 500-ft. level.

Juab County

The 100-ton plant of the Utah Minerals Concentrating Co., being erected below the dump of the Plutus Mining Co., and which is to treat ore from the Chief Consolidated mine dump, may be ready late in November. The mill consists of rolls, tube-mills, and concentrators.——Four blocks of ground are being worked by lessees in the May Day, and some good zinc ore is being shipped. The Company may pay a 3c. dividend this month, equal to $25,000.——At the Lower Mammoth there are 28 men at work, and zinc and lead-silver ores are being mined from 200 to 1800 ft. depth.——A new sub-station for the Utah Power Co. is about finished.

Salt Lake County

Labor claims will be the first to be settled by the receiver of the Ohio Copper Co. No effort will be made to resume work at the mine and mill under the receivership, unless the price of copper rises considerably.——The Tar Baby adit, in the Alta district, is in 1300 ft., and the expected lode formation should be cut within 150 ft. of driving, the present ground being mineralized.

Summit County

Holt-Dern roasting furnaces are to be installed throughout the Mines Operating plant at Park City. A 10-ton test furnace has been under observation during the current year, and a saving of $1 per ton will be made by less volatilization of metals, less dusting, less coal used, and better effect on treatment solutions. The plant will treat 4500 tons of ore per month. The first half of September yielded this Company 8500 oz. silver, also copper-silver precipitate.——A 30-ton Callow test plant has been ordered by the Daly-Judge company to experiment on tailing. The mill is treating from 140 to 150 tons of ore per day, and about 250 men are employed at the property.

WASHINGTON

In *Bulletin* 550 of the U. S. Geological Survey, the ore deposits of northeastern Washington are described by Howland Bancroft; and the Republic mining district by the same author and Waldemar Lindgren. This work consists of 215 pages with illustrations, maps, and index. The area covers the whole of Stevens and Ferry counties, 6000 square miles, and mention is made of the Park City district in Okanogan county. The field work was done in the summers of 1909 and 1910, in 4½ months. The literature on this area is scanty, and this work will be found of value to mining men. The climate at the elevation of 2050 to 2628 ft. is excellent. Mineral discoveries date back to 1865. Transportation arrangements are good.

FERRY COUNTY

The San Poil Consolidated Co. has leased to J. L. Harper the San Poil, San Poil Fraction, Baby Fraction, one-half of the Kangaroo and the Snowstorm Fraction, and the East San Poil, Hammond, and Little Joe Fractions, also the San Poil mill. The bond is for four years, calling for a payment of $185,000 on certain terms. The Last Chance mine at Republic has passed into the possession of the Western Union Mines, recently organized by J. L. Harper and West Virginia people. A 1000-ton mill is to be erected soon. Within two months the monthly output of this group of mines will be from $80,000 to $100,000.

STEVENS COUNTY

Another trial of the oil-burning furnace at the Copper King mine was made on September 30, with satisfactory results. J. J. Anderson is in charge of the plant.

CANADA

ALBERTA

There are 52 oil companies drilling or about to start in the Calgary district, according to H. T. Irvine, a broker of Spokane. There is confidence in the field, but a lack of money for development. The United well, near the Dingman, is down 2700 ft.; Mowbray-Berkeley, 3000 ft.; Dingman No. 1, 2800 ft.; Dingman No. 2, 1800 ft.; Alberta Petroleum, 2400 ft.; Heron-Elder, 1400 ft.; McDougal-Segur, 3500 ft.; and Monarch, 3500 ft. The latter is in the north field, the others in the south field.

BRITISH COLUMBIA

Mining and smelting operations have been suspended at the properties of the British Columbia Copper Co., only a little exploration being done. The management has announced that 10,000,000 tons of ore has been developed at Copper Mountain. The ore averages about 1.85% copper and 72c. gold and silver per ton. Construction work on the new mill has not yet been started, and the size of the mill has not yet been definitely determined. Mining operations in the Rossland district are active and continue to increase. Also mines in the Kootenai and Slocan districts have resumed work. Shipments of ore to the Trail smelter during the third week of September totaled 7261 tons from Rossland mines.

Operations by the Hedley company at its Nickel Plate mine, mill, and power-plant continue at the usual rate. It is expected that the hydro-electric plant will be finished by the end of the year. Water will drive Morgan-Smith twin turbines direct connected to a Canadian Westinghouse 1800-hp. generator. A new 2000-cu. ft. per minute Ingersoll-Rand motor-driven compressor is to be installed at the mine.

KOREA

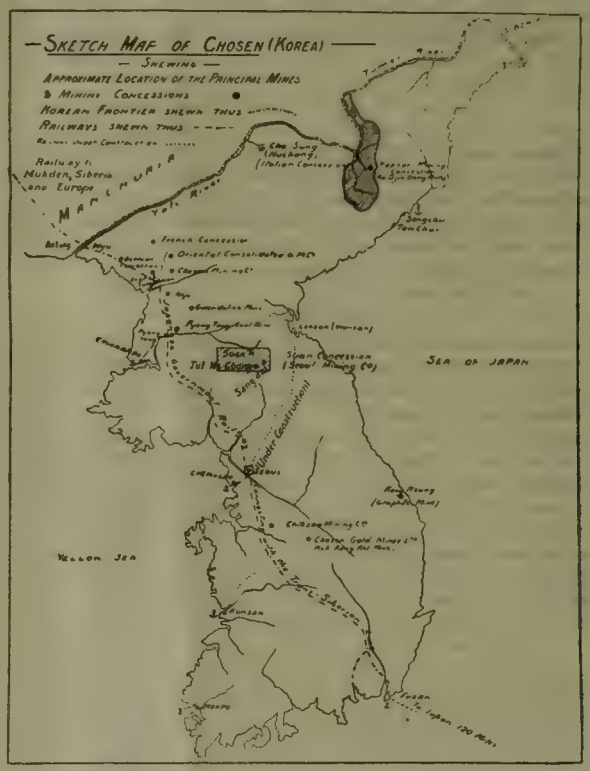
The Seoul Mining Co., operating the Suan Concession in Whang Hai province, reports the following results for September:

Stamps working	40
Time, days	27
Ore crushed, tons	6,005
Total recovery	$61,750
Operating expenses	26,000
Net earnings	35,750

NICARAGUA

Regarding its interests in this republic, the Tonopah Mining Co. of Nevada states that it has an option on the property of the Panama Mining Co. and has until February 1, 1915 to decide whether it will take the property or not. In case the option is exercised, a new company, controlled by the Tonopah company, will be formed to take title to the property and operate it, and the stock of this new company issued to pay for it. Forty per cent of the stock of the new company will be turned over to the Panama Mining Co. to be disposed of as its officers and stockholders may determine. Under this arrangement, if the option is exercised, the Tonopah Mining Co. buys the property and does not buy the stock of the Panama company. At present it seems that the full period of the option will be consumed before the directors are ready to announce their decision.

In view of the present conditions in Europe, the greatest obstacle to be overcome in the extension of American trade in Nicaragua is that of credits. As coffee is the principal



article of export, and about 90% of it has been going to Europe, the coffee growers and larger merchants do business with European exchange. Accounts in the United States are rarely paid with New York exchange, but usually 30 to 60 or 90-day paper on London or Hamburg, according to a recent *Daily Consular Report* from Washington, D. C. British companies operating in the Corinto district have gold and silver concentrate which will be shipped to San Francisco; the first shipment, on August 16, amounted to about $15,000. Nicaraguan dye-woods will need a market.

Members of the Montana section of the AMERICAN INSTITUTE OF MINING ENGINEERS will hold the October meeting on the 16th at the Silver Bow Club, Butte. A technical session will be held immediately after the dinner. The following papers will be read and ample time provided for discussion: 'Coal-dust Fired Reverberatories at Anaconda,' by L. V. Bender, and 'Mining Claims Within the National Forests,' by E. D. Gardner, with discussion by F. A. Silcox, district forester for Montana and northern Idaho.

The Los Angeles branch of the AMERICAN INSTITUTE OF MINING ENGINEERS will hold the first section meeting of the season on October 23 at the Hollenbeck hotel. H. W. Morse, of the Western Precipitation Co., will read an important paper on 'Electric Dust Precipitation in Smelter and Cement Mill Practice.'

PERSONAL

HAROLD A. MORRISON is in San Francisco this week.

H. HENDRICKSON has sailed from New York for Vera Cruz.

J. D. IRVING has returned to New Haven from Washington.

E. L. KURTZ has left Columbia University and gone to Pittsburgh.

C. A. CRISPIN, auditor for the Oriental Consolidated Mining Co., is in San Francisco.

HARRY W. NEWTON is now superintendent at the San Poil mill at Republic, Washington.

F. J. LONGWORTH is now on the staff at the Western Union mine at Republic, Washington.

T. WALTER BEAM, of Denver, Colorado, is examining mining properties in British Columbia.

E. J. JONES is now manager of the new zinc smelter at Leadville, in place of A. B. AUGUSTINE, resigned.

ADOLPH KNOPF was in San Francisco returning from a visit along the Mother Lode. He has gone to Nevada.

F. A. CRAMPTON has been retained by the California Magnesite Co. and the Magneso Products Co. as metallurgist.

J. T. TERRY, Jr., has returned from the Gold Bullion mine, Knik, Alaska, where he erected and operated the first sand-leaching cyanide plant in the territory.

FREDERICK BRADSHAW, of the Tonopah Belmont mine, is inspecting the Company's property at Surf Inlet, British Columbia, with the president, CLYDE A. HELLER.

CLIFFORD C. ENOS, a member of the Mexican staff of mining engineers for the United States Smelting, Refining & Mining Co., has returned to Mexico after a sojourn in Utah.

H. S. MUNROE has returned to New York rather the worse for his vacation, since hardships undergone in the war zone will prevent his immediately resuming his work at Columbia.

S. H. BRADY has resigned as manager for the West End Consolidated Mining Co. at Tonopah and will devote his time to the development of the properties of Thorkildsen & Mather and the Sterling Borax Co. He will make his headquarters at Goldfield, and is succeeded at the West End by J. W. CHANDLER.

JOHN R. STANTON has been elected president of the Michigan Copper Mining Co. to succeed JOSEPH E. GAY. FRANK McM. STANTON succeeds his brother as treasurer, and GEORGE W. DRUCKER is now the secretary. JAMES DUNSTON is director, succeeding JAMES GAY, and F. M. STANTON follows J. F. HARDLY.

CHARLES F. RAND has resigned as president and director of the Consolidated Coppermines Co. and its subsidiaries in order to devote his entire time to his South American interests. The directors meet October 20 to elect his successor. Mr. Rand is attending the annual meeting of the American Institute of Mining Engineers in Pittsburgh.

Obituary

EDMUND B. PRESTON, who died on Sunday, September 27, at Santa Rosa, California, of pleuro-pneumonia, at the age of 76 years, was born in Calcutta, India, October 17, 1838. He was educated in Germany, his early schooling having been in Dresden. At the age of 22 he graduated at Freiberg with the degree of mining engineer. At Freiberg he was a contemporary with the late Louis Janin and W. S. Keyes. From Freiberg he went to England with the intention of taking up the profession of iron-master, but on the advice of friends decided to come to California, where opportunities were not only more numerous but in many ways more attractive. He reached California in 1860, then a young man of 22, and soon identified himself with gold mining. He was one of the pioneers in the noted Meadow Lake region, in Nevada county, California, where he opened the first assay office in the district, but like several thousands of others when the mines proved disappointing, he walked out of the unfortunate camp over 20 ft. of snow, not even attempting to carry away his assay balances. From Meadow Lake he went to Virginia City, Nevada, where he engaged in engineering work for a time, later returning to Plumas county, California, where he soon found employment as a millman, work at which he was expert. From Plumas county, Preston went to Hayden Hill, in Lassen county, California, and there acquired an interest in some valuable gold mines, which he afterward worked with success for a number of years, finally selling out to advantage. He then came to San Francisco and in 1889 was appointed a field assistant to the state mineralogist, at that time William Irelan, Jr. Preston remained with the State Mining Bureau from that date up to the time of his death, a period of 25 years. He had planned to celebrate the twenty-fifth anniversary of this connection, by giving a dinner on the evening of September 10, to the attaches of the Bureau and some of those who in the past had been connected with that institution, but he was taken ill on September 9 and was unable to carry out his plan. However, he had been able to see fulfilled a most earnest wish —that he be able to complete his 25 years of service.

E. B. Preston had a long and useful career as a mining engineer, geologist, and metallurgist. He contributed valuable material to the Ninth, Tenth, Eleventh, Twelfth, and Thirteenth reports of the state mineralogist, and in his capacity of field assistant he repeatedly visited nearly every county, thus becoming familiar with the mineral resources of the state as he could in no other way, and of this useful knowledge he gave freely to all who sought it. His monograph, 'California Gold Mill Practices,' issued as *Bull.* 6, has had a wide circulation, not less than 10,000 copies having been distributed by the Bureau. It is one of the most valuable contributions to the metallurgy of gold, and has found practical use in the hands of many millmen, with whom it was a veritable *vade mecum.* Other special papers written by him were a description of the flooding of the Salton basin in 1892, and a valuable description of the North Fork mining district at the head of the San Joaquin river. Both of these contributions appeared in the eleventh annual report of the state mineralogist. In 1898 Mr. Preston took the chair as determinative mineralogist which was made vacant by the death of Karl Schneider, who had held the position for years. For 16 years Mr. Preston had occupied this place, having in that time made not less than 35,000 determinations of minerals, rocks, and ores, that are of record in the files of the State Mining Bureau, and many thousands of other determinations for citizens who called to submit their samples in person and of which no record was kept. It is seldom that anyone employed in a state institution continues to serve through one political administration after another for a period of 25 years. When such a thing does occur it is abundant proof of the integrity and capability of this public servant, and of the satisfactory manner in which he performs the duties of his office—such a man was Edmund B. Preston. In the conduct of his department he was not only punctual as to the hour of his arrival, but he was painstaking, careful, and conscientious in all the work he did.

The San Francisco local section of the AMERICAN INSTITUTE OF MINING ENGINEERS will meet Monday evening, October 12, in the rooms of the Engineers' Club, at 8 o'clock. The paper of the evening will be by James M. Hyde. Title, 'History of Flotation Concentration Processes.' The meeting will be preceded by an informal dinner at the same place at 6:30 p.m. Price of dinner, $1.10. Out-of-town members are especially invited to attend.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, October 8.

Antimony	13 —13¾
Electrolytic copper	13⅝—13⅞
Pig lead	3.75— 4.70
Quicksilver (flask)	$55
Tin	36 —37½
Spelter	6½— 6¾
Zinc dust, 100-kg. zinc-lined cases	15

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

New York and London prices for bar silver are 52½c. and 24d. respectively, being a trifle weaker. Exports of silver from San Francisco to Hongkong and China in September totaled $349,125, or about 790,000 oz. Shipments from Cobalt, Ontario, to England, during the week ended September 25 were as follows:

	Bars.	Ounces.	Value.
Nipissing	386	444,537	$234,099
La Rose	48	55,867	29,068
Caribou Cobalt	37	44,803	23,746
Total	471	545,207	$286,913

At the end of September the Constitutionalist authorities at Mexico City detained 512 bars of gold-silver bullion worth about ₱2,000,000, as it was thought that they were to be exported from Vera Cruz by enemies of the new administration. Another 175 bars worth ₱400,000 were held a day or so later. English, German, and Brazilian representatives protested. Export taxes on the bars had been paid. The bullion was claimed by the following: Real del Monte of Pachuca, 175 bars; Cinco Minas, 42 bars; Guanajuato Consolidated Mining & Milling Co., 41 bars; Banco Germanico de la America, 15 bars; Compania Minera La Blanca y Anexas, 364 bars; and El Oro Mining & Railway Co., 23 bars. After an investigation the bullion probably will be returned to its owners.

COPPER

Prices of electrolytic in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

Electrolytic metal was quoted at 11.70 to 11.80c. on October 2. Exports in September were 19,402 tons, against 19,676 tons in August, and 291,925 tons, against 291,350 tons for the first 9 months of the year. Indications are that there will be a decrease of about 35,000 tons for 1914. If exports are declared only for neutral countries England will not molest cargoes. Stocks in England and France are up 1738 tons, but 1950 tons down in Rotterdam. Anaconda output in September was 12,400,000 lb., compared with 23,800,000 lb. in June; and Mohawk, 1,516,000 lb. 65% mineral, against 1,460,000 in August. Annual loss to shareholders by reduction to date of dividends of copper companies is estimated at $28,639,909.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending		Week ending	
Sept. 10	75.00	Sept. 24	75.00
" 17	75.00	Oct. 1	55.00
		" 8	55.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mch.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Sept. 24	3.75	Aug. 19	3.88
" 25	3.75	" 26	3.87
" 26	3.75	Sept. 2	3.90
" 27 Sunday		" 9	3.85
" 28	3.75	" 16	3.85
" 29	3.75	" 23	3.85
" 30	3.75	" 30	3.75

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.36	3.86	Oct.	4.37	....
May.	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

Lead has been dull at St. Louis at 3.55 to 3.60c. per pound.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Sept. 24	4.88	Aug. 19	5.60
" 25	4.88	" 26	5.77
" 26	4.88	Sept. 2	5.75
" 27 Sunday		" 9	5.50
" 28	4.88	" 16	5.25
" 29	4.88	" 23	5.00
" 30	4.88	" 30	4.88

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

The highest price for zinc ore at Joplin, Missouri, last week was $42 per ton basis of 60% metal, while spelter at St. Louis declined to below 5c. per pound. Butte & Superior treated 35,500 tons of 18% zinc ore in September, yielding about 11,000,000 lb. metal.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	48.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

The price remains around 31c. per pound. The output of tin concentrate from 30 Nigerian properties in August was 228 tons, while July yielded 435 tons. Royalties and freight rates have been reduced by the British Colonial Office controlling the territory. Shipments from Australia and the Straits were lower in September. About 800 tons is due from London.

Gold exports during the last week of September were $78,000, and $811,566 of silver, a total of $127,598,948, and $32,431,014 respectively for the year. The U. S. Assay Office handled gold worth $4,162,009 in September, against $3,737,756 in August.

COMPANY REPORTS

FIRST NATIONAL COPPER COMPANY

This concern controls an operating company, the Balaklala Consolidated Copper Co., which has a mine and smelter in Shasta county, California. The report covers the year to June 30, 1914. Tests of the Hall process to eliminate sulphur from smelter fume have been suspended for the time. The system was but partly successful, but will be further tested. This plant cost $116,908. After being shut down for three years, the mine was reopened early in 1914, and ore sent to custom smelters, showing a small profit, but owing to the war in Europe the property was again shut down on August 21. All equipment is in good order, and when the price of copper warrants, mining will be resumed. The financial position of both companies is good, the First National having cash $16,322, and accounts receivable, $21,745, with a liability of only $7695; and the Balaklala has cash $260,762, and bills receivable $23,969.

NEW YORK & HONDURAS ROSARIO MINING COMPANY

The thirty-third annual report of this Company, which operates at San Juancito, Honduras, Central America, covers the 15 months ended December 31, 1913, and is just at hand.

Ore reserves in the mine consist of 125,396 tons assaying $16.51, 208,000 tons assaying $8.28, and 21,000 tons assaying $12 per ton, or a total of 355,396 tons averaging about $11.40 per ton. Development totaled 15,689 ft. Sixteen veins, known as the San Miguel, Capitana, Catalina, Buena Ventura, Northwest, Colonia, Nueva, Culebra, North, Socorro, Concepcion, Southwest, San Joaquin, West, Rosario, and Candelaria, are worked. The San Miguel produced 38% and Candelaria 15% of the output. The Southwest vein is developing well, but the country rock is loose, making work dangerous and expensive. The cost of mining was from $5.16 to $4.16 per ton of ore milled. A geological study is being made by V. F. Marsters.

The mill treated 91,606 tons, December being 9700 tons, yielding 1,913,637 oz. silver, and 13,086 oz. gold, valued at $1,379,373. The extraction was 88.24% actual, 90.17% theoretical, and 97.85% by bullion + tailing calculation. The treatment cost was $3.21 per ton. The mill showed mechanical defects during the year, and the Allis-Chalmers company overhauled it by September. The San Juancito and Guadalupe power plants are working at high efficiency, there being plenty of water available. Dwellings, hospital, club house, hotel, and a new laboratory were constructed, and all are comfortable.

The total cost was $9.81 per ton of ore milled. The profit from all sources was $575,343, of which $220,000 was paid as dividends No. 184 to 188. Net cash reserve at the end of 1913 was $291,000. To date, a total of $908,750 has been spent on buildings, plant, etc., and the output since 1882 is $18,741,329, of which $3,310,000 was paid in dividends. Louis F. Valentine is general manager; A. R. Gordon, mine superintendent; and Max F. Soto, local secretary.

BROKEN HILL SOUTH SILVER MINING COMPANY

The report at hand covers the half-year ended June 30, 1914, and the manager, W. E. Wainwright, made in part the following statement: Development in the mine totaled 9500 ft., of which 3979 ft. was diamond-drilling. The 625, 725, 825, 970, 1070, and 1170-ft. levels produced 4, 7.3, 7.8, 26, 36.3, and 17% respectively of the total ore mined during the term. Faces of drifts at 1270 ft. are 438 ft. apart. No. 1 shaft was deepened 178 ft., making a total of 1494 ft. Since then it was sunk to 1509 ft. No. 3 shaft is 1281 ft. deep. Stope filling consisted of 41,836 tons of tailing and ash, at a cost of 91c. per yard of filling, or 22c. per ton of ore mined. Mining cost $3.10 and development 81c. per ton. The mill treated 172,330 tons of ore averaging 15.2% lead, 6.9 oz. silver, and 13.8% zinc, yielding 28,745 tons of concentrate assaying 68.5% lead, 22 oz. silver, and 7.1% zinc, metal contents being 19,679 tons lead, 632,010 oz. silver, and 2034 tons zinc. Zincy tailing amounting to 105,779 tons and containing 16.7% zinc, 3.2% lead, and 3.2 oz. silver, was sold to the Zinc Corporation for flotation treatment. Total recoveries were 88.4% lead, 82.2% silver, and 82.8% zinc. Milling and concentrate cost $1 per ton.

Revenue for the half year was £349,095; profit, £163,480; dividends No. 59 and 60, £140,000; and balance forward, including previous surplus, £143,682. Supplies on hand are £47,750; concentrate, £23,750; fixed deposits at banks, £100,000; and cash, £18,454.

The first unit, of 500-ton capacity, of the slime flotation plant is well under construction, as is the acid and sulphur plants. Old tailing on hand amounts to 900,147 tons, and 378,243 tons of slime. The rainfall was 2.98 in., and water consumption, 34,650,000 gal., 12,282,000 gal. coming from the mine. Owing to the war the mine is only working at half time.

AMERICAN SMELTING & REFINING COMPANY

The report just issued covers the half-year to June 30, 1914. Results are best summarized as follows:

	Half-year, June 30, 1914.	Half-year, June 30, 1913.
Net earnings of all plants and industries.	$5,462,094	$5,200,713
Net earnings from mining properties....	614,727	867,007
Interest, dividends received, etc.....	705,433	603,812
Gross income	$6,782,254	$6,671,532
Administration, taxes, interest, discount, depreciation, etc.	1,815,562	1,643,717
Net income	$4,966,692	$5,027,815
Surplus at beginning of year.....	18,495,943	16,759,402
Gross surplus	$23,462,635	$21,787,217
Dividends on preferred stock:		
American Smelting & Refining Co.....	1,750,000	1,750,000
American Smelters Securities Co., 'A'...	510,000	510,000
American Smelters Securities Co., 'B'...	750,000	750,000
Total on preferred stock.....	$ 3,010,000	$3,010,000
Dividends on common stock:		
American Smelting & Refining Co.....	1,000,000	1,000,000
Total dividends	$ 4,010,000	$4,010,000
Surplus	$19,452,635	$17,777,296

Assets have a total value of $189,659,958, of which ore, bullion, and factory product on hand and in transit is worth net $27,018,480; materials and supplies, $2,943,944; and cash, bills, demand loans, accounts, and notes receivable, etc., $15,922,185. The total is $183,824 more than at the end of 1913. Current cash liabilities amount to $8,459,217; and reserve and suspended creditor accounts, $1,280,607.

Owing to the trouble in Mexico, and difficulties the Company had to contend with in that country, it was thought that dividends would not be earned for the preferred stock, but the president, Daniel Guggenheim, stated that even if no profit should result from Mexican operations, both the preferred and common dividends would be earned, which was more than fulfilled. About $900,000 was spent on additional equipment at the various plants of the Company.

BOOK REVIEWS

MODERN TUNNELING. With special reference to mine and water-supply tunnels. By David W. Brunton and John A. Davis. P. 450. Illustrated, index. John Wiley & Sons, New York, 1914. For sale by the *Mining and Scientific Press*. Price $3.50.

Much of the material in this volume, though in different form, was recently published as *Bulletin* 57 of the U. S. Bureau of Mines, under the title of 'Safety and Efficiency in Mine Tunneling,' which was reviewed briefly in the 'Recent Publications' of the *Press* at that time. The authors are well known tunnel engineers, and the information in the volume is as valuable as it is up-to-date, containing notes on the recently completed Mount Royal tunnel in Canada, and the Snake Creek tunnel of Park City, Utah, which is about half finished. There are but few books on the subject of tunneling, and these contain mostly historical data. This book covers all such matter in concise form. The various chapters include the history of tunneling, modern mining and water tunnels, power for tunnel work, air-compressors, ventilation, surface equipment, rock-drilling machines, haulage, underground equipment, drilling, blasting, mucking, timbering, safety, costs, a bibliography of 60 pages, and many illustrations explaining the work being done. It is the best volume printed in its field, and the only recent one of note.

IRON ORES. Their occurrence, valuation, and control. By Edwin C. Eckel. P. 430. Illustrated, index. McGraw-Hill Book Co., Inc., New York, 1914. For sale by the *Mining and Scientific Press*. Price $4.

In the production of over 60,000,000 tons of pig iron per annum the world's iron-ore mines are depleted by about 140,000,000 tons, and the large increase in recent years has made necessary the study of all deposits suitable for future production. A great deal has been written on the Lake Superior mines, and the deposits in Sweden have attracted considerable attention. Pig iron now makes up 95% of the total tonnage of all kinds of metal annually produced in the world. In relative natural scarcity of commercial metals aluminum stands first with 7.84% in the earth's crust, iron following with 4.44%, manganese being next with 0.8%. Taking gold as 1, the relative abundance of iron is 8,800,000. The geological and mineralogical occurrences of iron are fully described, also mining conditions, costs, furnace and mill requirements, prices, profits, and markets. The United States produces about 40% of the world's output, and the sources of the ore are fully discussed. The available reserves are estimated as from 5,200,000,000 to 7,550,000,000 tons, while in all America the total is 9,855,000,000; Europe, 12,032,000,000; Asia, 260,000,000; Africa, 125,000,000; and Australia, 136,000,000 tons. The whole subject is intensely interesting and is presented in a novel form.

MODERN PRACTICE IN MINING. VOL. III, METHODS OF WORKING COAL. By R. A. S. Redmayne. P. 210. Ill., index. Longmans, Green & Co., London, 1914. For sale by *Mining and Scientific Press*. Price, $2.

This is one of a series of which the volumes on 'Coal: Its Occurrence, Value, and Methods of Boring,' 'The Sinking of Shafts,' and 'The Ventilation of Mines,' have already been issued. They are devoted to a description in the simplest terms, of coal mining practice, especially in England. The books are designed for students and the special volume under review has the great merit of simplicity, and freedom from an overburden of details. The general features of British coal mining are well brought out, and frequent comparisons are made with continental practice. Just why American practice, with its many interesting features, is entirely ignored is not clear. One feature of the book that deserves comment is Mr. Redmayne's effort to write in English instead of the conflicting jargon of the men in the various British districts. Local terms are used abundantly, but they are quoted, and their equivalents in good English explained. This greatly widens the field of usefulness of the book and is worth noting, since British coal mining engineers, as distinguished from British mining engineers in general, have been persistently insular in this respect. The special chapters in the book cover the subjects of shaft pillars, opening out, main roadways, underground engine rooms and stables, roof support, room and pillar systems, longwall workings, mining pitching beds, accidents, and similar topics. It is an unpretentious but useful book.

METALLURGY. By Henry Wysor. P. 391. Ill. Second Edition. The Chemical Publishing Co., Easton, Pennsylvania, 1914. For sale by the *Mining and Scientific Press*. Price, $3.

That there seems to exist a distinct field for treatises such as this is a serious indictment of the present status of the teaching of metallurgy in this country. This book has the sub-title of 'a condensed treatise for the use of college students and any desiring a general knowledge of the subject,' but it might more correctly be designated as a superficial and inaccurate outline of general metallurgy. Thus, for example, in discussing fuels crude petroleum is not even mentioned, and in considering the factors which govern the choice of a fuel, transportation charges are ignored. In discussing gold the author says "telluride ores * * * are rarely of importance." In treating of the extraction processes for gold, hydraulicking and dredging are classed as amalgamating processes, instead of washing processes, which the author considers as "not of much significance." A dredge is described as "a huge machine for raising, concentrating, and amalgamating soft ores." Electrolytic precipitation of cyanide solutions is discussed at equal length with zinc precipitation, without any hint that the former is not a practical success, while the latter is in universal use. It would be interesting to know where the author secured his material in regard to extraction processes for nickel, for none of those described coincides with the process used by the International Nickel Co., while the Mond process, used by the only other American producer of nickel, is not even mentioned. Under silver all the old material familiar since the first editions of Schnabel is set forth again, while six lines is all the space devoted to cyaniding silver ores, and the methods used at Cobalt are not mentioned. Similar examples can be found on almost every page. If the title page were not dated 1914, one might suppose the book to have been written fifteen years ago. The great pity is that this book is likely to be welcomed in those schools where metallurgy is still taught as a side issue of industrial chemistry.

A POPULAR TREATISE ON THE COLLOIDS IN THE INDUSTRIAL ARTS. By Kurt Arndt, translated from the second German edition, by N. E. Katz. P. 73. The Chemical Publishing Co., Easton, Pennsylvania, 1914. For sale by the *Mining and Scientific Press*. Price, 75 cents.

Several years ago Professor Arndt delivered in Berlin a lecture on the significance of the colloids in the industrial arts. This awakened such enthusiastic interest that he was persuaded to put the lecture in book form so that it might be available to a large audience. In the four years since that time three German editions have appeared, and it has now for the first time been rendered into English, where it is likely to meet an equally hearty reception. Nearly everyone is familiar with the colloids in a general way, and is prepared to admit that they exert a tremendous influence in all phases of industrial activity. But most of the articles and books

dealing with colloids are entirely above the head of the average man, and we have all been waiting for someone like Professor Arndt to tell us in simple language just what is the influence of colloids on industrial processes. How widely he has ranged is shown in the topics covered: Colloidal Solutions, Colloidal Solutions of Metals, Flocculation of Colloidal Solutions, Reversible and Irreversible States of Aggregation, General Remarks on Dispersed Systems, Suspension and Emulsion Colloids, Ruby-Glass, Milky White Opaque Glass, Troostite, Phosphorous, Colloids in the Mineral Kingdom, Silver and Gold Mirrors, Manufacture of Tungsten Lamps, Colloids in the Ceramic Industry, Colloids in the Hydraulic-Cement Industry, Colloids as Adhesives and Glues, Usefulness of the Colloids in the Absorption of Liquids, Dehydration of Peat by Electro-Osmosis, Colloids as Diaphragms and Filters, Adsorption, Varnish-making, Dyeing, Tanning, Soap Manufacture, Brewing Industry, Lubricating Greases, Sewage Purification, and Colloids in Agriculture. No man of scientific training can afford to miss carefully reading this book, and, as a proper preface to it, 'Colloids,' by Emil Hatschek. Without the important ideas which these two little books convey his concepts of chemical technology are as hopelessly out of date as his appearance would be if he went about in clothes and hat of ten years earlier. There are many books in the world, and we can get on very well without reading most of them, but this is one of the exceptions. So valuable a text deserves a better translation; this is painfully literal, and the punctuation theory of the translator seems to be to insert a comma after every sixth word, so that it is frequently much easier to grasp the meaning of the text if the punctuation is disregarded. The translator seems also to be somewhat unfamiliar with mineralogy and general engineering, and the English text at times awakens suspicion as to its fidelity, especially on observing such slips as that on page 55, where 1 cm. has obviously been substituted for 1 c. m. These are defects, however, which can be remedied in the second edition which is likely to be soon called for. The translator deserves gratitude for supplying an index, a convenience which French and German authors have not yet been educated to the point of providing.

RECENT PUBLICATIONS

United States Bureau of Mines publications, Washington, D. C., 1914:

ACCIDENTS FROM FALLS OF ROCK OR ORE. By Edwin Higgins. *Miners' Circular* 17. P. 15, illustrated.

EXPERIMENTS WITH FURNACES FOR A HAND-FIRED RETURN TUBULAR BOILER. By Samuel B. Flagg, George C. Cook, and Forrest E. Woodman. *Technical Paper* 34. P. 31, plan.

FACTORS GOVERNING THE COMBUSTION OF COAL IN BOILER FURNACES. A preliminary report by J. K. Clement, J. C. W. Frazer, and C. E. Augustine. *Technical Paper* 63. P. 46, ill., index.

WASTE OF OIL AND GAS IN THE MID-CONTINENT FIELDS. By Raymond S. Blatchley. *Technical Paper* 45. P. 57, ill, index.

RESUSCITATION FROM MINE GASES. Report of the committee by W. B. Cannon, George W. Crile, Joseph Erlanger, Yandell Henderson, and S. T. Meltzer. *Technical Paper* 77. P. 36. Illustrated. An interesting summary on a subject being taken up generally in all mining countries.

ELECTRIC LIGHTS. For use about oil and gas wells. By H. H. Clark. *Technical Paper* 79. Petroleum Technology 19. P. 4.

THE ORIGIN OF COAL. By David White and Reinhardt Thiessen. With a chapter on 'The Formation of Peat,' by Charles A. Davis. *Bulletin* 38. P. 390. Index and 54 plates. This is a valuable contribution to a subject which has been often discussed. The authors conclude that all kinds of plants, especially such species as were adapted to the particular region where the deposit was located, in whole or in part went into the deposit. The process of decomposition, elimination, and chemical reduction begun in peat, chiefly by biochemical means, is taken up and continued by dynamochemical means into and through the various successive later stages, and results in the various grades of coal, as lignite, sub-bituminous, cannel coal, and anthracite. Coal, then, is chiefly composed of residue, consisting of the most resistant components of plants.

COAL-MINE FATALITIES IN THE UNITED STATES IN JULY. Compiled by Albert H. Fay. Monthly statement. P. 21. The total was 159 fatalities, compared with 184 in July 1913.

United States Geological Survey publications, Washington, D. C., 1914:

OUR MINERAL RESERVES. How to make America industrially independent. By George Otis Smith. *Bulletin* 599. P. 48. A summary of the mineral deposits of the United States, prospects of new ones, and how to increase the output. Editorial mention has already been made of this publication.

Abstracts from 'Mineral Resources of the United States, 1913':

PRODUCTION OF COBALT, MOLYBDENUM, NICKEL, TIN, TITANIUM, TUNGSTEN, RADIUM, AND VANADIUM. By Frank L. Hess. P. 26.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN COLORADO. Mines report. By Charles W. Henderson. P. 52.

PRODUCTION OF BORAX. By Charles G. Yale and Hoyt S. Gale. P. 16.

THE MANUFACTURE OF COKE. By Edward W. Parker. P. 65.

PRODUCTION OF ANTIMONY, ARSENIC, BISMUTH, SELENIUM, AND TELLURIUM. By Frank H. Hess. P. 11.

PRODUCTION OF LIME. By Ralph W. Stone. P. 16.

CARNOTITE NEAR MAUCH CHUNK, PENNSYLVANIA. By Edgar T. Wherry. *Bulletin* 580-H. P. 5.

LODE DEPOSITS OF THE ALLEGHANY DISTRICT, CALIFORNIA. By Henry G. Ferguson. *Bulletin* 580-I. P. 30, illustrated.

Water-Supply papers:

SURFACE WATER SUPPLY OF THE UNITED STATES, 1912. Part I. North Atlantic Coast Basins. By C. C. Babb, C. C. Covert, and J. G. Mathers. No. 321. P. 240, ill., index.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1912. Part V. Upper Mississippi River and Hudson Bay Basins. By A. H. Horton, W. G. Hoyt, and H. J. Jackson. No. 325. P. 193, ill., index.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1912. Part VIII. Western Gulf of Mexico Basins. By W. W. Follett, Robert Follansbee, and G. A. Gray. No. 328. P. 121, ill., index.

WATER RESOURCES OF HAWAII, 1912. By C. H. Pierce and G. K. Larrison. No. 336. P. 392, ill., index.

GEOLOGY OF THE GALLUP BASIN, NEW MEXICO. By Charles T. Kirk. *Bulletin* 76, of the University of New Mexico. P. 68. Ill., plan. Albuquerque, July 1914.

REPORT OF THE SLUDGE ABATEMENT BOARD FOR 1913. P. 21 and 25 plates. Government of Victoria, Australia, Melbourne, 1914. This is an interesting report on dredging in that state, the reduction of débris in rivers, and resoiling dredged ground.

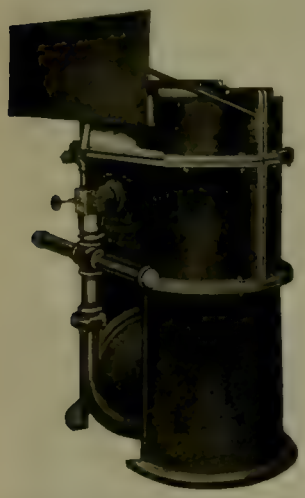
STATISTICS OF RAILWAYS OF UNITED STATES, 1900-1912. *Bulletin* No. 66 of the Bureau of Railway Economics. P. 75. Map. Washington, D. C. This bureau was established by railway companies of the United States for the scientific study of transportation problems, and in this publication is given a mass of details of all the operating roads.

New Machines and Devices

Low Pressure Oil Forge

In sharpening drill steel there are a number of important considerations of prime importance for the best results, and chief among these is the proper heating of the steel. With the coke or coal furnace the fuel invariably contains considerable sulphur, which, if not carefully dealt with, results in the steel becoming sulphurized, causing it to chip and reducing its efficiency. In this type of furnace it is also necessary to work in the blind, the steel being buried in the fuel, which often results in a loss of steel by burning, and it is often found that the steel will not hold its cutting edge for a reasonable length of time.

In the operation of oil forges the chief difficulty has been the inability to obtain a complete and properly regulated combustion which has resulted in volumes of smoke and formation of carbon in the furnace, to say nothing of the noise and other disagreeable conditions under which the operator works. For the purpose of obviating these difficulties, the Denver Fire Clay Co. has developed the Case low-pressure oil forge, which is claimed to embody principles hitherto foreign to forge construction. The oil burner is of special design, permitting of complete control of fuel and its complete combustion. The pressure on the inside of the furnace forces the air from the outside of the mouth of the furnace, thus reducing to the minimum the possibility of oxidation. The lining is of the best fire clay and made in such sections that a new lining may be placed in position or old parts replaced in a very few minutes without disturbing the entire forge. The oil for the burner may flow by gravity or pressure without danger of fire in case the air ceases to reach the burner.



The fan for atomizing the oil is direct connected with an electric motor and the air is used at a pressure of about 6 oz. From $\frac{1}{4}$ to $\frac{1}{2}$ hp. is necessary for driving the fan. A perforated cross-pipe seen at the front of the furnace and connected with the air main from the fan, acts as a cooling device and affords comfort to the operator.

Little Wonder Battery Stem Guides

The battery stem guide developed and used at the Yellow Aster mine is now being marketed by James A. Little and the Allis-Chalmers Mfg. Co. The guide consists of four parts; the frame, which is made of cast steel, the bushings, which are made of cast iron or cast steel, the gibs, and the keys. The frame is held to the guide girt by eight bolts, and these bolts are the only bolts used. The bushings are the only parts subject to wear and can be replaced at a small cost. They are furnished in halves, if desired, but the one-piece bushings are recommended. The bushing is slipped over the stem; the stem is put into the opening in the guide frame and the bushing dropped into place. The shoulder on the bushing prevents the bushing from falling through the socket. The gib is tightened against the bushing by driving the key to place with a light hammer and the stem is held in perfect alignment. The distance of the stem from the key protects the stem from being marred by the hammer in loosening or tightening the key. The keyway is wider than the key, allowing the head of the key to be inclined toward the operator in tightening the key, or the head can be knocked away from the operator, thus bringing the bottom of the key outward, in which position it is easily loosened by a light hammer. These guides have been in use at the 100-stamp mill of the Yellow Aster Mining & Milling Co., Randsburg, Cal., for more than a year and it is estimated that in that time there has not been a loss of five minutes due to guide troubles.

Perforadoras y Compresoras Sullivan

La Sullivan Machinery Cia. de 122 South Michigan avenue, Chicago, Illinois, E. U. de A. ha por distribucion catalogo No. 110 en que es encorporado descripciones cortas de los productos de la Compañía para minas y canteras, compresoras de aire, perforadoras y otros clases de maquinaria. Esta Compañía es una de las mas viejas en Los Estados Unidos y por mas que quarenta años ha fabricada maquinaria de la primera clase para minas y fundiciones. Entre la maquinaria se encontrarón descripciones de compresoras de aire, maquinaria para las minas de carbón, abanicos ventiladores y volquetes de paso automático, perforadoras, barrenas de martillo, malacates, acanaladoras, y otras cosas. Esto librito es muy bien hecho con el objeto dar á conocer á los lectores la Sullivan Machinery Cia., sus productos, su historia, lo que representa y la razón para que se hagan clientes.

Commercial Paragraphs

The Wm. Powell Co. has issued a special booklet descriptive of Powell steam whistles and whistle valves.

The Sprague Electric Works is distributing three new publications: 'Electric Hoists for the Efficient Handling of all Loads'; 'Sprague Electric Monorail Cranes'; 'Sprague Electric Dynometers.'

The Bryant silent call signal system for hospitals, is described in an attractive booklet now being distributed by the Bryant Electric Co. Mine managers equipping hospitals will find it of interest.

Lawson loop-line tramways are described in a pamphlet put out by the makers, the Consolidated Tramway Co. These tramways use the over-hung bucket and find a special field in short-haul transportation.

The Ingersoll Rand Co. has published Form 8013, dealing with 'Little David' chipping hammers, and Form 8207, describing the 'Little David' drill, the pneumatic tools that are proving popular and finding wide use.

The Hardinge Conical Mill Co. reports that the war in Europe is not seriously interfering with its business in the belligerent countries. Early in September machines were shipped into France and September 24 two 6-ft. ball-mills were sent to Russia by way of Scotland and Archangel.

Mexican Labor and Its Peculiarities—By Max J. Welsh, page 597

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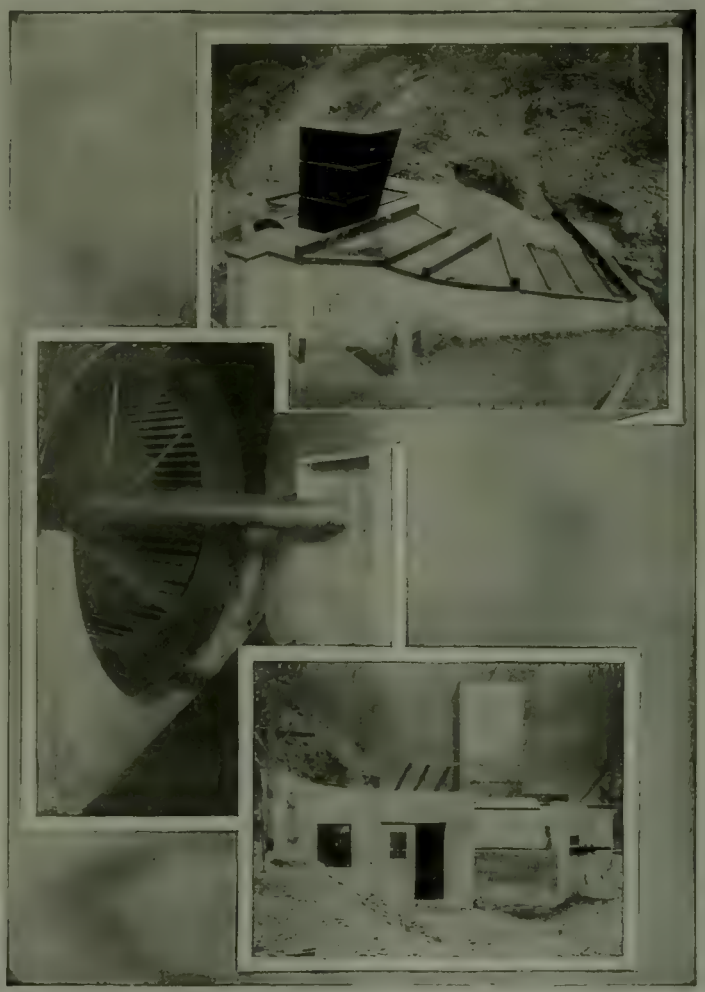

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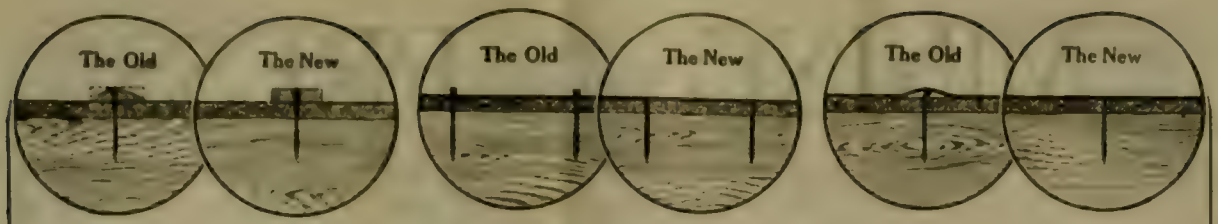

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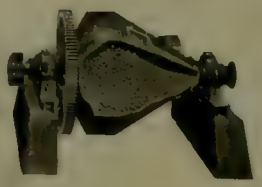

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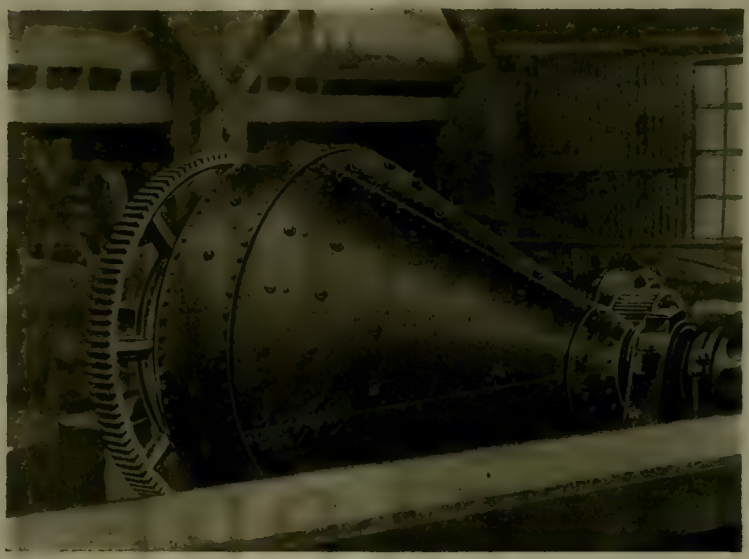

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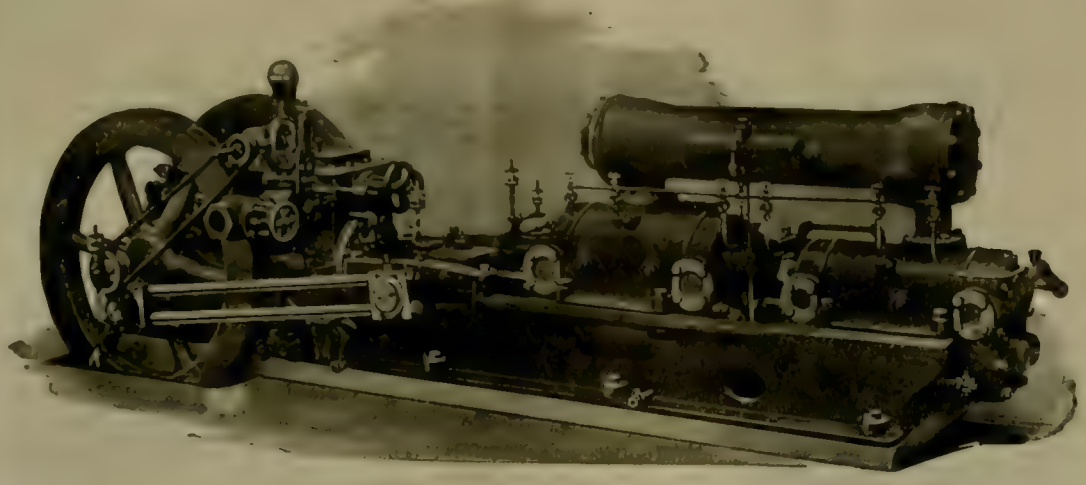

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With the Editor in Mexico

THE *Mining and Scientific Press* wishes to know the exact facts about present conditions in Mexico and to be in position intelligently to advise its readers and friends as to resumption of mining in that country. Following its usual custom, it has, therefore, sent one of its editors to learn of the situation at first hand.

Mr. E. H. Leslie, who has now been some time in Chihuahua and later will visit other parts of the Republic, is peculiarly well qualified to form a correct judgment in the matter, since he lived in Mexico three years, and, as technical editor of *The Mexican Mining Journal*, had unrivaled opportunities to become acquainted with the land and the people. What he writes will be *authoritative*, which means that it will be up to the *Press* standard.

This is not the first time an editor of the *Press* has been in Mexico. When Mr. T. A. Rickard came West to assume the editorship he made a fruitful 'Journey of Observation' through the country. Mr. De Kalb joined the staff after several years experience as an operator in that country, and left it to assume the management of an important enterprise in Sonora. Other members of the staff have visited Mexico enough to like the country and its people and to learn something of the problems faced by mine and mill managers in the land of 'manaña.'

The interest of the United States in Mining in Mexico is large and will be larger. To keep informed, read the *Press*.

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A COMPLETE report upon the meeting of the American Institute of Mining Engineers held at Pittsburgh last week is presented on page 588. The meeting was well managed, well attended, and of much technical interest.

IN SPITE of the recent troubles in Mexico, necessitating shutting down its smelters there, the American Smelting & Refining Company made more than enough profit during the first half of the current year to pay dividends on all of its stock. Many holders feared that this would not be possible.

CAMBRIDGE UNIVERSITY, England, has offered facilities to the Louvain University of Belgium to move temporarily what remains of that institution to Cambridge. Besides this offer, this seat of learning has provided about 1500 trained men as officers for the regular English army, while the eastern general hospital has been arranged in the courts and grounds of one of the large colleges.

MEMBERS and delegates attending the meeting of the American Mining Congress at Phoenix, Arizona, in December can be sure not only of an interesting meeting but a pleasant visit. The reception committee under the chairmanship of Mr. Will L. Clark, includes Messrs. Walter Douglas, B. Britton Gottsberger, L. S. Cates, C. E. Mills, Norman Carmichael, John C. Greenway, D. C. Jackling, and L. D. Ricketts. We understand that the committee has taken hold in earnest and that no effort will be spared to see that visiting technical men get a correct impression of Arizona hospitality.

ADOPTION of gasoline locomotives for use underground has been retarded because of danger to ventilation, but there have been few observations upon which to determine the exact amount of danger and the range within which the locomotives might be used without special safeguards. The figures therefore presented at the Pittsburgh meeting of the Institute of Mining Engineers by Mr. O. P. Hood, the chief mechanical engineer of the United States Bureau of Mines, are especially welcome. Evidently the situation is one where care in planning and in operation will permit the safe introduction of a form of engine which on surface roads is revolutionizing transportation. The auto-type of locomotive has many advantages underground.

CANADIAN authorities have appointed a special committee consisting of Messrs. O. E. LeRoy, G. C. MacKenzie, E. Lindeman, and J. McLeish, to investigate the need for a government bounty to stimulate iron mining in the Dominion.

THE Engineering Congress at San Francisco will be held in September 1915 as planned. The participating societies, after careful study of the situation and the probable effect of the war, have voted unanimously to carry out the original program. Promises of support are coming from all quarters, and even officers engaged in actual warfare are finding time to write that they will complete their papers at the earliest possible moment and send them in. It is even probable that the volume on military engineering, which had proved the most difficult to provide, will need to be enlarged to accommodate the material offered.

FLOTATION is finding many and wide applications. Mr. Clifford J. Dennis has been conducting experiments at the St. Johns mine on quicksilver ores, and with most gratifying success. With an old ice-cream freezer for apparatus he produced a heavy froth and a clean separation that promises well for commercial results with standard apparatus. This is all the more important since wet concentration of quicksilver ores, while often tried, has never been successful in any large way. The quicksilver mines are all working on lean ore and if flotation can be used, not only may costs be reduced, but the usual result of rendering available much material that is now waste will follow.

OUR recent editorial on tin smelting has called out the information that the most recent geological studies of the Bolivian tin mines give more ground for belief in the persistence of the deposits in depth than was previously available. While in general the workings are still shallow, veins have been proved to depths of 1500 feet below the apex, taking into account work above as well as below the adits through which deposits are worked. Bolivia would seem to afford the best opportunity for developing an independent supply of tin for the United States. The difficulties inherent in the fact that the mines are not well developed and do not carry much ore in reserve, are serious but not fatal. This is a good time to make the attempt.

FATALITIES in the metal mines of the United States, while more numerous in 1913 than in 1912, were at a lower rate, according to figures collected by Mr. Albert H. Fay for the United States Bureau of Mines. The total number killed in 1913 was 683, as compared with 661 in 1912, but there having been 24,000 more men employed, the ratio was 3.54, as against 3.91. All the great mining states of the West, except Colorado, showed a gratifying decrease in the accident rate.

FLOTATION AND THE PATENT LAW

The October meeting of the San Francisco section of the American Institute of Mining Engineers was especially interesting, since laboratory demonstrations and informal discussion displaced set papers. Mr. Edward Steidle, of the United States Bureau of Mines, brought to the meeting plans of self-contained breathing apparatus such as is used in the mine-rescue work of the Bureau and gave a most interesting discussion of the peculiarities, advantages, and disadvantages of each type. Following this, Mr. James M. Hyde told of the development of the flotation process, illustrating his remarks by demonstrations on various ores made with standard laboratory apparatus.

Concentration by flotation has attracted much attention during the present century, both on account of its wide field of application, and the unfortunate amount of litigation in which it has been involved. The process gained great publicity on account of experiments and later the large scale of operation at Broken Hill, New South Wales, where for about 20 years water concentration of the silver-lead-zinc ores gave only 60 to 65 per cent recovery. As the ore contained garnet and rhodonite, which have almost the same specific gravity as zinc-blende, the reason of this low extraction is obvious. Since the adoption of flotation, recoveries on some ores have risen to more than 90 per cent, and the district has produced over 3,000,000 tons of zinc concentrate, equal to 20 per cent of the world's output of spelter during that period. Mr. Hyde briefly named and described the more important patentees and processes, and stated that according to Mr. Theodore J. Hoover, whose work, 'Concentration by Flotation,' is now available in a second edition, 64 individuals are responsible for the present condition of the art. Recent work would add still others to the list.

Flotation was mentioned first by Herodotus, who described how the virgins of that time dipped feathers in a tarry substance, and so caught gold from the streams. In the nineteenth century, Haines, in 1860, patented a process in England. He was followed by Bradford, and Miss Carrie J. Everson in 1886 in the United States. The Everson patent claims are somewhat remarkable, and were the basis of argument in recent flotation suits. Miss Everson's process was tried at Leadville in 1889, and about the same time at a mine in eastern Oregon. Then came Robson in England, and Elmore, who made the first serious attempt to work with the process. Next were Froment, an Italian, in 1902; Potter and Delprat at Broken Hill in 1903; Cattermole; Sulman and Picard; Kirby in British Columbia; the main development of the Elmore vacuum system; Sulman, Picard, and Ballot; De Bavay; Hoover; Horwood; Hyde; Nutter; Lister; Bradford; and Callow. Mr. Hyde explained what led to the adoption of the process at the Butte & Superior mine in Montana. The zinc ore there mined gave only about 60 per cent recovery by water concentration, and slime made in crushing refused to yield its minerals. By treating this by flotation, the recovery was raised to from 88 to 91 per cent. During the second quarter of the current year the mill treated 95,500 tons of ore, assaying 18.28 per cent zinc and 9.85 ounces of silver per ton. This yielded 57,824,296 pounds of concentrate assaying 53.24 per cent zinc. The total milling cost was $2.02 per ton of ore, of which Mr. Hyde estimated the flotation cost as between 50 and 60 cents per ton. At the Broken Hill South mill, crushing and water concentration costs $1 per ton, and the various flotation systems in use on the 'Barrier' average about 85 cents per ton.

As one who has had considerable experience in patents and litigation, Mr. Hyde made pertinent remarks on the patent laws of the United States, and suggestions for the reorganization of the patent office. A patent suit at present rambles from one court to another, and eventually may find its way to the Supreme Court. The ordinary courts should not, he thinks, be allowed to hear any such disputes, especially as the judges are not capable of understanding the technicalities of inventions and disputes arising over them. Procedure in the courts is now far too long, trivialities receiving too much attention. If a patentee is unsuccessful in a suit, he starts another in some other district and attempts to secure a local decision contrary to the first. This should not be allowed. There should be one court, preferably in Washington, for patent business only. It should be presided over by technical men. Another great waste of time and money is the practice of transcribing original testimony in question and answer form into a discourse, for another hearing. Mr. Hyde suggested that the Patent Office be re-housed and given a good library; that proper laboratories be available in which inventors should be required to demonstrate that they have really an invention; minute variations should be cast out; salaries of Patent Office officials should be made worth while; publication of all applications for patent should be required; and much discretion should be left with the patent examiner, as is done in this department in Germany. Mr. Hyde is of the opinion that the whole system of patents in the United States requires investigation and overhauling.

In this general conclusion he is evidently in accord with virtually all who have come into contact with the patent law. No one doubts the value of a patent system, but the present cumbersome and expensive method of determining the validity of a patent places a heavy tax on industry and certainly does not operate to reward inventors.

WORKMEN'S COMPENSATION AGAIN

A general workmen's compensation law went into effect in California the first of the current year. It is still too early to measure the general result, but within a few weeks it became apparent that the cost of indemnity insurance for mining companies had risen to prohibitive figures. We have discussed the various steps that have been taken to meet the situation, and in March we addressed a circular letter to 500 representative mining companies operating in the state, asking for cost data. With the resulting figures in hand, we have conferred with the Industrial Accident Commission and others directly concerned. While all the conferences were marked by the most friendly spirit, there seemed, for the moment, to be little that could be done. Two moves have, however, been made in part as a result of this activity. The Mine Owners' Casualty Indemnity Exchange has been organized and a start has been made toward the formation of a California Mine Owners Association. The present law provides no adequate means of organizing a mutual insurance company and, for reasons that we have already discussed at length, the insurance department of the Industrial Accident Commission has, so far as the mines are concerned, been unable to provide the state insurance that was expected to relieve the situation. The insurance exchange is one means of meeting the situation; a means that has proved adequate and acceptable in various other industries. The one organized for the miners is controlled by two experienced insurance men working with the mining men who have become members, and is enlisting support. There are objections to the exchange plan, but they are not insuperable, and if enough of the mining companies will join the exchange there is no good reason why they should not have excellent insurance at little more than cost. In the meantime the difficulties incident to insurance have brought into the field of action a number of the larger operators who feel that there is need for a general and permanent organization to represent the operating companies. At a meeting held at the Engineers' Club, September 21, an organization committee was formed which is to report to a second meeting held at the same place at 2:30 p.m., Wednesday, October 28. The committee, consisting of Messrs. Henry Mallock, W. F. Kett, William Hague, Gordon Hall, Seeley W. Mudd, and E. A. Stent, is busy drafting a set of by-laws and perfecting plans for the organization. A general invitation is extended to the companies to send representatives to this meeting.

The Industrial Accident Commission itself has not been idle. Despite the large amount of business naturally incident to its first year of work, the members have been carefully studying the situation. Mr. H. M. Wolffin, of the United States Bureau of Mines, has been in the field most of the year as agent for the Commission, and both by correspondence and personal conference the commissioners have been gathering data as to the experience of other states in insuring against the mining risk. The members of the Commission are anxious to afford any possible relief to the mining companies, and with that in view have issued a general invitation to all those interested to attend a conference at the headquarters of the Commission in San Francisco, Thursday, November 5, at 2:30 p.m. It has been suggested that the Commission might be of service in devising and proposing legislation, if any, which would tend to relieve the situation. One of these suggestions takes the form of a proposed state managed or state supervised mutual insurance company designed to secure protection to the companies at cost. The Commission has no desire to undertake such a charge unless there be a real need for it, but is willing to do what it can to help in any such movement. It is most important that the mining men and the Commission get together. Knowing both, we are satisfied as to the fairness of each, and we believe that the proposed conference will result in real benefit. We strongly urge mining men to arrange to attend.

PIONEERING IN OLD COUNTRIES

Influence of frontier conditions on the life and character of the pioneer of civilization is the subject of one of the many able essays written by Nathaniel S. Shaler. During the past century, frontiers throughout the world have steadily moved closer together until they have in most instances coalesced and disappeared. But within the settled regions there remain many scattered areas, such as the geologist would designate as inliers, in which frontier conditions still obtain. These, however, differ in essential particulars from the true frontier. A frontier is *per esse* remote; these regions are often contiguous to populous cities, and only resemble the true frontier in that they support with difficulty a sparse population. Many of the dangers and difficulties of true frontier life are thus removed, but others remain. The essential function of the pioneer consists in so modifying the aspect of the land that its produce, from being of little value to man, is altered into that which is of much value to man. Frontier problems persist, therefore, wherever arid, sandy, boggy, or otherwise unprofitable tracts of land remain to tempt the stout-hearted man to undertake to remake them nearer to his heart's desire. Even in such old countries as England and Germany large areas of this character still exist. Indeed, ordinary agriculture partakes to a large degree of this frontier problem, for the constant endeavor of the progressive farmer must be to cause crops to grow in increasingly greater abundance on the land which he cultivates. Every farmer is, therefore, to some degree a frontiersman and a geological engineer, for the fundamental problems involve engineering and geological chemistry. So although the frontier may go, many of its attributes will long remain with us, and its usefulness in character building will thus extend beyond the generation which sought the bounds of civilization, there to hew out a home.

Pittsburgh Meeting of the A. I. M. E.

EDITORIAL CORRESPONDENCE

PROGRAM

THURSDAY MORNING, OCTOBER 8

Register at General Headquarters, Schenley hotel, in charge of the secretary, Bradley Stoughton. Distribution of programs, badges, and committee ribbons, booklets to members.

THURSDAY AFTERNOON, OCTOBER 8

2:30 P.M.—Carnegie Library and Institute. Lecture Hall, rear of Museum. Address of Welcome by W. J. Holland. General technical session.

THURSDAY EVENING, OCTOBER 8

8 P.M.—Carnegie Library and Institute. Lecture Hall, rear of Museum. Informal reception, followed by illustrated lecture at Carnegie Lecture Hall on 'Ancient Methods of Manufacture of Iron in China,' by T. T. Read. Illustrated moving-picture lecture on 'Safety Methods in Mining' by representatives of U. S. Bureau of Mines: three reels showing method of mining anthracite coal at Nanticoke, Pennsylvania, explained by J. W. Paul. Two reels showing mining of iron ore at Mineville, New York, explained by Edward Higgins.

8:25 P.M.—Special excursion to Allegheny Observatory for the ladies and members by special trolley car, leaving Hotel Schenley at 8:25 P.M. and the Observatory at 10:25 P.M.

FRIDAY MORNING, OCTOBER 9

9:30 A.M.—Technical sessions of: Iron and Steel Section, Lecture hall School of Applied Industries, Carnegie Institute of Technology. Coal and Coke Section, State Hall, University of Pittsburgh. Non-Metallic Mineral Section, Hotel Schenley.

10:25 A.M.—Excursion for the visiting ladies and members to Heinz company's works.

FRIDAY AFTERNOON, OCTOBER 9

Excursions:

12:30 P.M.—Experimental mine at Bruceton. Leave Hotel Schenley by special trolley car for B. & O. R. R. station. Train leaves B. & O. R. R. station at 1:30 P.M. Round-trip tickets should be procured at B. & O. R. R. station.

1:25 P.M.—National Tube Co., McKeesport plant. Leave Hotel Schenley by special trolley car.

1:30 P.M.—Carnegie Steel Co., Homestead Steel Works. Leave Hotel Schenley by special trolley car.

1:35 P.M.—Harbison & Walker brick works. Leave Hotel Schenley by special trolley car.

FRIDAY EVENING, OCTOBER 9

7:15 P.M.—Informal subscription dinner at Hotel Schenley, banquet hall. Tickets for the dinner at $3 each should be secured at the registration desk.

SATURDAY MORNING, OCTOBER 10

9:30 A.M.—Technical sessions of: Petroleum and Gas Section, Hotel Schenley. Electricity and Miscellaneous Mining Topics, Hotel Schenley. Iron and Steel Section, Hotel Schenley.

SATURDAY AFTERNOON, OCTOBER 10

Excursions:

12:30 P.M.—Oil and Gas District at Oakdale, Pennsylvania. Leave Hotel Schenley on special trolley car for Pennsylvania station. Train leaves Pennsylvania station at 1:30 P.M. Round-trip tickets to McDonald, Pennsylvania, should be procured at Pennsylvania station.

1:40 P.M.—Bureau of Mines. Leave Hotel Schenley by special trolley car.

The 109th meeting of the American Institute of Mining Engineers was held in Pittsburgh on October 8, 9, and 10, under the auspices of the Iron and Steel, Coal and Coke, and Non-Metallic Minerals technical committees. The headquarters for the meeting was the Hotel Schenley, technical sessions being held in the nearby buildings of the Carnegie Museum, Carnegie Technical Schools, and the University of Pittsburgh. The morning of October 8 was devoted to registration at the Hotel Schenley and foregathering by the members, of whom many had come from a considerable distance. The management of the hotel unfortunately had failed to provide more than a few rooms, so that even some of those who had made reservations in advance failed to secure accommodations. The local members rose to the situation at once, however, and provided their visiting brethren with cards to the nearby Athletic and University clubs.

THURSDAY AFTERNOON

The technical sessions were formally opened in the afternoon by an address of welcome by W. J. Holland, director of the Carnegie Museum, on behalf of the city of Pittsburgh and of the local technical organizations. This was followed by a technical session, over which S. A. Taylor, chairman of the Executive Committee, presided. L. C. Morganroth presented a paper on the occurrence, preparation, and use of magnesite, which was briefly discussed by R. V. Norris, E. G. Spilsbury, and T. T. Read, the discussion turning chiefly on the possibility of the use of California magnesite in place of the Grecian magnesite now used in this country. The chief use of magnesite is for refractories, for which it must be dead-burned, and the views of Mr. Morganroth were that the California magnesite was more difficult to burn, mining costs in California were higher than in Greece, and freight charges from California were too high to permit shipment to the Eastern seaboard in competition with Grecian magnesite. A paper by E. C. Harder on the iron ores of Brazil was read in abstract by the secretary and briefly discussed by I. C. White, who emphasized the present lack of transportation facilities there, but pointed out that the present lack of coal may be overcome, since experiments have shown that the low-grade coal present can be washed and briquetted into a satisfactory fuel. George S. Rice next described the investigations of coal mine explosions being carried on by the Bureau of Mines at its Pittsburgh station, the paper being in some degree preparatory to the excursion to the experimental mine the following day. The technical session was concluded by a paper on the appraisal of coal lands for taxation, by H. M. Chance, read in abstract by R. V. Norris. This elicited vigorous discussion, as this topic always

does, the conclusion, as always, being that any scheme of taxation is unsatisfactory.

Thursday Evening

In the evening an informal session was held, again in the Carnegie Museum. Thomas T. Read briefly described the primitive methods of iron metallurgy and of deep-well drilling practised in China, illustrating how an elaborate technology can be worked out by the use of purely empirical methods. This was followed by a set of three reels of motion pictures, made by the Bureau of Mines, illustrating anthracite coal mining, and intended to impress on miners the need for safety precautions. These were explained by J. W. Paul, of the Bureau of Mines, and a second set of two reels, similarly illustrating iron mining at Mineville, New York, was explained by Edward Higgins. An alternative entertainment had also been provided at the Pittsburgh Observatory, where a new 30-in. refractor has just been constructed, and which several of the members took the opportunity to see.

Friday Morning

On October 9 three technical sessions were held in the morning, beginning at 9:30. The coal and coke session, over which R. V. Norris presided, met in the State hall of the University of Pittsburgh. H. N. Eavenson presented a paper on coal dust explosions, and in discussing this, S. A. Taylor suggested that since certain explosions of dynamite have been traced to wireless telegraph waves, the extension of this means of communication was possibly a new menace to safety in coal mining. A paper by A. E. Gibson on an aerial tramway for mining cliff coal was read by title, and S. A. Taylor pointed out that this was an unusual procedure and that the paper merited a good deal of attention. The paper by M. B. Yung, on the tin and coal deposits of the Fu Chuan district, China, was read by title, and T. T. Read indicated some of the more important features of the paper, George S. Rice also taking part in the discussion. J. P. K. Miller then described the manufacture of coke, illustrating his talk with numerous slides of by-product ovens. I. C. White, in the following discussion, pointed out that the use of by-product ovens was an example of true conservation and that not only the engineering profession, but the country as a whole is to be congratulated on their growing use. W. H. Blauvelt pointed out that by-product coke, at one time regarded as of inferior quality as compared to bee-hive oven coke, has demonstrated its superiority for many uses, one of its good features being its uniform quality. Referring to the dye-stuff industry and others based on coke oven by-products, he pointed out that the present situation is exactly similar to that of the tin-plate industry 25 years ago, and that ample raw material, chemical skill, and the willingness to produce such by-products are here available. If the industry can be protected by a tariff until it is firmly established here it will then be able to maintain itself without a protective tariff, but it is impossible to establish it without such aid. The other papers on the program were read by title and there was no discussion. About fifty members were present.

At the iron and steel section, which met in the Carnegie Technical Schools, and over which Albert Sauveur presided over 80 members were present. The paper by G. K. Burgess and others on the finishing temperatures and properties of rails attracted much attention and elicited general discussion, in which Messrs. Trimble, Webster, Dudley, Waterhouse, Weckhorst, Aston, Kenney, Gibbs, Waldo, Aiken, and Burgess participated. The paper by J. K. Furst, on the duplex process for making steel was read by title, and was discussed at some length, Messrs. McJohnston, Hebbard, Stoughton, McQuaid, and A. J. McKee taking part. Albert Sauveur then briefly summarized his paper on manganese steel and the allotropic theory, and written discussion by H. M. Howe and G. K. Burgess was read, to which Albert Sauveur replied briefly. The other papers on the program were read by title, and there was no discussion.

The section on non-metallic minerals, over which Heinrich Ries presided, met in the Hotel Schenley, and though the attendance was small, it was select. David T. Day presented the paper by W. C. Phalen on the making of salt by solar evaporation. The other papers on the program were by E. H. Sellard on the mining of phosphate, and by J. A. Barr on Tennessee phosphate practice. In the general discussion, J. A. Dresser, O. B. Hopkins, D. T. Farnham, H. A. Gardiner, and G. B. Heckel participated.

Friday Afternoon

The afternoon was devoted to excursions. A large number went to the experimental mine of the Bureau of Mines at Bruceton, Pennsylvania, where the visitors were first shown through the mine, and then an explosion was set off, the crowd being grouped on the hillside to view the effects. Following the explosion, a trained crew was sent into the face to demonstrate rescue methods, after which the gases were blown out of the mine and the visitors were again permitted to enter and view the effects of the explosion. George S. Rice and J. W. Paul, of the Bureau of Mines, had charge of this excursion, which was handled with unusual skill and awakened much interest in the methods and results of the Bureau's work. A second party went to the McKeesport plant of the National Tube Co., a third to the Homestead steel works of the Carnegie Steel Co., and a fourth to the Harbison & Walker refractories plant. All these excursions were well attended.

Friday Evening

In the evening a subscription dinner was held at the Hotel Schenley, 135 members and guests being in attendance. After the dinner, over which S. A. Taylor presided, B. B. Thayer, Bradley Stoughton, and C. F. Rand spoke for the Institute, Mr. Thayer pointing out the growth which the Institute had made during the past year. The secretary of the Engineers' Society of

Western Pennsylvania spoke on behalf of that organization, and Mr. McCormick, chancellor of the University of Pittsburgh, gracefully expressed the welcome which the Pittsburgh members and the local organizations had extended to their visitors. I. C. White told of the importance of Mexico in the oil-production field, and Philip N. Moore dwelt on the rapid growth of the Institute in recent years. The feature of the evening was the reminiscences of Edmund Pechin, one of the four surviving charter members of the Institute. Mr. Pechin, though over 80 years old, is still active of body and mind, and his accounts of the first meeting of the Institute in Pittsburgh and of events of the following years were greatly enjoyed by all. E. Gybbon Spilsbury related an amusing story of an iron-eating insect, constructed by himself and brother students in Germany many years ago, and which has been bobbing up in the daily papers of the world ever since.

Saturday Morning

On Saturday the sessions were all held at the Hotel Schenley, and the meeting rooms were crowded to full capacity. The program of the various sessions was as follows:

Petroleum and Gas—C. W. Washburne, 'The Capillary Concentration of Gas and Oil;' L. Edeleanu, 'Refining Petroleum by Liquefied Sulphur Dioxide;' general discussion on 'Gas and Oil Wells through Coal Seams.'

Electricity and Miscellaneous Mining Topics—S. S. Rumsey and W. F. Schwedes, 'A Test of Centrifugal Motor-Driven Mine Pumps;' O. P. Hood, 'Gasoline Locomotives in Relation to the Health of Miners;' G. S. Rice and H. H. Clark, 'Shot-Firing in Coal Mines by Electric Circuit from the Surface;' general discussion on the 'Use of Electricity in Mines' (under the direction of the committee on the use of electricity in mines).

Iron and Steel—J. C. H. Ferguson, 'Rolled Steel Roll Shells;' J. V. Emmons, 'Surface Decarbonization of Tool Steel;' R. H. Rice, 'Turbo Blowers for Blast-Furnace Blowing;' Edwin Higgins, 'The Safety Movement in the Lake Superior Iron Region;' Harrison Souder, 'A New Safety Detonating Fuse.'

The session of the committee on use of electricity in mines was presided over by William Kelley, and concluded with a general discussion of the advisability of appointing a committee to formulate a set of rules governing the use of electricity in mines. It was the consensus of opinion that the distinction between rules intended for the operator and regulations to be enacted into state law should be kept clearly in mind.

The session of the committee on iron and steel was presided over by E. Gybbon Spilsbury. The various papers listed were read and discussed at a length that forbids summation here.

The session of the committee on petroleum and gas had for presiding officer David T. Day. The meeting was largely devoted to discussion of methods of refining oil. It ended with a general discussion of the problem of drilling wells through coal beds.

Saturday Afternoon

In the afternoon most of the members went to Oakdale, Pennsylvania, to visit the oil and gas district there, while a smaller group visited the Bureau of Mines plant in Pittsburgh. At noon the committee on nominations, W. J. Cox, chairman, held its meeting and made its report, which will be published in the November *Bulletin*.

Between 275 and 300 members and guests were registered as in attendance at the meeting, and the enthusiastic interest manifested in the technical sessions was a tribute to the quality of the papers presented, and to the skill and energy displayed by the chairmen and members of the coal and coke, iron and steel, petroleum and gas, non-metallic minerals, and electricity committees which had general charge of the meeting. No less is credit due to the members of the local committees, who were:

Executive Committee—S. A. Taylor, chairman; G. S. Rice, K. Seaver, J. S. Unger, F. C. Phillips, O. P. Hood, C. F. W. Rys, secretary.

Reception Committee—Dr. W. J. Holland, chairman; Dr. S. B. McCormick, Dr. A. A. Hammerschlag, Dr. John A. Brashear, A. C. Dinkey, Taylor Allderdice, Ralph Harbison, Joseph Guffey, W. K. Fields.

Finance Committee—S. A. Taylor, chairman; K. Seaver, C. F. W. Rys.

Entertainment Committee—W. L. Scaife, chairman; W. G. Wilkins, E. K. Hiles, John W. Boileau, W. E. Fohl, W. W. Keefer.

Committee on Arrangements—H. B. Craver, chairman; Frederick Crabtree, H. B. Mellor.

Costs at the Goldfield Consolidated mine and mill in August were as follows:

Mining:	Per ton.		Per ton.
Stoping	$2.31	General expense	$0.48
Development	0.60	Bullion tax	0.08
	$2.91	Construction	0.41
Shipping expense	0.05	Filter royalty	0.05
Contract ore	0.39		
Dump moving	0.04	Total cost	$6.49
Transportation	0.07	Miscellaneous earnings	0.25
Milling	1.93		
Marketing	0.08	Net cost	$6.24

Bismuth production of the United States in 1913 was estimated to be 157,300 lb., worth $273,650. Imports were 117,747 lb. valued at $213,257. No large deposits have been found in this country. The output in foreign countries in 1912 was as follows: Australia, metal and ore, 257,802 lb., worth $72,530; Bolivia, ore, 1,053,799 lb., worth $83,637; Peru, metal in ore, 112,518 lb., worth $68,885; Saxony, refined metal, 7145 lb., worth $12,763; and Spain, ore, 160,965 lb., valued at $1801.

Gold production of Alaska to the end of 1913 was $228,392,540, of which $15,626,813 was recovered in 1913.

How to Make Money Through Mining

In the course of an address before the northern California and southern Oregon Mining Congress a few weeks ago, William A. Burr gave some excellent advice that we cannot do better than reproduce. He said:

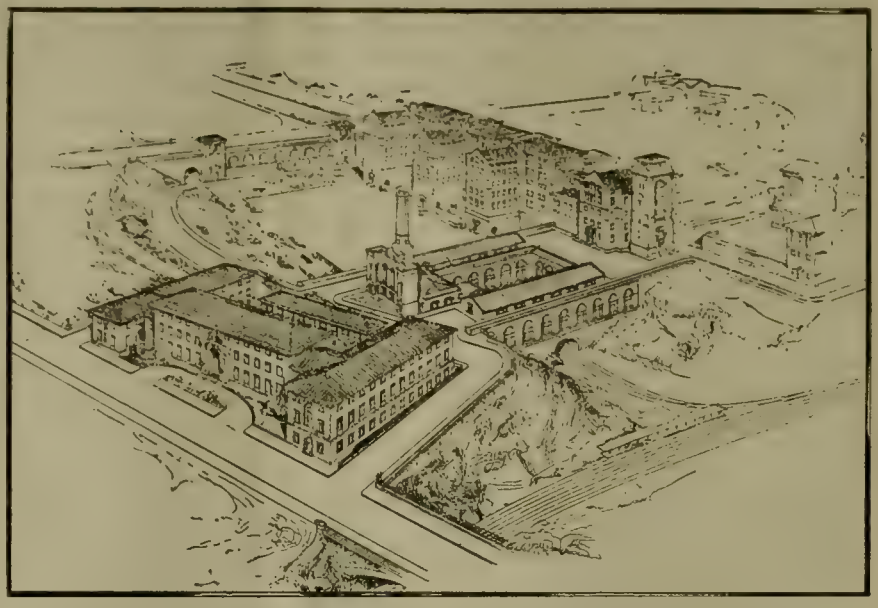
Keep the mill running, keep the stamps dropping; don't hang up for every little thing. Teach your men to change screens in three minutes; to dress plates, if you insist on amalgamation, in ten minutes. Teach them to adjust a tappet on one stamp with the other four dropping. Teach them to feed so that the stamps will rebound without pounding cold iron. Teach them to keep grease on the cam shaft and bearings and not in the mortars and on the plates. Teach them to make repairs without shutting down the mill. Teach them to make the concentrators do their work, and not to try to secure results from them with an inch of pulp running over them. Teach them to keep track of the time lost by various machines and of the reason for such lost time. This gives them a due appreciation of how much the capacity of the mill is being curtailed by the 'hanging-up' habit, affords a basis for the accurate approximation of the tonnage passing through the mill, gives a line on the competency of the mill man in manipulating the plant, and serves as an indicator for the management and the metallurgists as to defects in the machinery or in its installation.

Above all else, teach them to keep the mill clean. The mill man who turns his shift over with shafting and machinery lubricated and floors swept and dry, is entitled to protest if the man on the opposite shift does not turn the mill over to him in the same way. If you are cyaniding, teach him not to try to filter through a one-eighth inch carbonate of lime. Teach him to run the tanks, samples, and solutions by the clock, to plug leaks in tanks and launders and avoid losses in solution, as that means losses in money.

In conclusion I will say, don't decry the scientific part of milling and other branches of metallurgy, but absorb as much of it as you can, subscribe for the leading mining magazines and journals, they will get you abreast and keep you abreast of the times. Hydro-metallurgy is making great strides, it has brought about a new era in many gold and silver camps which were formerly hopelessly unprofitable. It is doing the same thing for copper camps today.

New Buildings of Bureau of Mines

Coincident with the opening of the meeting of the Institute of Mining Engineers at Pittsburgh, detailed plans for the $500,000 group of buildings for the United States Bureau of Mines were made public. The main building, in the front of the group, is divided into three parts, the central being for the mining engineering department and the administration offices, the east wing for the electrical engineering department, and the west wing for mechanical engineering. The architecture conforms with that of the Carnegie Technical Schools buildings. The building in the rear will house the testing laboratories. On each side of it, subsidiary buildings will bridge the hollow between the mines group and the Tech plant. Between the front and rear buildings there will be entrances to several experimental mining shafts. Only $150,000 of the $500,000 authorized by Congress to be spent in the erection of the group has thus far been appropriated, but it is believed that sum will cover the cost of the plans, the preparation of the site and the foundation work.



PROPOSED GROUP OF BUILDINGS FOR THE U. S. BUREAU OF MINES AT PITTSBURGH, WITH BUILDINGS OF THE CARNEGIE TECHNICAL SCHOOL IN THE BACKGROUND.

The war being waged adjacent to their countries has affected Swedish and Norwegian undertakings considerably. The Kurunavaara and Luossavaara iron mines are working, but the ore is being stored; the Kjöli pyrite mines are closed; construction at the Nitrogen Products & Carbide Co. has been suspended; the great Dunderland iron mines have stopped construction; the Foldal Copper Co. has increased its working force; the Evje nickel works, near Christiansand is again at work; and the Hafslund carbide plant is to resume; while other corporations, constructing hydro-electric plants, etc., have reduced their staffs, or are paying lower wages.

Gasoline Locomotives and the Health of Miners

By O. P. HOOD

None of the methods now in use for the transportation of materials underground is entirely free from objections. The great flexibility, ease of control, and economy of operation of electric tramming is accompanied by the serious menace of a trolley wire. As the gasoline locomotive has even greater flexibility of application and requires no similar dangerous distributing system, it might be considered a safety device which would make possible the elimination of the dangerous trolley were it not possessed of other objectionable qualities peculiar to itself. It is found that the exhaust gases from the engine may be injurious to the health of those breathing the air in which the locomotive has been operating. While electric shock may kill the individual who makes contact with uninsulated parts, the gasoline engine may be detrimental to the health of all those who have to work within the atmosphere corrupted by its exhaust gases. The degree of pollution measures the magnitude of the menace. This may be negligible at times, but with careless operation it becomes serious. The exhaust gases from an engine are composed of nitrogen, a little free oxygen, hydrocarbons, hydrogen, carbon monoxide, and carbon dioxide, the last two being considered dangerous.

Effect of Carbon Dioxide

The presence of carbon dioxide as a product of combustion of the gasoline was recognized as an objection from the beginning of the use of these machines, but attention was called to the fact that the amount produced was relatively small as compared to other sources of this gas, and it was not likely to be made in dangerous quantities. The effect of carbon dioxide, except in relatively large percentages, is confined to reducing the oxygen content of the air that is breathed.

The presence of carbon monoxide in the exhaust gases in injurious quantities was less apparent, but it appears from what is now known that this is the limiting factor in the use of these locomotives if they are not to be injurious to health. The presence of carbon monoxide in the air in relatively small quantities has been shown to have a marked effect upon the blood, producing sickness, and, if inhaled in sufficient quantity, death.†

It is difficult to get those most conversant with the effects of carbon monoxide to assign a definite limit to the amount which may be in the air without detriment to health. There is no sharply defined line on one side of which is to be found safety, with danger on the other side. It has been shown that the physiological effects vary with different people, and with the state of health and degree of activity required of the individual, so that a condition which may be considered safe may prove to be unsafe under conditions of harder work and unfavorable physical state. After careful inquiry, the best that can be stated at this time is that, without injury to health, no more than 0.1% of carbon monoxide can be breathed and that for short and infrequent intervals. It is probable that one-half of this percentage could be allowed for a considerable period of time without noticeable effect.

Protection Against Carbon Monoxide

The per cent of carbon monoxide in the mine air depends upon the amount made by the engine and on the quantity of air with which it is mixed. It will be necessary to provide ventilation for the worst possible combination of gases which such engines can make under unskillful handling, or else to become informed as to the actual amount of carbon monoxide produced and provide air accordingly. To provide for the worst conditions it becomes necessary, then, to consider the gasoline locomotive as a carbon monoxide producer, and to discover the maximum quantity of this gas which any engine is capable of making. It is not sufficient to consider the average amount produced as distributed over the whole time of running such a machine. The total quantity of gasoline burned in any one day may have produced but a small quantity of carbon monoxide, but if this has been confined to a relatively short period during bad carburetor adjustment, and in some poorly ventilated space, the momentary percentage may be very high and the consequences may be fatal. It is evident that to be entirely safe the ventilation must be sufficient to keep the percentage of carbon monoxide below the assigned limit when the engine is producing the maximum quantity possible. If this maximum quantity is provided for by proper ventilation, the chance of injury to health may be considered to be remote. Certain peculiarities of gasoline engines cause the percentage of carbon monoxide generated to vary between rather wide limits, but the maximum is fairly constant. No other constituent of the exhaust gases varies so much or so rapidly with slight changes of adjustment as does the carbon monoxide.

Maximum Gas Production

Extended experiments have been made by the Bureau of Mines to determine under what conditions of running, such locomotives give a maximum quantity of carbon monoxide. This maximum quantity is found when the engine is running at full load and full speed, and when burning the greatest quantity of gasoline which will

*Prepared for the Pittsburgh meeting of the Amer. Inst. Min. Eng., printed by permission of the director of the U. S. Bureau of Mines.

†A discussion of the effects of these gases is to be found in *Tech. Paper* 62, U. S. Bureau of Mines, by G. A. Burrell, F. M. Seibert, and G. W. Robertson.

maintain these conditions. Any further enriching of the mixture results in weaker explosions, misfires, and reduction in speed of the locomotive, and thus a reduced total quantity of gases. The weight of gasoline used per stroke may vary nearly 100%, without varying the speed or power. As the mixture is enriched the combustion is less complete, reducing the efficiency but affecting the power but little until the upper limit of explosibility is approached, when the power falls rapidly. Under these conditions a maximum quantity of carbon monoxide equivalent to 53½% of the piston displacement may be generated and delivered into the surrounding air. When the engine is throttled down to a slow speed and with a light load it is possible to produce exhaust gases containing a greater percentage of carbon monoxide, but the total quantity is less because of the slow speed of the driving engine. It can therefore be stated that the amount of carbon monoxide possible to generate with a gasoline locomotive is a function of its piston displacement.

The sizes of locomotives in common use at present are given in the accompanying table, together with the maximum quantity of injurious gases which they may generate.

The air with which the exhaust gases are mixed is the air passed by the locomotive. If the speed of the air current and that of the locomotive are the same there would be a concentration of exhaust gases immediately surrounding the engine, which would very soon reach the danger limit. The engine runner would be exposed to this excessive amount. Similarly, the air may be stationary, and if the locomotive passes through this air at such a rate as to distribute the exhaust gases into the required quantity of air the dilution may be below the danger limit. It becomes necessary, therefore, to investigate the relative velocity of the locomotive and the air current, together with the cross-section of this air current in order to determine whether a sufficient quantity of air is passed to insure a proper dilution. The mixing due to the movement of the cars and the diffusion of the gases is expected to distribute the gases through the air.

An investigation of this kind will frequently disclose some portion of the run of the locomotive where the air and the locomotive are traveling together and the dilution is insufficient, forming the basis for just complaint. By a change in the speed of the locomotive, or more careful running, perhaps with lighter loads, these

TABLE I

Engine cylinder size, inches.	Number of cylinders.	Speed, r.p.m.	Piston displacement (cu. ft. per min.)*	Maximum probable amt. of noxious gases (cu. ft. per min.) at 60°F. and 30-in. barometer produced with				Amt. of air (cu. ft. per min.) required to dilute exhaust gases to 1 part carbon monoxide per 1000 parts air.†	
				Good carburation.		Bad carburation.		Good carburation.	Bad carburation.
				CO	CO_2	CO	CO_2		
4.75 by 5.25	4	800	172	2.61	6.80	9.91	3.65	2,610	9,910
5 " 5	4	600	136	2.06	5.37	7.84	2.88	2,060	7,840
5 " 5	4	800	182	2.76	7.18	10.48	3.86	2,760	10,480
5 " 6	4	800	218	3.30	8.60	12.56	4.62	3,300	12,560
5.5 " 5	4	600	165	2.50	6.51	9.50	3.50	2,500	9,500
6 " 6	4	700	275	4.17	10.86	15.85	5.82	4,170	15,850
6 " 7	4	500	229	3.47	9.04	13.19	4.85	3,470	13,190
6.5 " 7	4	500	269	4.07	10.63	15.50	5.70	4,070	15,500
6.5 " 8	4	650	399	6.04	15.76	23.00	8.46	6,040	23,000
7 " 7	4	500	312	4.73	12.33	17.97	6.62	4,730	17,970
7 " 7	6	500	468	7.08	18.49	26.97	9.92	7,080	26,970
8 " 7	4	500	407	6.16	16.08	23.45	8.62	6,160	23,450
8 " 7	6	500	610	9.24	24.10	35.14	12.93	9,240	35,140

*Area piston in square feet by stroke in feet by number of cylinders by revolutions per minute.
†Amount of carbon monoxide allowed for short and infrequent intervals and which must not be exceeded.

The size of a locomotive that may with safety be introduced into a mine depends upon the amount of air that can be mixed with the exhaust gases in the most unfavorable portion of the run of the locomotive. For each cubic foot of carbon monoxide possible to generate in the engine there should be available 2000 cu. ft. of air to mix with the exhaust gases if this air is for continued breathing, while for short and infrequent intervals the proportion may rise to one part in one thousand.

difficulties can frequently be overcome. It is evident from the foregoing that it is a dangerous practice to allow locomotives to stand idle for any length of time in situations where there is not ample movement of air. The introduction of a self-starter on locomotives which are compelled frequently to wait for cars would be a great aid. The engines on these locomotives are usually difficult to start, and to stop the engine whenever the locomotive is compelled to wait for a few minutes would not be practicable unless some easy means of re-starting

was provided, but this practice would greatly reduce the chance of air pollution.

The requirement that not less than 1000 cu. ft. of air shall pass the locomotive for each cubic foot of carbon monoxide possible for the engine to generate, will limit the size of the locomotive in many cases to sizes less than are now in use. It may also limit the movement of these engines to main entry-ways.

This maximum quantity of noxious gases which is here provided for should not actually be realized with improved carburetor construction and skillful manipulation. The percentage of carbon monoxide in the exhaust gases under the worst conditions is about 13½%, while under normal running conditions the amount seldom exceeds 6%. It is this great variation in the possible amount of carbon monoxide due to unskillful operation that makes the experience of different users of these machines vary through the wide limits noted. If a locomotive is used in a place where the quantity of air is not sufficient properly to dilute the maximum quantity of carbon monoxide, analyses of the exhaust gases should be made to determine just what percentage is actually produced with the carburetor in use and the methods employed in running these machines. The ventilating current may then be regulated to conform to the actual amount of carbon monoxide as found. It is proposed that this be done by a method somewhat as follows:

Suppose, upon analysis, that the actual amount of carbon monoxide is found to be not over 4%; allowing a factor of safety of 2, and assuming that this percentage might on occasion mount to 6%, and, since the maximum percentage possible is about 13½%, the ventilating current required can be regulated in the proportion of 8 to 13½.

If a careful study is made of the amount of air available for dilution throughout the run of a locomotive, and the quantities are kept within the limits that are here proposed, a wide field of usefulness for these locomotives remains, where it is believed there would be no injurious effects upon health.

Thermit Weld of Broken Crank-Shaft

*On February 8, 1914, the engine driving the crushing plant of the Queen of the Hills gold mine, Meekatharra, fractured the crank-shaft. This is a tandem cylinder, 220-hp. gas-engine of English manufacture, and was installed at the mine about six months prior to the above date. The shaft is 13 ft. long and 11 in. diameter, with a single crank of 12-in. throw, the crank-pin also being 11 in. diameter. The cheeks of the crank were 7 by 12 in. rectangular section. The fracture occurred in the cheek of the crank between the crank-pin and the main shaft, partly tearing into the journal of the main shaft. Because of this the mine was idle, as no spare shaft was obtainable in the country. It was then decided to attempt a thermit weld as a temporary expedient to cover the period during which a new shaft could be imported from England.

On February 10 an engineer left Perth for Meekatharra, arriving there two days later. The shaft was inspected, the necessary material ordered by wire from Perth and landed in Day Dawn on the 14th. The shaft was removed from Meekatharra to Day Dawn, where the Company's workshops are situated, about 80 miles distant by railway, reaching there on February 17. By this time the special appliances required for the operation had been manufactured or improvised from material available at Day Dawn. These special appliances consisted of a thermit crucible capable of holding 560 lb. of thermit during its reaction. It was of conical shape, 4 ft. high, with a diameter of 22 in. at the top. The crucible was lined with magnesium cement and dried in a foundry coke-oven.

In lieu of face-plates and "V" blocks for leveling the shaft, a pipe molding box was secured in the foundry floor, perfectly leveled and capable of taking the long end of the shaft, the short end of the shaft being brought up to the same level on a piece of old boiler plate well bedded in the sand. The fracture in the crank-cheek was drilled and cut out, leaving a gap of 1⅛ in. for the thermit. The crank was set in its proper position relative to the shaft and securely bolted together, a stiff distance piece being inserted between the crank-cheeks to secure alignment. The short end of the shaft was placed $\frac{3}{16}$ in. out of line to allow for shrinkage, and being free on the boiler plate it had nothing to prevent the action. The judgment in deciding to allow $\frac{3}{16}$-in. shrinkage proved to be sound, as on completion of the work the shaft was put in the lathe and found to be perfectly true in every respect. The crucible of thermit was placed in position and all was ready for the reaction on February 20. The crucible contained 560 lb. thermit, and, in addition, 40 lb. of small bright wire nails, 5 lb. of nickel thermit, and 5 lb. of manganese free of carbon. The ignition was perfect, and the crucible securely held during its reaction. As soon as this subsided the crucible was tapped, and the metal successfully run into the mold prepared across the fracture. This mold was run from the bottom and all metal passed up through direct to the gap cut in the crank-cheek, the slag in turn passing through from the runner to the riser. As soon as the crucible was emptied a further charge of 22 lb. of thermit was put into the riser, which had sufficient temperature to ignite it, and so fed the casting through the riser and insured that no gas could be imprisoned.

The whole was left in position as cast till February 21. The spare material round the cast was then removed in the lathe, or by pneumatic chisel. The shaft was returned to Meekatharra on February 25, and the engine again started work on March 1, or only 22 days after the accident. Two tons of plant was required, in order to complete the work, which had to be conveyed by rail a distance of nearly 600 miles.

*Abstract from *Monthly Journal* of the Chamber of Mines of Western Australia.

Mining Methods on the Marquette Range

By Committee of the Lake Superior Institute of Mining Engineers Consisting of H. T. HULST, G. R. JACKSON, and W. A. SIEBENTHAL.

Shrinkage-Stope System

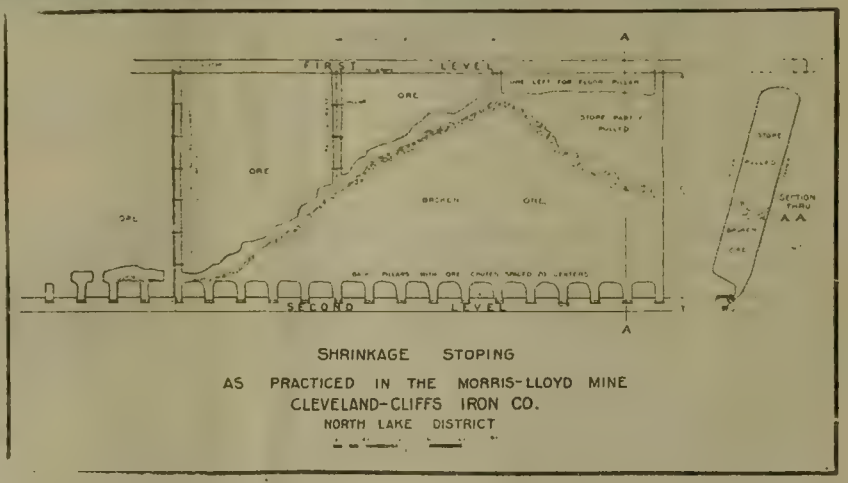
At the Lloyd mine of the Cleveland-Cliffs Iron Co., a form of the shrinkage-stope system has been followed in mining a part of the orebody. A siliceous orebody 500 ft. in length, and from 25 to 75 ft. in width, and from 50 to 175 ft. in thickness, has been taken out according to this system. Because it forms the hanging of a narrow high-grade orebody, it had to be mined first. Furthermore, if it was to yield a profit, it had to be mined cheaply. After a study of conditions, the shrinkage-stope system was selected.

The formation in the North Lake district stands at a steep angle, the dip varying from 70 to 85°. In using this system of mining, there was no danger from falls of ground from the back, but special attention had to be given the hanging side of the stope.

The shaft is in the foot-wall 300 ft. away from the ore, this site having been chosen on account of the situation of the loading tracks. Levels were opened 150 ft. apart and crosscuts were driven from the shaft to the ore. Drifts were driven in the ore both ways in the formation to the limit of the orebody. These drifts were timbered with sets four feet apart, 8-ft. legs and 7-ft. caps being used. The orebody was developed by crosscuts turned off every 100 ft. to determine the width and grade. The main haulage drift was driven near the foot-wall, in the wide part of the deposit; a parallel drift was later driven near the hanging, as the orebody was too wide to be removed in one stope. Up to widths of 40 ft. the ore was removed in one stope; greater widths were taken out either in a parallel stope with a pillar between, or by stopes at right angles with pillars between. This latter method was used where pockets of ore extended into the hanging at points above the main level.

As the body was being developed on the main levels, rises without cribbing were put up to the top of the ore every 100 ft. Above the first level these rises connected with each other at the top, and two rises were extended through to surface. The rises from the second level were carried up to the first level and holed on the side of the haulage drift. These rises provided traveling roads to the stopes, ventilation, and a means of bringing in the air lines. Small rises without cribbing, with 15-ft. pillars between, were put up 10 ft. above the level in the main haulage drift. These rises were strongly built, being reinforced with 40-lb. rails and 3-in. hardwood planks, because of the blasting of hang-ups. Chutes were built to these rises. At a point about 15 ft. above the level the rises were connected; the stope was then opened to full size, and mining started. One gang of miners worked about 50 ft. of the stope, or the territory above three rises. Each miner had a drill, there thus being two machines to one contract.

About 30% of the broken ore had to be drawn from the stope to make room for the men to work. One laborer was required to each 100 ft. of stope to sledge the large pieces. Occasionally it was necessary to block-hole large slabs which had been blasted or barred down from the hanging side of the stope. On the completion of the stope, the chutes were drawn as nearly equal as possible, as this seemed to prevent blocking. This system of mining has worked out very satisfactorily as regards costs and safety.

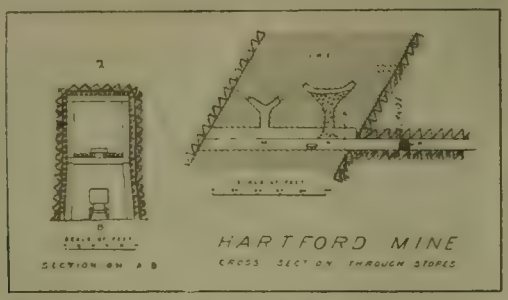


SHRINKAGE STOPING
AS PRACTICED IN THE MORRIS-LLOYD MINE
CLEVELAND-CLIFFS IRON CO.
NORTH LAKE DISTRICT

Stoping System, Hartford Mine—Republic Iron & Steel Company

A comparison of the methods of mining at the Hartford and Section 21 mines shows many points of similarity; the chief difference between them is that the Hartford employs overhand stoping, and Section 21 underhand stoping. The ore at the Hartford is peculiar as to its physical character, being a little different from any hematite heretofore produced on the Marquette range. In consequence, the usual methods of mining such deposits failed to give the desired results, so that considerable experimenting was necessary in the early stages of development to find the most economical system for removing the ore.

The room-and-pillar system was tried on the 750-ft. level with but indifferent success, and was finally abandoned for the overhand-stoping and milling system modified and combined. In developing the orebody the ground broke in such large masses that it was almost impossible to keep the opening small enough so that standard sized drift sets could be used. Frequently a space of 12 or 15 ft. would open up between the timber and solid ground. As a result, a prohibitive amount of lagging had to be used, and even then the drifts were always dangerous and expensive to maintain because of the breaking of timbers and blocking of the tracks. To overcome this difficulty the openings were driven two sets high; little additional labor was required to break the ground to this increased height.



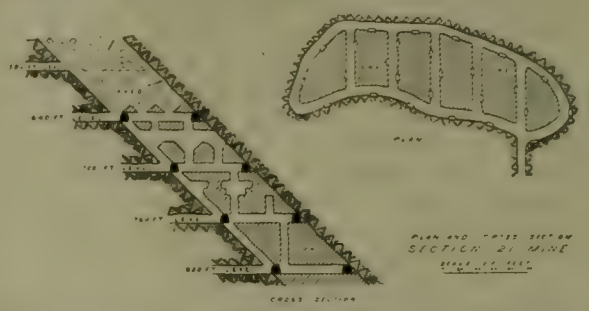
The illustration shows a cross-section through two of the stopes which were started from rises put up from a cross-cut. The stope marked N is a little farther advanced than M, in which the core has not yet fallen. No timber is used in the rises or stopes; thus no ladderways can be maintained in the openings through which the ore is milled. The working faces of the stopes are reached through the rises which are put up at frequent intervals from the foot-wall drift marked K. The stopes themselves are also connected by small drifts entirely independent of the drifts from the rises, so that there may be half a dozen or more ways of entrance or retreat. As the stopes advance, several may connect before the level above is reached. Where this happens, the conical shape is not continued, but the sides are carried up vertically instead; or one stope may be abandoned while the other is developed as originally started.

The section through the double-set drift shows a method of filling cars without using the chutes found in so many mines on the Marquette range. The caps of the lower set of timbers are lagged over to an opening in the centre directly above the track, and this opening is covered with short pieces of timber which can easily be removed to let the ore fall into a car below. When any considerable tonnage falls away at one time from the core of a stope, masses several feet in diameter must be reduced to a size small enough to pass through the opening in the lagging. With the double-set drift these masses are always accessible.

Section 21 Mine—Oliver Iron Mining Company

In the western portion of Section 21 mine a stoping system is now used which has proved both economical and safe. The physical character of the ore is such that no timber is required except for the construction of chutes for handling the product when it is drawn from the mills.

In the opening of a new level, a cross-cut is driven from foot to hanging and both are then followed until the drifts connect. Cross-cuts are usually driven between these drifts at distances of from 50 to 60 ft. Rising is started on the foot-wall as soon as development has advanced enough so that a chute can be operated without interfering with the other work on the level. The foot-wall rise is put up at this time chiefly for ventilation purposes and traveling way, as it is not needed for handling ore until later. The ideal section shows a cross-cut on 820-ft. level driven to the hanging with foot-wall rise completed, also another rise connected with the level above. Rises from the 760-ft. level show the system of milling; the dotted lines indicate the next step in advance. A floor pillar of six to ten feet is sufficient to support the level until all the available ore above it has been removed. Between the 700 and 640-ft. levels a condition still further advanced is shown, and on the 640-ft. level is shown the final stages of removing the pillars.



Practically all of the ore was removed to a depth of 350 ft. by this method without any apparent weakening of the hanging, but below this depth it has been necessary to modify the system so as to prevent caved rock from contaminating the ore. To accomplish this the pillars above the nearly exhausted level, as well as the floor pillars below it, are drilled and blasted continuously by fuse firing, with the result that the ore falls into the mills and is drawn from the chutes on the level below without any appreciable contamination.

All rises are vertical or nearly so, with the exception of the foot-wall rise and a few next the hanging. A plan of the workings just below the floor of each level, after mining has been started, would show a succession of circular mills of various sizes with a rise in the centre of each. Numerous rock intrusions and dikes make it impossible to conform rigidly to any predetermined geometrical plan further than to place rises to reach the thickest portions of the pillars on the level above. Although the drawings show four levels in operation, this is not the actual condition in practice; instead, all of the various stages of development shown in detail are worked simultaneously over different parts of one level.

VIEW FROM THE STACK AT AGUASCALIENTES SMELTER.

Mexican Labor and Its Peculiarities

By MAX J. WELCH

The mining and manufacturing interests contemplating operations in Mexico when the present war is over, are interested in the peculiarities of Mexican labor. It will not be out of place to review some of the native religious and social customs, in so far as these play an important part in the employment of labor.

To understand Mexico one must know something of its geography. Upon entering Mexico from the United States, by way of El Paso, there is a 30-hour ride by rail, due south over a sand and cactus desert. Each year the cactus grows and each dry season the wind blows sand against the cactus, until mountains of sand are formed hundreds of feet high. South of this desert country lies a tableland, from 4000 to 6000 ft. above sea-level. This tableland is the region of rich soil and fine climate that attracted Cortez and his Spanish followers in the fifteenth century. The country slopes down to the Pacific ocean upon the west and drops abruptly to the gulf upon the east. Toward the south it is mountainous. In the north-central part of this tableland is the city of Aguascalientes. This city derives its name from *agua*, meaning water, and *calientes*, meaning hot; the city being near a hot spring. Aguascalientes is the second largest city in Mexico and is also an important mining and railroad centre. Near Aguascalientes is the 'La Gran Fundición Central Mexicana,' which translated means, the great foundry or smelter of central Mexico. This smelter came into existence in the early eighties at a time when Porfirio Diaz was offering extensive inducements to foreign enterprise. It was subsequently purchased by the Guggenheims and later became one of the plants of the American Smelting & Refining Company.

When this smelter was first established it was at the request of the President that Mexican laborers were not paid more than 25c. per day. The reason given for this maximum wage scale was that the farmers paid only this wage. If the smelter paid more, the farmers would not be able to secure help in harvest time. As soon as the novelty of work at the smelter wore away, it became necessary to increase the wage scale. From time to time the wages have gradually increased until now it is often a close decision whether to use crude methods and Mexican labor or to use labor-saving machinery and American men. Along the northern border of Mexico labor-

MEXICO, SHOWING THE MEXICAN CENTRAL LINE.

saving machinery has been introduced with great success. Mexicans prove very efficient in the simple duties of attending a machine, though skilled mechanics are required to keep the machinery in working order.

Responsibility is a word that is not in the Mexican people's vocabulary, and the meaning of responsibility is not to be taught to him. To understand why, requires knowing something of his origin. The Mexicans are a race produced by crossing the old world Spanish and the American Indian. The early Indians were a hardy type of men who lived close to nature. They knew little of responsibility. The fifteenth century Spanish were characterized by diplomacy, art, and refinement. Now, when diplomacy is injected into the Indian race, the result is a Mexican; in other words, a type that diplomatically shirks responsibility.

The possible use of the present type of Mexican is therefore limited to routine work. He must be under the supervision of a patient and careful foreman. The foreigner makes the best foreman, whether he be American, German or French. The tendency is for the foreman to become soon a human 'cussing' machine. This is the case when the foreman expects too much from the Mexican, but this is unwise and unnecessary, as it can be shown that patient watchfulness, with slight losses, is more profitable in the end. To swear at a Mexican is to win his enmity. This develops his tricky and deceptive nature. In one instance the carpenter foreman had made a template of a building rafter. The Mexican carpenters used only to saw the rafters like the template. When the building was erected it developed that the Mexicans had cut every rafter a different length. This playing of tricks on the foreman, by destroying lumber, holding a tape line short of the scratch line, mixing samples of ore, breaking machines to get a *siesta*, is a trait of character that will require many years to eliminate from the Mexican laborers.

SMELTER GATEWAY AT AGUASCALIENTES

There are certain people, the world over, who do not believe in the storage of human energy. Money, the representative of human energy, is to keep in circulation, not to store up. The Mexican is an advocate of this principle. To give a man of a 'circulating' disposition too much money at one time will result in making him an unsteady employee. La Gran Fundición adopted the plan of paying every day. The system is not complex and results in keeping the men at work. When the timekeeper knows the rating of each employee, it requires less bookkeeping to pay him than to enter the account.

Toward the interior of Mexico the natives are adept in the art of pilfering. All houses have iron bars over the windows to protect interior furnishings. Encircling La Gran Fundición is a high wall of adobe. During the late war this wall made the grounds a veritable fortress for the protection of foreigners. A very artistic Roman arch gateway adorns the entrance to the works. This gateway consists of three arches. It is the central arch which I wish to mention in particular. It is necessary to search every Mexican who passes out through this arch. This is done by a corps of Mexican guards. These guards look under the hat, feel over the pockets and under the belt. The material which is pilfered is not so valuable in small quantities, but a check has to be placed on the amount. The men will take belting with which to make shoes, bars of iron to trade to native blacksmiths, carpenter's tools, and almost anything they can secrete and carry.

The native Mexicans live in adobe houses which are built, as an American would say, "inside out." Adjacent to the sidewalk is a wall with windows. A front gate is attended by a servant at all times. The wealthy have inside the wall their own private court. The poor may have a colony of many families in one court and one common gate entrance. The home of a poor man consists of a room without any furniture except a bench, with a dirt floor, and a hole in the wall for a window. In cold weather they stop up the window and build a fire on the floor in the middle of the room. This system may be classified under the head of 'conservation of heat energy.'

It is difficult to change the habits and customs of a race of people. La Gran Fundición began to build a town for the workingmen according to the American system; the yard on the outside. The Company piped water into sinks and made these houses modern in every way possible. The Mexicans looked upon the project with scorn. Not one native could be induced to occupy a house built upon such unusual lines. The homes were afterward used for Chinese bunk houses.

The Mexicans wear very plain clothing, although they love bright colors. Prior to the age of two years, a child

inhabits his mother's shawl or *serape* when out in public. About the age of three he is given a garment which in the United States would be called a shirt. The life of one of these shirts is several years. Each year the shirt shrinks some and the youth grows some: the reader only needs to draw upon his imagination to complete the story. At about the age of ten years the youth dons overalls. The older men wear hats and always carry a blanket over the shoulders. The women wear a one-piece suit resembling the garment known as a 'mother hubbard.'

In the early eighties, when Diaz was taking an interest in manufacturing and commercial enterprises for his people, he also instituted an educational system for the masses similar to that in the United States. The intention was to school the native children until some day Mexico could take its place in the civilized world. This educational system was virtually abandoned about ten years later for a reason that only students of history and religion can fully appreciate. The world has always been controlled by religion. It is a question how far the masses of the people can study a creed and not grow out of it. In Mexico the houses of worship are the same old stone churches that were built by the Spanish and Indians. There are no seats in these churches. Those who come first go up front and kneel upon the floor, and each successive person kneels behind his predecessor until the church is filled. Then they kneel upon the steps out into the street and across the road. The ringing of the chimes tells them the progress of the service.

Mexico is a country that is rich in minerals, it has a fine climate in the higher table lands, it has fertile soil and it cannot remain long as a play ground for the unprogressive. If its people will not develop their lands, others will.

Low Drill-Repair Cost on the Gogebic Range

By J. F. BERTELING

Unusually low costs for drill repairs are reported in work done at the Mikado mine, Verona, Michigan, on the Gogebic iron range, during the first half of 1914. In the first week of January 1914 the Verona Mining Co. began to sink the last 175 ft. of its Mikado shaft. For this work, four Sullivan 'Liteweight,' class 'FL-12,' 3¼-in. cylinder drills were purchased. The actual work of sinking was done with two machines, the other two being kept at hand to be used in case of break-downs or delays. The dimensions of the shaft were 8 by 16 ft. outside the timbers; a round consisted of from 28 to 32 holes, and the material was an exceedingly hard quartzite. Air was supplied the drills at 85 lb. receiver pressure.

When the work was begun, the holes were drilled to a depth of 6 ft., but as sinking progressed it was found that better results were obtained with deeper holes, owing to the tightness of the ground. The holes were therefore increased to a depth of 8 ft.; and when squaring up the bottom, when one side was too high, the holes were occasionally drilled to 9½ ft., with no apparent reduction in drilling speed. After completing the shaft, 175 ft. in depth, a pump station was cut in the quartzite, 15 by 30 by 10 ft. in size. A cross-cut 257 ft. long and 8 by 8 ft. in size was also driven in the same material. All this work was done by the same two machines that had been used in the shaft. This work took 6½ months, during 5½ of which three working shifts were employed. The repair bill on these two drills for the above period, from January 1 to July 15, amounted to $24.09, giving a cost per machine of $1.69 per month, or of $0.015 (one and one-half cents) per cubic yard of rock excavated, the total amount being 1605 cubic yards.

So far as can be learned, this is a low record for repair cost, especially for big machines in hard rock, on the Gogebic range. A feature, in addition to the low repair bill above mentioned, that was particularly pleasing to the management, was the fact that no delays were caused by breakage of the machine, as all replacements were made while the 'muck' was being cleaned away at the end of the drilling round.

The Sullivan 'Liteweight FL-12' drill, employed on this work, represents a new development in reciprocating piston machines for mine use. The cylinders instead of being hardened and ground in the bore, are fitted with a separate steel liner whose walls are hardened throughout, and which is forced into the cylinder bore under a hydraulic pressure of many tons. At the end of the working period mentioned above, these cylinders were carefully measured, and the superintendent reported that no wear could be detected in them. The valve motion is of the familiar Sullivan air-thrown differential pattern, but the valve chest contains some new features. The valve buffers, instead of being screwed into the chest, are held in place by side rods with flat leaf steel springs at each end of the chest. The valve itself runs in interchangeable hardened steel bushings which can be replaced in a few moments if wear occurs.

A feature in these machines that met particular favor with the runners consisted in a set of ball bearings immediately under the crank handle. The superintendent stated that on the 9½-ft. holes this ball-bearing crank was of particular value. It was almost as easy for the runner to crank back the long steels as it was to handle a two-foot starter. One of the miners was curious to know what made his machine crank back so easily, and was only enlightened when he had succeeded in losing a number of the balls out of the race. In addition to the Mikado, the Castile, Eureka, Cary, Ottawa, and Montreal mines are members of the Gogebic Range group in which these drills are in use.

Ore Deposition In and Near Intrusive Rocks by Meteoric Waters

By ANDREW C. LAWSON

*In a recent number of *Economic Geology*,[1] Waldemar Lindgren has done me the honor to interpret my views on ore deposition and to dissent from them. His paper is a denial of two hypotheses which occupy the field of criticism in current discussions on the origin of ore deposits, and an advocacy of a third. This hypothesis, so ably championed by my distinguished critic, has become the favorite of most recent writers on the subject, whether they describe particular occurrences or discuss the general question. It invokes juvenile or magmatic waters, emanating directly from molten magmas, as the agency whereby ores have been deposited in or near intrusive masses. In the literature of the day almost every deposit of ore that is found to be in any way connected with igneous rocks is triumphantly explained as an exemplification of the operation of this process. So general has been the acceptance of this hypothesis that it has acquired a curious air of finality. It seems to have escaped the ordeal of criticism to which every scientific hypothesis should be subjected, not only by the skeptics but also by those who believe in its probable truth. The hypothesis is today being taught as a doctrine in texts and in lectures to the students of geology throughout the United States with as much certainty and as little question as was the doctrine of the metamorphic origin of the Archean granites thirty years ago. Many of its advocates appear to be more concerned with securing its general acceptance by the coming generation of geologists than with sifting out the evidence upon which it is based; the special pleading of the lawyer has been substituted for the dispassionate consideration of the adverse evidence as well as the favorable—for the weighing of counter-hypotheses which is the essence of scientific method. In itself the notion that magmatic waters deposit ores is fascinating and plausible, and the fact that so many eminent writers have been captivated by it is, of course, indicative of its strength as compared with other hypotheses that may be suggested to explain the same phenomena. Should it, after discussion and criticism, become a scientifically established theory to the exclusion of other hypotheses, it will undoubtedly rank high among the achievements of geological science; and those who criticize it in its formative stage will have contributed no less to its establishment than those who advocate its acceptance without criticism. But the fact that an hypothesis is fascinating and plausible, that there is much to be said in its favor, and particularly that eminent geologists teach it, does not make it a scientifically established theory. Skepticism must perform its function and exhaust itself before that comes to pass. Competitive hypotheses must be exploited. To close our eyes to them is to sacrifice our intellectual integrity. Dogmatically to deny them is to substitute for the method of science that of the church.

In my review of 'Types of Ore Deposits'[2] I advanced one alternative hypothesis which seems to be capable of explaining many ore deposits in and about intrusive masses. I said:

> The doctrine [of magmatic waters] remains feeble and can never attain to the dignity of a scientific theory until it disposes of another possible means of accounting for these ores, which has even greater claims to our attention than the supposed magmatic waters. The means I refer to is the ordinary ground-water as affected by igneous intrusion. The circulation of the ground-water would in every case be profoundly disturbed by the injection of hot igneous magmas into sedimentary terranes. The disturbance would, however, be far from chaotic. The presence of the hot body would be the controlling influence in determining the circulation. The circulation would always be upward on the periphery of the hot mass. This would be true, not only while it was still molten, but also long after it had solidified. Such a circulation of the heated ground-water would be quite competent to do all that is ascribed to magmatic waters, including the formation of lime-silicate zones. It would not only bring to a zone of active chemical reaction the materials leached from the surrounding region, but it would attack the still hot, though solid, igneous mass itself and abstract from it part of its metallic constituents. And it is significant in this connection that most of the igneous rocks that have ores either on their periphery or within their mass have been subject to very severe chemical attack. Until this very probable means of ore deposition at the contact of limestone and igneous rocks has been disposed of, the doctrine of magmatic waters is unnecessary. It remains at best a possibility, one of the fashionable vagaries of our time, not entitled to respect as a scientifically established theory.

Mr. Lindgren's quotation of part of the last sentence of this statement fails to make my position clear, and as he combats the hypothesis which it expresses, I feel constrained to reproduce the statement in full, as the text of following discussion. His hope that I have already changed my view of this question is not yet realized; and the present paper is intended not only as a reply to his strictures upon the alternative hypothesis, as above stated, but also as a further exploitation of its possibilities. My only positive view in the matter is that the deposition of ores by magmatic waters as a general scientific theory is not yet established. I shall be glad to accept it as such when its advocates shall have fulfilled

*[At the New York meeting of the American Institute of Mining Engineers last February there was a most interesting symposium upon the genesis of ore deposits. In the course of it Mr. Lindgren criticized views of Mr. Lawson, originally published in the *Mining and Scientific Press*. In reply Mr. Lawson has published in the *Bull.* Geol. Dept. Univ. California, Vol. 8, No. 9, a complete review of the subject of ore deposition near intrusives by meteoric waters, from which this extract is taken.—EDITOR.]

[1]Vol. IX, No. 2, April 1914.

[2]*Mining and Scientific Press*, February 3, 1912.

the usual scientific requirement of disproving opposing hypotheses. I agree with Mr. Lindgren's statement[3] that there are "three possible methods of deposition: (1) by atmospheric waters heated by contact with the cooling porphyry; (2) by ascending magmatic waters; or (3) by a mixture of both." But inasmuch as meteoric waters are known to have deposited many important orebodies in situations where there is no suggestion of magmatic emanations, I am inclined to the view that they may discharge the same function even more efficiently as a consequence of intrusion; and I am, therefore, more impressed by the probability of the first of these three possibilities than by that of the second. In assuming the rôle of critic of the more popular explanation of ore deposition I do not, of course, venture to hope that Mr. Lindgren will change his view as a result of my remarks; but I shall be more than content if I succeed in convincing the younger geological students of this country that the origin of ore deposits in or near intrusives is still an open question and that further observations, made in the light of alternative hypotheses, are necessary before we can arrive at a settled theory.

Lindgren's Criticism

The circulation of ground-water.—The phase of the question which Mr. Lindgren deals with particularly is the origin of garnet zones and associated ore deposits at the contact of intrusive rocks with limestone. He says: "These deposits are high-temperature deposits. * * * The lowest temperature at which garnets, diopside, etc., may form is about 400 or 500°C. * * * It devolves upon the supporters of the view set forth to explain the possibility of such a circulation upward along the contact at temperatures of from 300 to 1000°C. The Daubrée experiment will really not suffice any more as an explanation."

In reply to this I may say, first, that I have never invoked the Daubrée experiment to explain the upward circulation under the conditions discussed, nor have I ever considered that the Daubrée experiment, the inferences drawn from it by various writers, or the exposition of the fallacy of these inferences by Johnson and Adams[4] as in any way affecting the question at issue. The question is: Is it possible for the ground-water of stratified rocks, assuming its presence, to circulate upward in the heated zone peripheral to an intrusive mass, or through the mass itself if the latter be rendered permeable by fracture? I understand from Mr. Lindgren's remarks just quoted that he considers this impossible, or at least that he is very skeptical as to its possibility; although he apparently regarded it as possible when he wrote his monograph and folio[5] on the Clifton-Morenci district. If he now denies the possibility of such upward circulation, it is easy to understand why he adopts the hypothesis of magmatic waters as the only one explanatory of the origin of such contact deposits. It behooves me therefore to demonstrate this possibility. I will first, however, disclaim the belief, which I fear will be imputed to me if I do not anticipate the imputation, that the sedimentary rocks of the earth's crust everywhere contain similarly large quantities of water. The water in rocks is very unequally distributed and is in general more abundant in the superficial portions of the crust than in the deeper, though under certain conditions this relation may be reversed as, for example, in certain artesian basins. The inequality of distribution is, however, due to the variation in size or in prevalence, or both, of the voids in the rocks. In some rocks, such as shale, the voids may be so small and the movement of the water through them may be so slow that in an excavation they may appear to be dry. Thus, in certain coal mines beneath the sea, where the coal seams lie between beds of shale, the workings may be so dry as to be dusty. The escape of water from the shale is less than can be evaporated. Nevertheless all sedimentary rocks below the water-level are saturated to an unknown but great depth. But saturation does not imply an abundant flow to a conduit or fissure. The rate of flow from rocks in the direction of negative pressure is a function, not of the percentage of volume occupied by water, but of rock texture as expressed in the size of the voids in which the water is held. With the increasing pressure that comes with depth and as a result of cementation, these voids diminish in size, thereby decreasing the proportion of water which the rock is capable of holding as well as the rate of flow. But making all allowance for this diminution of storage capacity there is a vast quantity of water contained in the sedimentary rocks in their unaltered state at all depths; and at high temperatures, which are an essential condition of our problem, the rate of flow and therefore the rate of escape to fissures, etc., is undoubtedly greatly accelerated. Moreover, brittle rocks such as quartzite, sandstone, and limestone, which have been folded and otherwise disturbed, are usually traversed by fractures, faults, and joints, and these, together with the partings of stratification, afford comparatively free access of surface waters to the limit of the zone of fracture for such rocks. That limit for strong rocks is very much deeper than C. R. Van Hise[6] would have us believe, as we know from the experimental work of F. I. Adams.[7]

Now, for the purpose of demonstrating the possibility which Mr. Lindgren denies or doubts, we may assume that an intrusive mass has invaded a syncline of sedimentary strata, including limestone, within the zone of fracture for strong rocks. As a mechanical consequence of a sudden intrusion the structure of the encasing rocks will be disturbed or modified. If it be a sill it will lift the superincumbent strata and there will be stresses and ruptures inaugurated on its margin. Radial ruptures may be

[3] U. S. Geol. Surv., Clifton Folio, 1905, p. 13. See also *Prof. Paper* No. 43, p. 24.

[4] 'Observations on the Daubrée Experiment and Capillarity in Relation to Certain Geologic Speculations,' *Jour. Geol.*, Vol. 22 pp. 1-15, 1913.

[5] *Loc. cit.*

[6] U. S. Geol. Surv. 16th Ann. Report, part I, p. 593.

[7] *Jour Geol.*, Vol. XX, pp. 97-118, 1912.

occupied as dikes; tangential ruptures may escape such occupation. The lifted strata may be broken into blocks faulted against one another.[8] If it be a plano-convex laccolith, besides similar stresses and ruptures there will be distension of the overarching strata in a central position. If it be a steep-sided laccolith, the tendency to peripheral tangential rupturing will be pronounced and effective. If the intrusive mass, on the other hand, make its way slowly into the syncline by a process of stoping or resorption or both, there may be a certain amount of shattering and faulting of the sedimentary rocks on its periphery.[9] These results of the intrusive act, in so far as they fracture the encasing rocks, provide channels for the subsequent circulation of vapors and waters, but their efficiency as conduits may for a time, particularly at the immediate periphery of the intrusion, be greatly reduced by the expansion of the encasing rocks due to rising temperature.

Probably a more important development of conduits for the circulation of vapors and water is that which follows the solidification of the intrusive mass by reason of the shrinkage due first to crystallization and then to subsequent loss of heat. Such shrinkage would give rise to stresses that could be relieved only by distensional fractures, many of which would doubtless be partly sealed by normal faulting and the gouges thereby produced. That such shrinkage cracks are important features of cooling igneous masses and may become the conduits of water circulation and ore deposition is being freely recognized in recent years, notably by L. V. Pirsson,[10] W. H. Weed,[11] Joseph Barrell,[12] W. G. Miller,[13] and J. B. Tyrrell.[14] It is to be noted that such shrinkage cracks are not confined to the encasing rocks of the intruded mass, but may equally well affect the igneous rock itself; although it is probable that the fracturing is begun beyond it by collapse due to crystallization.

Certain veins in volcanic rocks in Nevada, which came under my observation a few years ago, I ascribed in an unpublished report to shrinkage by cooling of an intrusive mass. The temperature of the region in which shrinkage cracks should begin to form would be but little less than the melting-point of the magma, and therefore well above the lower limit of the range specified by Mr. Lindgren. The necessary conduits and temperature being thus provided, we may proceed with the question of circulation. (Illustrated by diagram not reproduced here.) It is apparent that water entering on the outcrop of tilted beds and following the stratification will tend to keep the lower part of the syncline saturated. The intrusive mass provides conduits transverse to the stratification, initially by disruption and subsequently by shrinkage, and it also creates a high temperature in the rupture zone. If the temperature were uniform throughout the region that is concerned, the movement of the water would be up through these conduits on the artesian principle. If the temperature at the contact be high and that at the outcrop be low, the artesian principle operates *a fortiori*, a short column of superheated steam being lighter than a long column of water. As the steam is drawn off above the contact the supply is replenished from the inlets, so that a prolonged circulation is maintained. If the suppositious magmatic waters can rise at the contact there is no reason why the real meteoric waters should not do so also. It seems to me, therefore, that it devolves upon the supporters of Mr. Lindgren's view to explain the *impossibility* of such a circulation upward along the contact at temperatures of from 300 to 1000°C. The Daubrée experiment has nothing to do with the case. But the zone of rupture due to shrinkage is not confined to the region exterior to the intrusion. The latter is itself affected by the process as well as by faults due to less local stresses. The igneous rock becomes sheared and dislocated, so that the meteoric waters in the underlying strata have access to its interior, rising at high pressure and at high temperature through its lower part where the magmatic sulphides abound. The igneous rock may thus be leached of a portion of its metallic content and supply the minerals for deposition in the fissure-replacement or contact-replacement veins above, either in the igneous mass or in the encasing rocks.

Lateral movement of the circulation.—In an effort "to make the real position of the leaching theory a little clearer," Mr. Lindgren states his second objection as follows: "The metals, etc., were extracted from the intrusive rock, that is, from a hot body having a temperature of from 500 to 1500°, and deposited in the adjacent, cooler sediments, say at temperatures from 300 to 1000°C. Consequently the circulation of the atmospheric waters would really take place in a lateral direction and not simply along the contact as maintained by Mr. Lawson." I am somewhat at a loss to answer this objection. It seems so trivial that I fear my critic has not fully expressed himself. I have stated that "the circulation would always be upward on the periphery of the hot mass." But this surely does not preclude a horizontal component of motion in the zone of upward circulation. The term circulation implies that. I see no difficulty in the conception of the rising meteoric waters permeating the hot igneous mass, both from its limiting surface and by way of fissures traversing it, and carrying silica, iron, salts of the ore metals, etc., to (1) positions in the upper cooler parts of the mass, as may very possibly have been the case at Butte,[15] (2) higher positions on its contact with the adjoining rocks in the fashion advocated by G. F. Becker[16] for the Comstock,

[8]Cf., F. Ransome, U. S. Geol. Surv. *Prof. Paper* No. 12, pp. 97-106.

[9]Cf., Joseph Barrell, U. S. Geol. Surv. *Prof. Paper* No. 57, pp. 99-104.

[10]*Am. Jour. Sci.*, 3rd ser., Vol. 50, 1895, p. 116.

[11]*Trans.* Amer. Inst. Min. Eng., Vol. 33, 1903, p. 745.

[12]U. S. Geol. Surv. *Prof. Paper* No. 57, p. 104.

[13]Quoted by Tyrrell. Original paper not available.

[14]*The Canadian Min. Jour.*, August 1, 1907, pp. 301-305.

[15]Cf., *Bull.* Dept. Geol. Univ. Cal., Vol. 8, No. 1, 1914.

[16]U. S. Geol. Surv. *Mon.* III.

or 3 higher positions within the encasing rocks, as may well have been the case at Bisbee or Bingham. That the waters in their upward circulation should also move laterally goes without saying. It may be also again noted that the waters thus coming in contact with the hot igneous mass would not be wholly dependent upon it for the supply of mineral matter. The sedimentary rocks would also yield their quota.

Deposition of ores in inclusions and salients.—Mr. Lindgren's next objection is that "ores are generally found at limestone points projecting into the intrusive mass or in slabs of limestone swimming in the igneous rock. It is difficult to see why the circulating atmospheric waters should seek such places by preference. In many deposits there is no evidence of fractures or paths which could have been followed by the water." Here my critic leaves the *a priori* method of attack and descends to the safe field of observation, where of course he is very much at home. It is to be regretted, however, that he did not cite some specific instances of ores formed in inclusions in igneous rock. That ores may occur in slabs of limestone swimming in igneous rock I do not deny, but it is incumbent upon Mr. Lindgren to show that the ore was not formed when the slabs were an integral portion of the invaded country and before they were subsequently torn off and engulfed as inclusions as the irruptive process advanced. The same inconclusiveness inheres in the statement as to ore being generally found at limestone points projecting into the intrusive mass. An intrusive mass as it invades a limestone country by stoping or resorption encroaches upon the zone which may have previously been the seat of ore deposition and so may bring mineralized points into the transgressive contact. This explanation involves, of course, the possibility of the garnet zone and some of the ore associated with it having been formed by circulating heated waters during the intrusion, if the latter be a single act. But until such occurrences are particularized I shall be inclined to doubt their generality and to regard them as exceptional. The *general* condition appears to be that the ores were formed after the consolidation of the intrusive mass. Thus Joseph Barrell,[17] speaking of the ores at Marysville, says:

> Some little time elapsed between the solidification of the batholith and the opening of the vein fissures, since not only had there been a period of aplitic and pegmatitic injections, but a number of later intrusions of porphyry had occurred previous to the formation of the vein fissures. It would appear probable, therefore, that the fissure veins, if indeed they are contraction effects, belong not to an initial stage but to the final stages of cooling.

At Butte the quartz-monzonite had solidified and it was traversed by two distinct intrusives, the first aplite and the second quartz-porphyry, before the veins were formed:

> The vein and fault-fracture systems intersect the granite, aplite, and quartz-porphyry dikes alike, and all these are similarly affected by the general alteration processes accompanying later vein formation.[18]

Again, Emmons has said:

> In the Wasatch the orebodies found at the points of actual contact of country rock with eruptive masses have not proved to be so important economically as those which lie at some distance from the contact zones and have no evident and direct connection with them.[19]

At Bingham the descriptions which Arthur Keith and J. M. Boutwell[20] have given us afford no warrant for the statement that the occurrence of ore at points of limestone projecting into the intrusive mass is a general phenomenon. Neither do I find such occurrences described in the most valuable memoir on the Clifton-Morenci district[21]; but I do find that important orebodies occur in fissures in the porphyry, and the evidence that these are of later age than the ore in the metamorphic contact zone is not conclusive.

> Fissures and extensive shattering developed both in porphyry and altered sediments after the congealing of the magma and these fissures and seams were cemented by quartz, pyrite, chalcopyrite, and zinc-blende, forming normal veins largely of the type of replacement veins.* * * As far as the metallic minerals are concerned, there is a striking similarity between the veins connected with the porphyry and the contact metamorphic deposits. * * * A relationship is also clearly seen in the remarkable action of the vein solutions on the adjoining wall rock wherever this is limestone, tremolite, and diopside being formed by metasomatic action. On the whole, iron and silica are the main substances added during contact metamorphism as well as during vein formation.[22]

If, then, the waters that formed the fissure veins at a period subsequent to the consolidation of the porphyry laccolith replaced the limestone walls by tremolite and diopside, why may not the contact deposits have been also formed by similar late waters? And what ground is there for rejecting so absolutely the possibility that these were meteoric waters heated by the cooling intrusion?

It would seem, therefore, that the assertion regarding the generality of the *formation* of ore in included slabs and projecting points of limestone requires some elaboration and specification before it can become an argument either for the hypothesis of magmatic waters or against the hypothesis of meteoric waters. The failure of "evidence of fracture or paths which could have been followed by the water" applies equally well to magmatic as to meteoric waters, and is of little moment when we admit that the water in either event was probably in the form of superheated steam.

Hydrothermal attack.—Mr. Lindgren's next objection is stated as follows: "Inevitably, such a hydrothermal circulation as is suggested by Mr. Lawson would result in a strong alteration of the intrusive. In many in-

[17] U. S. Geol. Surv. *Prof. Paper* No. 57, p. 106.

[18] Sales, Reno, 'Ore Deposits at Butte, Montana,' *Bull.* Amer. Inst. Min. Eng., No. 80, August 1913.

[19] S. F. Emmons, U. S. Geol. Surv. *Prof. Paper* No. 38, p. 25.

[20] U. S. Geol. Surv. *Prof. Paper* No. 38.

[21] W. Lindgren, U. S. Geol. Surv. *Prof. Paper* No. 43.

[22] *Op. cit.*, pp. 219-220.

stances there is no such evidence of replacing solutions. Fresh granite rock often borders the ore."

The obvious answer to this objection is of course that, in so far as it is a fact, magmatic waters escaping from a magma constitute a hydrothermal circulation no less than meteoric waters locally heated, and that where they traverse the solidified intrusion, as is so often assumed, they must also equally inevitably cause a strong alteration of the rock. When this is found not to be the case, as Mr. Lindgren states, there must be something wrong with the hypothesis of magmatic waters. But, as a matter of fact, in those cases in which the waters responsible for ore deposition are known to have traversed the igneous rock, as for example, at Butte and at Clifton-Morenci, there has been a notable amount of hydrothermal alteration; and the whole question at issue is whether this water is magmatic or meteoric in origin.

Thermal and reactionary metamorphism.—Finally, Mr. Lindgren dissents from any attempt to discriminate between thermal metamorphism and reactionary metamorphism at the contact of intrusive rocks. Thermal metamorphism I consider to have been proved experimentally by the conversion of chalk into marble by heating in a sealed chamber[23] and also to have been proved inductively by Rosenbush's studies at Barr-Andlau.[24]

Reactionary metamorphism may be freely recognized without admitting that it is responsible for the deposition of orebodies, particularly those occupying fissures in the irruptive mass which produces the metamorphism. Emanations from magmas are not denied and certain of these by reaction with the encasing rocks give rise to the deposition of minerals which are rather characteristic and different from those of the ore deposits in question.

It thus appears that Mr. Lindgren's criticism of the brief expression of my views, appearing in the review of 'Types of Ore Deposits,'[25] has not overthrown the hypothesis which I there advanced; nor has it weakened my position, which is that much of the argument in favor of magmatic waters applies equally well to the hypothesis of meteoric waters, that the question of the origin of contact deposits is an open one, and that our students should know it is open.

Kemp's Criticism

Association of ores with fissures.—In a recent paper[26] J. F. Kemp, in referring to my suggestion that meteoric waters under the influence of heat given off by intrusives may be the agency whereby the ores of contact zones are formed, states that:

> In general, although not invariably, the formation of the silicates seems to precede that of the magnetite and the sulphides, but they all are believed to belong to one process. The sulphides are irregular in distribution, and so far as recorded descriptions go, *they do not seem to be associated with faults or other nourishing waterways through which they might have entered after the contact effects had been produced.*

In reply to the part of this statement which I have italicized I call Mr. Kemp's attention to the ores at Butte which occur in fissures, to the ores at Bingham which occur either in fissures or associated with fissures, to the fissure lodes at Morenci in the porphyry, to the ores of Marysville in fissures, and to the ores at Matehuala, all of which are ascribed to magmatic waters, that have reached the places of deposition by ample waterways. If the presence of fissures is all that is needed to negative the hypothesis of magmatic waters it surely fails in many cases where it has been applied. But even if fissures and other nourishing waterways were lacking, the objection is singularly feeble, for if the waters from the magma can make their way through the rocks and promote chemical reactions, there is no reason that I can imagine why the equally hot meteoric waters should not do the same. The only other objection that Mr. Kemp urges against the possibility of meteoric waters doing the work which he ascribes to magmatic waters is that "the well-nigh unanimous concensus of opinion of those who have studied the zones has been that the metallic minerals go along with the others in method of introduction" and "despite Mr. Lawson's strictures, the general testimony favors essentially pneumatolitic methods." I am aware of the "concensus of opinion" and the "general testimony," but I fail to see that it proves anything scientifically. I have great respect for the gentlemen who hold this prevailing opinion, but I can have no great respect for the hypothesis which it embodies until the alternative one of meteoric waters is negatived somewhat more definitely than by Mr. Kemp's method of quoting opinions.

Knopf's Criticism

Paragenesis of tourmaline and ore.—In a recent paper[27] I pointed out that the commonly accepted view, which refers the deposition of the copper ores at Butte to magmatic waters, is not the only possible explanation of their origin. If the quartz monzonite of Butte be regarded as a laccolith resting on a floor of sedimentary rocks, which have sagged below it in synclinal fashion, then the deposition of the ores may be ascribed to the ascent of meteoric waters through fissures traversing the hot mass. These waters would pass through and leach the zone of magmatic sulphides at the base of the laccolith and deposit the salts of the metals thus obtained at higher and cooler levels. A. Knopf has recently reviewed[28] this paper in a most kindly and appreciative spirit. I accept his correction that there is evidence of a certain amount of doming of the roof, though this is so slight that it still leaves us under the necessity of recog-

[23] Sir James Hall, *Trans.* Roy. Soc. Edinburgh, Vol. VI, p. 107, 1805.

[24] 'Die Steigerschiefer und ihre Contactbildungen an den Granititen von Barr-Andlau und Hohwald,' Strassburg, 1876.

[25] *Loc. cit.*

[26] 'Notes on Garnet Zones on the Contact of Intrusive Rocks and Limestones,' Toronto, 1912.

[27] 'Is the Boulder batholith a laccolith?' *Bull.* Dept. Geol., Univ. Cal., Vol. 8, No. 1, 1914.

[28] *Econ. Geol.*, Vol. 9, No. 4, pp. 396-402.

nizing a sag of the floor to accommodate the intrusive mass. Mr. Knopf intimates that I have not given due weight to his argument in favor of magmatic waters based on the paragenesis of tourmaline and ore, taken in connection with the concentration of the former in the aplitic magma. I may also admit this charge without blushing, but after further reflection I am still not satisfied that the argument is entirely convincing. It may be conceded from Mr. Knopf's observations and those of Ward and Gramigg which he cites that the tourmaline is a concentration product in the residual magma. But is it not possible that after consolidation such concentrations of tourmaline may, in a laccolith which has been broken by faults, be open to the attack of superheated steam rising from below, and so be taken into solution again together with salts of the metals obtained by attack upon the earlier precipitated sulphides? If the sulphides remained residual with the constituents of the tourmaline and the waters escaped directly into fissures carrying both sulphides and tourmaline, I should expect to find besides the veins some rather remarkable tourmaliniferous dikes rich in sulphides following similar fissures. I am free to admit, however, that the evidence adduced by Mr. Knopf has more weight than most of that which is urged in favor of the hypothesis of magmatic waters.

[Following this, Mr. Lawson presents some general remarks upon the relation of laccoliths and batholiths to ore deposition and reviews the occurrence of ore at Butte, Bingham, Ely, Bisbee, Clifton-Morenci, and Cananea, showing that in each case there is evidence of the ores having been formed in a structural syncline. Such occurrence is believed to favor their origin through the stimulation of the circulation of ordinary underground waters by the intrusion of heated rocks.—EDITOR.]

THE MINERAL PRODUCTION of Virginia increased in value from $14,995,842 in 1912, to $17,178,580 in 1913, according to the U. S. Geological Survey. The following were the chief products:

Mineral.	1913.	Value.	1912.	Value.
Coal, tons	8,828,068	$8,952,653	7,846,638	$7,518,576
Pig iron, tons	380,508	5,310,167	328,961	4,364,708
Coke, tons	1,303,603	2,840,275	967,947	1,815,975
Clay products	.....	1,705,651	.....	.....
Quarry products	.....	1,063,782	.....	877,746
Iron pyrite, tons	148,259	587,041	.....	.....
Soapstone, tons	26,487	615,558	25,313	576,473
Mineral waters, gal.	2,873,288	298,473	.....	.....

Virginia also produces asbestos, barytes, cement, copper, feldspar, occasional gems, gold, gypsum, infusorial earth, mica, millstones, mineral paints, salt, sand and gravel, silver, slate, and zinc.

MINERAL OUTPUT of Queensland, Australia, for the second quarter of 1914 was £460,274, a decrease of £43,375, due mainly to silver, tin, lead, and wolfram. For the half-year the total is £137,832 behind that period of 1913. Gold output for seven months was 135,578 oz., a decrease of 20,853 ounces.

Sampling and Assaying Cobalt Ores

Sampling and assaying rich silver ores of Cobalt, Ontario, have recently been discussed by members of the Canadian Mining Institute. According to A. M. Smoot of New York, results from samples crushed, rolled, trammeled, mixed, shoveled, cut from ridges of ore, reduced by riffles, further crushed, coned, and divided, and finally ground through 100 mesh, metallics being separated and assayed alone, are excellent. The following table shows how close several samples agreed by assay:

	Silver, ounces per ton.				
	A	B	C	D	E
No. 1	2269.7	2082.8	1527.7	535.8	353.3
No. 2	2263.6	2079.2	1533.0	538.5	355.1
No. 3	2260.7	2072.6	1528.6	540.1	358.6
No. 4	2267.2	2080.4	1526.2	544.5	355.1
Average	2265.3	2078.8	1528.9	539.8	355.5

For rich ores the scorification assay is sometimes used at Cobalt, one-tenth assay-ton being taken, but furnace conditions affect the results. A better method is the combination assay, which yields higher results and more concordant than can be attained by any all-fire process, and is acceptable to smelters. In this assay a ¼ or ½ assay-ton of the sample is weighed, and 75 to 100 c.c. of strong nitric acid added in beakers until frothing is finished. The solutions are heated on a steam bath until red fume ceases, when they are diluted with 200 c.c. of distilled water, and allowed to stand over night. Certain points are to be observed during this procedure, and insoluble residue is fused in scorifiers or crucibles, and a lead button obtained. The cold solutions are next filtered, and to the filtrate is added standard sodium chloride solution to precipitate the silver as a chloride. The precipitate is transferred to a filter and washed slightly. The filters are then put in scorifiers which have been glazed on the inside by melting litharge in them, and pouring off the excess. This is to prevent the porous scorifier from absorbing moisture from the filter paper. As further protection, a small disk of pure sheet lead is placed under the paper. The charge is now dried, and the paper charred in an oven heated to 250 to 300°C. Fine test lead is sprinkled over the dried chloride, and buttons from insoluble residue are added. Scorification in a muffle is conducted at a low temperature so as to obtain 15-gram lead buttons. Care must be taken to avoid spitting at the end of cupellation. Bismuth in Cobalt ores is a source of irregularity and it should be dealt with during the solution period. In ¼ assay-ton charges, samples assaying 3293.1 oz. per ton do not vary over 6 oz., and many check exactly; and in ½ assay-ton charges, samples with 274.5 and 962.8 oz. per ton were more even. Four assays are made of each individual sample. Metallic scales are assayed separately by the all-fire assay.

MANGANESE DEPOSITS of promise occur in several places in Page and Rockingham counties of Virginia, according to M. A. Rowan in the *Manufacturers Record*.

DISCUSSION

Readers of the MINING AND SCIENTIFIC PRESS *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Milling in Cyanide

The Editor:

Sir—Mr. A. W. Allen's suggestion in his discussion under the above head in your issue of September 9, that I had criticized the ultimate results of the Dome milling practice in my remarks published in the July 4 *Press*, is quite without foundation. In a previous discussion he instanced comparative data on the performance of the Dome and Hollinger mills which were inaccurate with regard to the latter. I merely corrected his data and pointed out that upon his own line of reasoning the correct figures reversed his argument. Had he carefully read Mr. Megraw's articles from which he quoted, he would have noted that it was specifically stated that the Hollinger was just starting up at the time of writing, and milling data were still only vaguely indicative. No experienced metallurgist should have been misled, and corrections were palpably not in order. Mr. Allen included '% extraction' in his comparative tabulation, and my tabulation was merely a correction of the data as far as it referred to the Hollinger.

Mr. Allen goes on to state that in practice, precipitation ratio is not proportional to grade of ore. Presumably he can cite facts to prove his point. In my notes under a date about two years back, I find the following tabulation which directly bears upon this point:

Mill and location.	Mill heads.	Precipitation ratio.
Mogul (Pluma plant), Black Hills	$ 4	1.25
Lundberg, Dorr & Wilson, Black Hills	6	1.5
El Tigre, Mexico	8	2.5
Esperanza, Mexico	10	2.5
Tonopah Mining Co., Nevada	20	5.0
Belmont (Millers plant), Nevada	20	5.0

An examination of this table shows that in these well known and representative mills precipitation ratio varies almost exactly with grade of ore.

Mr. Allen states that milling in water is impracticable unless the pulp is dewatered before cyaniding to "within a few percentages of moisture contained in discharged residues." I should say that 40% moisture is about as low as this dewatering can economically be carried. At 40%, 0.67 tons of water per ton dry will go into the cyanide treatment with the pulp. If the residues are thickened by decantation before discharging, about 40% would be the final moisture and no water wash could be given without building up solutions. In that case cost of dewatering ahead of cyaniding and cyanide loss due to no water wash on tailing must be charged against milling in water as against milling in solution. Also more tons of barren must be used in washing than would be required of barren plus water had milling been in solution—hence increased precipitation. If any form of filtration is used the moisture in residue will be considerably lower than 40%, and not only can no water wash be employed, but waste solution must result. I am gratified to learn that Mr. Allen disapproves of waste solution, and wait with interest a further statement as to just how he expects to avoid it when milling in water.

Timmins, Ontario, September 13.

As an interesting commentary on the remarks above I add the following excerpt from a letter received today from W. D. Alderson, general manager for the Mother Lode Sheep Creek Mining Co. The italics are mine. Mr. Alderson says: "We switched our system of milling from stamping in water and amalgamation to stamping in solution followed by continuous decantation and filtration, with the result that we *cut down on our consumption of cyanide by one-half* with a *greater saving*. We also precipitate a *smaller tonnage of higher grade solution*. This gives us a high-grade product, $40 to $50 per pound, giving bullion 750 fine by direct melt."

NOEL CUNNINGHAM.

Timmins, Ontario, September 23.

Titration Results and Solution Control in Cyaniding

The Editor:

Sir—Having read A. W. Allen's article on titration results in the *Press* of August 15, in which he states that the methods used by him in obtaining his titration results were those described by him in an article also in the *Press* of September 20, 1913, which I have carefully studied, I think that his free cyanide and zinc double cyanide results given in his article of August 15 are not correct.

In determining free cyanide, Mr. Allen says that he first determines the 'total cyanide' by adding an excess of caustic alkali, then titrating the sample to a yellow opalescence with silver nitrate, using a potassium iodide indicator. In another sample he determines the protective alkalinity by adding potassium ferrocyanide, and a slight excess of silver nitrate over that required in the total cyanide determination, and titrating with N/10 HNO_3 in the presence of phenolphthalein, to the disappearance of the red coloration. And then determines the free cyanide in a third sample by adding N/10 acid till the protective alkalinity is neutralized,

that is the amount of N 10 acid shown necessary in the preceding test, and titrating the neutralized sample for free cyanide by means of silver nitrate in the presence of potassium iodide, using the yellow opalescent end point. That this method is doubtful may be proved by the following:

In the first step of Mr. Allen's method, where he adds caustic alkali before titrating for total cyanide, the following reactions would occur:

$$(1) \quad 2KCN + AgNO_3 = KAg(CN)_2 + KNO_3$$

$$(2) \quad K_2Zn(CN)_4 + 4KOH + 2AgNO_3 = 2KAg(CN)_2 + Zn(OK)_2 + 2KNO_3 + 2H_2O$$

In the tests for protective alkalinity he does not add any caustic alkali, but adds the same amount of $AgNO_3$ to it before titrating for protective alkalinity, as he added to his test for total cyanide. If his solution contained no protective alkalinity, the following reactions in the case of $K_2Zn(CN)_4$ would occur on the addition of the same amount of $AgNO_3$ as was added to his total cyanide test:

$$(3) \quad K_2Zn(CN)_4 + 2AgNO_3 = 2AgCN + Zn(CN)_2 + 2KNO_3$$

But if the solution contained some protective alkalinity, though not sufficient to supply the alkali necessary for the reaction No. 2, the results of adding the amount of $AgNO_3$ found necessary for the total cyanide would be the formation of more or less alkaline zincate, according to the amount of caustic alkali contained in the original solution. The alkaline zincate formed by the addition of silver nitrate, according to equation No. 2, only possesses a protective alkalinity toward phenolphthalein, equal to half of that which was possessed by the caustic alkali consumed in the reaction No. 2 which resulted in its formation. (In his article on solution control, Mr. Allen states that, on adding a caustic alkali to a neutral potassium zinc cyanide solution the result should be an increase of the sum total alkalinity to phenolphthalein, and a decrease to methol orange. This is incorrect, as $K_2Zn(CN)_4$ gives only 7.9% alkalinity to phenolphthalein, while it gives 100% alkalinity to methol orange.) In making his total alkalinity determination, using phenolphthalein, the addition of acid first neutralizes the caustic alkalies, then the loosely combined alkalies [the K in $Zn(OK)_2$], when the protective alkaline contents of the solution have been sufficiently neutralized by the acid, the cyanide in the solution immediately combines with the zinc which existed originally in the solution as an alkaline zincate, forming potassium zinc cyanide, which, as previously mentioned, only gives 7.9% alkalinity to phenolphthalein. Therefore, the alkalinity of the solution toward phenolphthalein would be balanced, excepting for the increase due to the 7.9% of the alkalinity of $K_2Zn(CN)_4$ by the addition of four molecules of caustic alkali to one molecule of alkaline zinc cyanide.

In cases wherein solutions contained sufficient alkalinity to cause all of the zinc to be held in solution as a zincate of an alkali, Mr. Allen's methods would give low results in free cyanide, and his protective alkalinity would be high. (In making this statement regarding protective alkalinity, I may mention that I do not consider alkaline zincates as true protective alkalies, for if they were neutralized with acid the resulting zinc hydrate would immediately combine with any free cyanide present to form zinc double cyanide, which would not be available for extraction purposes, unless it should be treated with a caustic alkali.) The reason for the low results in free cyanide obtained by Mr. Allen's method is, that in neutralizing his solution with acid he neutralizes the alkalinity which protects and holds the zinc in solution as a zincate, as may be expressed by the equation

$$Zn(OK)_2 + 2HNO_3 = Zn(OH)_2 + 2KNO_3$$

forming zinc hydrate, which combines immediately with free cyanide to form an alkaline zinc cyanide according to the reaction

$$Zn(OH)_2 + 4KCN = K_2Zn(CN)_4 + 2KOH$$

which alkaline zinc cyanide does not show by the silver nitrate titration in the neutral solution any considerable portion of the free cyanide, which was consumed in dissolving the zinc hydrate formed by neutralizing the protective alkalinity of the solution, by means of acid, prior to the titration for free cyanide. Therefore, any free cyanide which the solution contained before it was neutralized and which combined with the zinc hydrate during the neutralizing of the solution is not shown as free cyanide by the method which Mr. Allen uses. It is probable that his methods would be approximately correct for free cyanide when applied to solutions containing little or no protective alkalinity, but they would vary in their accuracy accordingly as the protective alkalinity varies.

My statements herein relative to the accuracy of Mr. Allen's methods have been proved to some extent by E. M. Hamilton's article on solution control in the *Press* of July 25, 1914. The fifth and sixth series of titration results there printed clearly show the value of my statements.

There is no doubt in my mind regarding the form in which zinc exists in cyanide solutions. I am absolutely certain that it can and does exist in some working solution wholly as a zincate, while it may exist in other solutions either as a double cyanide or a mixture of double cyanide and a zincate.

Mr. Allen does not prove that zinc does not exist in solutions as a zincate of an alkali, nor does he prove that there is no regeneration of free cyanide when the alkaline zinc cyanide is acted upon by an alkali, although he attempts to prove in his article on solution control that a regeneration did not occur in his tests. While his tests did not show a regeneration of free cyanide, nevertheless there was undoubtedly some regeneration which was not shown through the fault of the methods used by him.

HARAI R. LAYNG.

San Francisco, August 18.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

STEEL RAILS weighing 120 lb. to the yard, and the largest made for any line in the world, are to be laid and tried by the Pennsylvania Railroad Co. on its Pittsburgh division, near Altoona, where traffic is heavy.

PUMPING ENGINES at the Parramatta sewerage works, a suburb of Sydney, New South Wales, are being successfully run by sewer-gas power. The new power is more effective than coal gas, and is considerably less expensive.

THE VISCOSITY OF WATER decreases with rise in temperature. This fact may be made use of in connection with the settlement of slime. The operation is hastened in some installations by the preliminary heating of the battery water with exhaust steam or other means.

SAFETY-WORK DEPARTMENTS are now maintained by practically all the iron-ore mining companies of the Lake Superior region. The cost of such work varies greatly, but it may be said that during the year in which safety devices are installed, it may be as high as $10 or more per man employed; but a fair average for maintaining the department, after preliminary work has been done, would be about $5 per man.

GASOLINE LOCOMOTIVES are used in mines for haulage purposes, but care must be taken to provide plenty of air to dilute the exhaust in drifts, so as not to cause discomfort to miners. Both carbon monoxide and carbon dioxide are produced by the engine, varying in quantity, according to good or bad carburation. For each cubic foot of carbon monoxide possible to generate in the engine, there should be available 2000 cu. ft. of air to mix with the exhaust gases if the air is for continued breathing.

CYANIDE CONSUMPTION FORECASTS should be based on titration tests made before experimental ore treatment, and after treatment and precipitation of the contained gold and silver. The estimation should be checked by comparison with the actual amount of cyanide required to re-standardize the solution. Such tests are preferably carried out in series, the re-standardized solution being used again for fresh extraction tests. By this means any ill-effects on extraction or precipitation which may result from the accumulation of precipitant salts in the solution will be noticed and the scheme of treatment regulated accordingly.

GRAPHITE in ores has interfered with cyanide treatment at several gold mining districts of the world. At Gympie, Queensland, Australia, there are several large heaps of tailing assaying about $2.50 per ton, but no serious attempt has been made to treat them. The Scottish Gympie Co. has two dumps of tailing, one of 60,000 tons or more, and mostly graphitic, and a smaller lot of 20,000 tons of what is called Inglewood tailing, derived from the Inglewood vein, which runs at right angles to the main lode series. The tailing is white and contains no graphite, and is particularly amenable to cyanide, the only consideration being the degree to which it is ground. The graphitic tailing, on the contrary, is not suitable for cyaniding, only yielding 40% or so after complete sliming. W. Macdonald, who studied the problem there for a year, came to the conclusion that this poor extraction by cyanide was not due to premature or re-precipitation of the gold. On mixing the two classes of tailing, and subjecting the mixture to cyanide solution, and comparing the results with the results of similar tests carried out on each class separately, he found the extraction on the clean Inglewood tailing was just as good as when treated separately, showing that the graphite had not caused precipitation of the gold dissolved from the Inglewood ore. There is no chemical difficulty in treatment and the consumption of cyanide in both cases was abnormally low. A characteristic feature of the graphitic tailing is its yield of gold to amalgamation. By grinding very fine, practically all-sliming, an extraction of upward of 70% of the gold resulted. The proportion of gold to silver is about 5 to 3, and it is likely that they exist in the form of an alloy.

GOLD OUTPUT of the Lena Goldfields property, Siberia, from October 1, 1913, to July 20, 1914, was as follows:

OLD-TYPE WASHING MACHINES, LENA GOLDFIELDS, SIBERIA.

gravel mined, 651,687 cu. yd.; gravel washed, 524,835 cu. yd.; gold yield, 238,715 oz. worth $4,300,000. There are 6133 men employed, compared with 8364 in 1913.

MINING IN THE FAR NORTH*

Skagway-White Horse Mining District

By EMIL EDWARD HURJA

The district embodied in this sketch is a vast one made up of smaller districts, tributary to the White Pass railroad, operating from Skagway to White Horse, and for that reason all are treated together. The Rainy Hollow and Porcupine areas are tributary to Haines, a port 12 miles south from Skagway. The Atlin, Wheaton, Conrad, Kluane, and White Horse districts all are served by the railroad from Skagway.

The Rainy Hollow mining district is 50 miles from Haines, and lies within the British Columbia boundary line by ten miles. Martin Conway, Richard Kennedy, and J. W. Burnham own a group of 13½ claims, all of which are crown-granted. The property is at an altitude of 2000 ft., on the headwaters of the Klehina, a tributary of the Chilcat river. On the Maid of Erin claim, an ore deposit with a width of from 30 to 40 ft. has been stripped on the surface. On the Sonora claim, a 40-ft. adit has been driven in ore. On the Wonderful, a 140-ft. adit comprises the development, and on the Majestic claim is an open cut 40 ft. long. Two men are employed by the owners at present in extending the adits. J. W. Bryant, at present with the Spassky Copper Mines in Siberia, who was to have made an examination of the claims some time ago, has written that he is considering a trip to the district in the near future. Thirty tons of ore from the claims was shipped three years ago to the Tacoma smelter. Net returns were $81.65 per ton. The returns showed 55.67 oz. of silver and 32.17% copper.

In the same district other prospecting is being done. The Three Guardsmen property, owned by A. C. Smith and James Irwin, showing ore of a character similar to the Conway-Kennedy-Burnham group, is being prospected steadily. M. J. O'Connor has two claims on which he is doing the annual assessment work. Timothy Creedon owns one claim on which he is working and Dan Sullivan owns two. A wagon-road built by the Canadian government connects the boundary terminus of the American wagon-road from Haines with the properties in the Rainy Hollow district.

SKAGWAY, ALASKA, TERMINUS OF WHITE PASS ROUTE.

In the Porcupine gold mining district, at least three outfits are at work hydraulicking. The Porcupine Gold Mining Co., of which S. C. Hunter is manager, is operating a plant on Porcupine creek. Between Cahoon and McKinley creeks, the Cahoon Creek Mining Co.'s holdings have been taken over by the Glacier Creek Mining Co., of which Hal G. Knight is manager. Two automobiles are used to haul supplies for the operations. It is expected that the plant will be ready for operation at the beginning of next season. Considerable ditch and pipe-line work has been done.

The Mountain Jewel Mining Co. owns 12 claims in the Salmon River basin, in the Skagway mining district. The prop-

*[Previous articles in this series by Mr. Hurja on mining in Alaska and the Yukon have been 'Mining Revival in the Ketchikan District, Alaska,' July 4; 'Wrangell, Alaska,' special correspondence, July 11; 'Development of the Alaska Gold Mines Co.,' July 18; 'Juneau, Alaska,' special correspondence, July 25; 'Cordova, Alaska,' special correspondence, August 8; 'Valdez and Prince William Sound,' August 15; 'Seward and the Kenai Peninsula,' August 29; 'The Koyukuk Mining District,' September 12; 'Operations of the Yukon Gold Company,' October 10. Mr. Hurja in subsequent letters will give full accounts of present conditions in each of the great producing districts of the Far North.—EDITOR.]

erty is 45 miles from Haines. W. J. Bledsoe, chief owner, is preparing a hydraulic plant for operation near the mouth of Nugget creek. Open cuts and shallow shafts have been used to prospect the placer body. Last season's operations produced $375 off rimrock. One $75 nugget was obtained the previous season.

The most recent discovery of gold was made between Rainy Hollow and Porcupine creeks, which caused a small stampede in June. Forty locations were made, a little fine gold was taken out, but only a few prospectors are at work in the diggings at the present time.

Skagway District

Many promising quartz properties are being held for development in the Skagway district. Values so far have been so low that no extensive development has been attempted. W. J. Bledsoe has a group of quartz claims three miles from Skagway above Reid's falls. He is doing the assessment work on them. Assays have shown from 40c. to $60.40 per ton in gold.

During the early days of the Klondike rush, the Skagway valley was plastered with both quartz and placer locations. Very few of them were worked, however, and consequently the mining development of the district has not gone ahead very rapidly. The town of Skagway is situated at the head of Lynn canal. It was the outfitting point for all the stampeders to the Klondike and other interior points. It is a point of call for many steamship lines and the coast terminus of the White Pass & Yukon railroad, which was built during the early days of the rush. The railroad is 111 miles in length and runs to White Horse, the head of steamboat navigation on the Yukon river. During the incumbency of O. L. Dickeson, now the president of the railroad, great strides have been made in the mineral development of the Skagway-White Horse district. Encouragement has been given to miners in the development of their prospects, and in the instance of the Pueblo mine, financial assistance has been given to put the property on a shipping basis and to furnish tonnage for the railroad. The White Pass railroad employs two mining engineers whose duty it is to make reports and examinations of prospects and properties developed, and aid the prospectors in the territory served by the line. They have been of material assistance in the development of the more promising prospects of the district.

Wheaton District

The Wheaton district, tributary to the White Pass railway, lies in Yukon Territory, just north of the British Columbia boundary. The area flanks the mountains of the coast range on their eastern side. The Yukon government has constructed wagon-roads from Robinson, on the White Pass railway, to different parts of the district. Robinson is 78 miles by rail from Skagway. When the influx of gold-seekers to the Klondike was at its greatest in 1897 to 1898, hundreds and thousands of prospectors passed through a corner of the Wheaton district. The first prospecting reported from there was done during the summer of 1893, when Frank Corwin and Thomas Rickman are known to have located a number of claims. They returned to Juneau afterward with some samples of rich ore which assayed over $1200 per ton, but before any steps had been taken to work their discoveries, the men had died. In 1898, W. F. Schnabel is reported to have found veins carrying ore corresponding to that of the two prospectors. In the summer of 1906, the discovery of gold tellurides on Gold hill caused a stampede, and 500 claims were staked within 90 days.

On the west side of Tally-Ho gulch, the Tally-Ho group of 8 claims, owned by Adam Birnie, C. F. Irvine, C. I. Burnside, W. M. Hair, and F. T. McGlashan, is being developed steadily. A quartz vein varying in width from 6 to 36 in. and impregnated with argentiferous galena has been opened up with 350 ft. of drift, two 40-ft. rises, and a 15-ft. cross-cut. Twenty tons of ore shipped recently yielded $54 per ton. Other veins on the claims are being prospected on the surface.

An English syndicate has arranged to send an engineer to look over the Buffalo Hump group of claims, owned by George Stevens and situated along the north end of Mt. Stevens, 16 miles west of Robinson. A vein eight feet wide has been developed with open cuts and shallow shafts. The quartz carries small quantities of galena as well as sylvanite and decomposed tellurides. The Hawkeye group, owned by the 'Tally-Ho' boys, and situated on the Wheaton River slope of Mt. Stevens, has had some surface development done. The largest quartz lens in the district is that on the Acme claim, owned by O. Dickeson. Only assessment work has been done on the McDonald fraction, Silver Queen, and Gopher claims, on the western side of Wheaton mountain.

Becker & Cochran, owners of a group of eight claims on Becker creek, tributary to Wheaton river, 25 miles southwest of Robinson, have incorporated the Wheaton Mining Co. with a capital stock of $90,000. The stock has been taken up by White Horse residents, and development work on the claims

SKAGWAY AND THE BACK COUNTRY.

will be carried on steadily henceforth. The Rip claim has been developed with two adits. The upper, driven on the outcropping, is 387 ft. long. Another adit, 137 ft. below this one, penetrates ore 173 ft. from the portal. One hundred and sixty-five feet of drift has been run on the vein. The vein is five feet wide, with only the 18 in. nearest the hanging wall containing metal to workable extent. Repeated assays show the average value of this ore to be $10.50 per ton in gold, silver, and lead. A basalt dike cuts the quartz vein. On another lode 370 ft. away, but lying parallel to the first, a 110-ft. adit has been driven. On the Wheaton claim, adjacent to the Rip, 40 ft. of adit has been driven on the same vein, with a width of nine feet. The value was less than on the Rip claim. An adit to tap the vein at greater depth has progressed 35 ft. Ore going $50 per ton has been mined from a slide on the Mountain Sheep claim, also one of the group. Only surface work has been done on the other claims. Cabins have been built at the property, looking toward a resumption of work this fall.

Claims in the Gold Hill district have been prospected more or less. Only assessment work is being done on the holdings at present. George Curtis is developing his property on Gold hill. The Gold Reef, Lucky Boy, and Legal Tender claims are the principal locations in this district.

A vein from 14 in. to 3 ft. thick, carrying stibnite, with

BUNKERS AT SKAGWAY.

sphalerite and jamesonite in minor amounts, has been opened by W. J. Fleming on the Carbon Hill group of claims. But little prospecting has been done on the Goodell claims on Carbon hill, or on the Morning and Evening claims on Chieftain hill.

Atlin District

The Atlin Mining district is situated in the northwestern corner of British Columbia between latitudes 59 and 60°. Atlin became known as a productive placer camp in January 1898 because of discoveries made on Pine creek by Miller and McLaren. In 1898 the district produced about $75,000; the following year $800,000 was taken out. The average production since that time has been about $400,000. In 1909 it was $200,000. Estimates of the 1914 production are $450,000, in excess of 1913 by over $100,000. Atlin is reached by a rail journey to Carcross from Skagway and steamer to Taku landing, thence by rail and steamer to Atlin. During the winter a stage runs between Carcross and Atlin. Because of placer activity, interest in quartz mining has not been very lively in the Atlin district. Outside capital is beginning to look toward the district, and engineers of several companies are already investigating different properties there.

The Columbia Gold Mining Co., of which J. M. Ruffner is manager, is hydraulicking on Pine creek. A crew of 45 men is employed. The Inland Trading Co. is erecting a hydraulic plant on O'Donnell creek, a tributary of Atlin lake. A mile of pipe has been laid. The Company has obtained eight leases on the creek and is assured of ground for its work. Preston & White started to drive this spring on O'Donnell creek. The Pierce outfit is working on Birch creek with a small hydraulic plant. McCluskey brothers, driving on Spruce creek, expect to take out $50,000 this season. T. M. Dalton is having a satisfactory season on Ruby creek, tributary to Surprise lake. Four or five small outfits are at work on Wright creek. On Otter creek, Melthuin & Co., a French syndicate, is erecting a plant with the intention of carrying on hydraulic operations on a big scale next season. Water conditions during the present season have been much better than during the last two years.

Dail & Fleming, owners of the Humper group of quartz claims on Windy arm of Tagish lake, are planning to dispose of their property. H. L. Van Wyck, an engineer representing a Vancouver, B. C., syndicate, recently made an examination of the claims and completed a thorough sampling of the veins. A 5-ft. vein has been uncovered, with an 18-in. pay-shoot carrying gold, silver, and lead. A depth of 130 ft. has been attained. The ore is argentiferous galena. A site for a camp has been graded off at the portal of a proposed adit. The road to the property has been graded and widened. The Conrad property on Windy arm of Tagish lake has a 100-ton reduction plant on it, erected in 1907, but idle for several years. The group comprises three claims, the Montana, Venus, and Big Thing. R. S. Stokes, representing the Canadian Mining & Exploration Co., this season completed an examination of the property. An adit on the Venus claim has a length of 2000 ft. Three stopes have been started. Development work aggregates 10,000 ft. A resumption of work at the property is planned.

The Laverdiere group of quartz claims is the only one on which active work is being done in the Atlin district at present. The property consists of six claims, all of which have been crown-granted. They are situated on the west side of Hobo creek. Two quartz veins have been found and opened on the surface, as well as one contact metamorphic deposit. At one point the ore deposit is 150 ft. thick, and analysis of the ore by mineralogists of the Canadian Geological Survey shows magnetite, hematite, chalcopyrite, and malachite. Tunnel work in excess of 400 ft. has been done on the different claims. A mining engineer from Dawson left White Horse for Atlin, July 25, to make an examination of the claims.

A number of copper locations have been made recently near Carmacks. On the Bonanza claim, owned by C. P. Mack, an open cut has been made into the orebody. The hill has an iron capping impregnated with chalcopyrite. Two hundred feet from the top, an adit has been driven. The vein outcrops along the top of the hill for a distance of 900 ft. Ore has been found on the adjoining Hazel May claim at a depth of 300 ft. greater than the Bonanza. On Merritt creek a number of locations have been made. Three hundred ten feet of adit has been driven on one group situated two miles from Lewes river. Different leads are being developed, varying in width from two to ten feet. A lode eight feet wide, between granite and diorite, said to contain 10% copper ore, is being opened a mile from Lewes river.

The Kluane district, west of White Horse, is getting more attention now than before, because of the number of men who went through en route to the Chisana field. Small hydraulic plants are at work in many parts of the district. That quartz prospecting is being taken up is reported by the territorial assayer, W. C. Sime, of White Horse. E. G. Lewis, an engineer in the employ of the Atlas Mining Co., last fall prospected the lower part of Gladstone creek, 3½ miles from

ATLAS MINE; BOILER HOUSE AND SHAFT.

its outlet to Kluane lake, with a Keystone drill, with a view to determining availability for dredging purposes.

White Horse, Yukon Territory, took shape around the settlement at the foot of White Horse rapids, a treacherous stretch of water through which hundreds of stampeding miners went with their boats during the years 1896 to 1899. It is the terminus of the White Pass & Yukon railroad, is the outfitting centre of a big area of country, and the head of steamboat navigation on the Yukon waterways. It has modern hotels, a mounted police barracks, a weekly newspaper, and numerous stores. Many mines are adjacent to the town.

Assessment work is being done on the Arctic Chief claim, owned by the Arctic Chief Mining Co., seven miles west of White Horse.

The Pueblo Mine

The Pueblo mine is a constant shipper now. It is situated seven miles from White Horse by wagon-road and is operated by the Atlas Mining Co. under a 20-year lease. Five claims making up the group were staked in 1900. The present Company took over the operation of the mine in 1912. The development work of the Company has been centred on the contact deposit on the Pueblo and Pueblo No. 3 claims. New work on the property consists of development on the 400-ft. level, where, up to July 1, 622 ft. of cross-cut had been driven. Present development work on the lower level now aggregates about 800 ft. Ore is being mined from one stope on the 400-ft. level. Mining is done from a vertical shaft 450 ft. deep. For the lower 300 ft. the shaft is three-compartment; the rest of the distance to the surface it is two-compartment. Mining is being carried on from the 200-ft. level. Drifts on the 200-ft. level aggregate 1600 ft. The fill system of mining is followed entirely. Timbering with square sets is necessary because of the unstable character of the walls. Native timber, of which a good supply is available, is used. The ore mined is a hematite carrying copper and silver. The copper content varies from 3½ to 6%. Four bodies of ore have been found on the 200-ft. level and are mined from what are known as the east, northeast, west, and northwest stopes. The northwest body has been found recently on the 400-ft. level. The carbonates on the 200-ft. level are giving way on the lower level to sulphides. Native copper, chalcopyrite, cuprite, and specular hematite form the chief minerals. The ore is very desirable for fluxing purposes. Shipments are made by railroad to Skagway, an 11-mile spur connecting with the White Pass railway, and from there to the Tacoma smelter by steamship. In 1912 shipments aggregated 31,538 tons; in 1913, 36,663 tons; and up to July 1, 1914, 7399 tons. Shipments are aggregating 250 tons per day at present. Present plans provide for sinking the shaft to a depth of 650 ft., the work to start this fall. A rise from the 400-ft. level to the surface has been started, to provide an emergency outlet from the lower level. An incline shaft has been completed from the 200-ft. level to the surface. Diamond-drill work is being done in an effort to outline the dimensions of the orebodies. During 1913, 28 holes were drilled an aggregate length of 3796 feet.

Mine equipment consists of a 16 by 9 by 18 Cameron station pump and six sinking pumps, a No. 5, a No. 9B, two No. 9, and two No. 7. Water is discharged from the mine at the rate of 400 gal. per minute. Three 150-hp. boilers using wood as fuel supply power for an Ingersoll-Rand straight-line Class AA2 compressor and a Franklin compressor, as well as a Lidgerwood 12¼ by 15 hoist. A Sturtevant mining set supplies the mine workings and buildings with electric light. A Cochran feed-water heater has been replaced by a 60-hp. locomotive type boiler, by means of which water is heated with exhaust steam. An ample supply of hot water for all uses is thus obtained. A complete machine-shop is maintained at the property. Equipment includes lathes, drill press, and a Leyner drill sharpener. During the summer, 200 men are employed, including woodcutters and teamsters. Mess and bunkhouses are well and comfortably furnished.

Prospect work is being carried on by the Company on the War Eagle and Leroy claims, situated a mile north of the Pueblo property. The claims are under bond to the Atlas Mining Co. A hand drill is in use on the War Eagle. If developments at the property justify placing it on a shipping basis, the spur to the Pueblo mine can be extended easily to the property.

The Anaconda claim, situated four miles from White Horse and owned by W. A. Puckett and associates, was originally located September 28, 1898. Its first development was in the hands of W. S. Thomas, who represented James Guffey, of Pittsburgh, Pennsylvania. Since 1907 the claims have been in the hands of Mr. Puckett, who is doing a small amount of development each year. On the Anaconda two parallel contact deposits of bornite, one from 12 to 14 ft. wide and the other 4 ft. wide, both 55 ft. apart, are being opened. Shallow shafts and open cuts comprise present development. The adjoining Rabbit Foot claim has a 20-ft. shaft on a deposit similar to that on the Anaconda. Several hundred tons of ore is on the dump awaiting shipment. S. Tanner, said to represent English capital, has asked for a bond on the claims. J. R. Alguire is prospecting the Sandon claim, 400 ft. north of the Pueblo. The ore deposit is said to be an extension of the Pueblo deposit.

The Livingston Creek district, in the Big Salmon watershed, is the scene of considerable activity in placer mining. Some quartz prospecting has been done, but because of the inaccessibility of the area, development has been slow. On the left limit of Livingston creek, James Geary is operating one giant on the claims of the A. C. company. D. G. Snure is driving into the hillside a short distance below to tap a bench pay-streak. A. M. Wallick, on 1 Above Discovery, has discovered some rich dirt in frozen ground. He is using points to thaw the ground. H. Berry is driving an adit into the hillside gravels, trying to find another channel. It is in a distance of 350 ft. On Lake creek, LeRoy Churchill is hydraulicking with one giant. A. Officer is driving in thawed ground and is reported to be working good pay.

J. E. Peters worked until the middle of June on Summit creek, but was forced to suspend operations because of a shortage of water for sluicing. He has started a sawmill and is cutting lumber for a flume 6500 ft. long which he hopes will eliminate damage from droughts. He already owns four claims and has options on more, so that he will have ample ground for his proposed work. Peters plans to start hydraulicking on the upper end of Discovery. George Bruce is mining pay by the open-cut method below Peters' claim. William Clethero is hydraudicking with a single giant on Little Violet creek. L. Keyzer is working a small hydraulic plant on Cottoneva creek. An automatic dam controls the water-supply. A Pelton water wheel is used to hoist the boulders. One nugget, worth $215, was found during the present season.

On Quiet lake, at the head of the Big Salmon river, Alexander Brown has found gold on Brown creek, tributary to the lake. He drove up on the rim on one side and took out $156. Upon petitioning the government for a road, work was started at once. He expects to do more work next winter on the find. Twelve men are prospecting in the district.

W. Cameron, working at the head of Sheehan's gulch, a tributary of Livingston creek at 1 Above Discovery, has cross-cut a quartz lode with a width of 75 feet.

The mineral resources of Yukon Territory, northern British Columbia, and that part of the Skagway recording district lying adjacent to British Columbia are but scratched. Encouragement has been given in every manner to prospectors and miners. The Yukon government is particularly willing and anxious to aid prospectors by building trails and wagon-roads where they will be beneficial in developing the mineral resources of the country.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

WAIHI, NEW ZEALAND

Gold and Silver Output of the Dominion.—The Waihi Field Geologically Discussed.—Further Development Schemes.—The Thames District.—Blackwater, Progress, and Wealth of Nations Mines.

The gold output of New Zealand for July 1914, amounted to 27,150 oz., valued at £110,828, compared with 40,103 oz., valued at £154,319, for July last year. The silver output was 53,017 oz., valued at £5313, against 107,909 oz., valued at £11,984. The gold output for August amounted to 3045 oz., valued at £12,876, against 41,442 oz., valued at £156,348, a year ago. The silver output was 32,410 oz., valued at £3240, against 68,135 oz., valued at £7446. The heavy falling off for August was due to the decrease in exports due to the war risk of shipping bullion to England.

A languishing industry and a lack of capital for new enterprises seems to be affecting the Waihi district. The parent mine, the Waihi, is practically living on its ore reserves. For the year 1913 the ore developed was 197,222 tons, against a mine output for the same period of 183,124 tons. At the end of August, work at No. 11 level was delayed for some time on account of an accident and disablement of the 'B' pump. On the bottom levels of the mine, gold and silver content of the lodes are not consistent, and shoots are not extensive.

The Waihi Grand Junction Co., whose property adjoins the Waihi, is producing steadily. Recent developments on the 1082-ft. level (No. 6) have been most encouraging, disclosing a long run of good-grade ore on the Empire lode. As forecasted by J. M. Bell in his geological report to the New Zealand government, this vein has now become the main one on the field, the great Martha lode being of little account as an ore producer in either the Waihi or Junction mines. At 786 ft. east from the main cross-cut in the Junction mine on No. 6 level, the Empire is cut off by a fault, and Mr. Bell held small hopes of profitable ore being opened up by development beyond this faulted area. In spite of this, the management drove through the broken country beyond the fault, and at 200 ft. came again on the Empire lode, which proved to be 20 to 30 ft. wide, with several feet of milling ore on both walls. The drift is now, August 28, 1220 ft., from the main cross-cut, and is going ahead in sulphide ore on the south wall, the ore broken going to the mill for treatment. At 1180 ft. a cross-cut was driven through the vein, proving it to be 40 ft. wide, of which 5 ft. is worth $8.16 per ton, the remainder being of low grade. At 1100 ft. a cross-cut proved the vein to be 28 ft. wide, with 7 ft. on the hanging-wall side worth $7.28 per ton, and 30 in. on the foot-wall side worth $5.76 per ton, and the balance low grade. The reef is solid and well defined, and as the workings are 1700 ft. from the boundary on the strike of the vein, the possibilities are great.

These developments in the eastern portion of the Junction property have considerably enhanced the prospects of the adjacent property owned by a Wellington company, and known as the Waihi Gigantic Reef Consolidation, Ltd. (the old Waihi Consolidated and other claims). This latter concern, in spite of the exaggerated pretensions of its friends is a genuine prospecting undertaking. If the Empire or other lodes are found eventually to continue through into this property, they must be deep seated, and, in order to carry out any comprehensive scheme of exploration, it is necessary for a company to be well capitalized. Capital has not been freely forthcoming for this new venture, chiefly on account of the field being under a cloud by reason of the adverse character of the report on the field by Mr. Bell.

According to his theory, the 'productive' area is restricted to a supposed 'intrusive' mass of dacite which is encircled by an 'inferior' or bedded dacite. The area of the dacitic intrusion at the 1000-ft. level in the Waihi mine is given as about 1320 by 3300 ft., and the fault already referred to in the drift on the Empire vein in the Junction mine is supposed to mark the approximate boundary between the 'intrusive' and 'bedded'

dacites in this part of the mine. Although Mr. Bell expresses his opinions in most guarded language, the only inference which can be drawn from his statements is that it is not of much use prospecting in the bedded dacite. According to utterances of W. F. Grace, general manager for the Waihi Grand Junction company, when interviewed by a *Herald* representative in Auckland in August, this theory has now been exploded so far as the eastern part of the field is concerned, and this is obviously so when it is stated that milling ore has been developed in bedded dacite 500 ft. beyond the boundary of the supposed intrusion. Furthermore, it would seem that some structural differences between the two classes of dacites should exist, and possibly be detected in hand specimens or rock sections; but Mr. Bell does not allude to any such differences in

his report. Possibly the strongest evidence against the theory is supplied by the discovery in the Waihi mine of a carbonaceous seam, where the rock was supposed to have been intrusive. Such seams are specially mentioned in the geological report, as indicating the bedded nature of certain masses of dacitic rock. A petition is now in circulation in Waihi with the object of inducing the government to revise the geological report on account of this new evidence. Needless to say, the prime movers in this are those interested in the Consolidation company, whose prospects would be very much improved if Mr. Bell's theory were definitely disproved. The present position is certainly very unsatisfactory, and the local press has been very outspoken on the matter.

August bullion return of the Waihi mine was £25,466 from 14,538 tons of ore; and Grand Junction 10,200 tons yielding £20,100. The working cost of the latter was $4.76 per ton.

J. W. Walker, well known as one of the original promoters of the district, is trying to get a concession from the government for ground on the eastern side of Waihi. His idea is to drive a cross-cut from the ocean beach, six miles east, to the Junction mine. It is thought that as the shoots in this mine have a fairly sharp pitch east, the drift will be above any good ore that may exist.

The Talisman at Karangahake relies on its Bonanza shoot to keep up its $22 average, but the end of the shoot is not in sight.

The Thames district of the North Island, 36 miles north of Waihi, is very dull at present, from a mining standpoint, in fact, if it were not for the fishing and dairying industries it would be a deserted village. Deep-level development, that is, testing the whole field at a depth of 1000 ft. from the Queen of Beauty pump shaft, which is practically at sea-level, is not very promising. The main cross-cut at that depth was driven to the Moanataiari fault, but work was stopped until the water and gas were drained. During this time the Waiotahi shaft was sunk to connect with this cross-cut, and a junction was made late in July. By using this shaft as an upcast to the Queen of Beauty shaft (about a half-mile distant) aided by a Sirocco fan, the cross-cut is now well ventilated, and the May Queen company, whose mine adjoins the Queen of Beauty, has started to open the Exchange lode. This is the only orebody cut during 3000 ft. of driving that showed any promise and it is too small to forecast any great help for the district. The Waiotahi, which four years ago yielded a bonanza of $2,400,000, will continue to develop the Cambria lode and foot-wall leader. An assessment will be made to carry out this work. The Tararu end of the field, about three miles from those mines mentioned, has been producing almost the total bullion output for the past year or so. The Sylvia is yielding about $5000 per month, and keeping out of debt. Sinking is to be done. The Watchman mine was expected to average $11.14 per ton, but the stamp-mill gives only $6.

In the *Press* of September 19 were given the annual reports of the Blackwater, Progress, and Wealth of Nations mines, which are at Reefton in the South Island. A report for the second quarter of 1914 shows the following results:

	Blackwater.	Progress.	Wealth of Nations.
Development, feet	1,045	846	582
Width of lode opened, inches	17	49.3	43.3
Assay of lode opened, per ton	$6.96	$5.03	$4.15
Ore treated, tons	12,731	8,441	6,750
Average yield, per ton	$ 8.96	$ 5.97	$ 7.34
Total cost, per ton	5.04	4.90	4.56
Working profit	49,000	9,700	19,500

As the cyanide manufacturing company of Glasgow is able to supply Africa, it is likely that it will be able to keep New Zealand mines going. Large stocks are usually carried. No zinc dust is used, but zinc sheets are imported. Practically all the silver produced in the Dominion is from the Waihi-Karangahake district.

JOHANNESBURG, TRANSVAAL

DEVELOPMENT OF THE FAR EASTERN RAND.—GOLD OUTPUT AND PRETORIA MINT.

Everything seems to point to the far east Rand beyond Boksburg, for at least some distance beyond Springs, contributing a fair proportion of the gold output of the Rand in the immediate future. It is true that the profitable proportion of the reef area cannot compare with that of the Central Rand, say from the Nourse to the Langlaagte mines, but the far eastern portion has already shown itself to be more profitable than the far western Rand. The way in which the Van Ryn Deep, Modder Deep, Brakpan, Government Areas, Geduld, and Springs have opened, has done much to rehabilitate the far eastern Rand in the good opinion of investors, as until these properties were developed the area was not in much favor. The broken country east of the town of Boksburg was much to blame, and even when the Main Reef series took a decided turn north toward Kleinfontein, it was still of low value. The fact that it took at least 20 years of almost continuous prospecting on Reitfontein, now the Apex Mines, to find a satisfactory area of reef, did not mend matters, while the results achieved at the Van Dyk and Rand Collieries seemed to add much to the doubtful value of this new field.

The August gold output of the Transvaal was 711,918 oz. valued at £3,024,037, against 732,485 oz. and £3,111,398 in July. There was an increase of 1825 boys employed at the gold mines; but a reduction of 11,603 in the total employed at gold, coal, and diamond mines, due to closing the latter. The export of raw gold has ceased until trade routes are safe, and the mint at Pretoria has been overhauled with a view to coining money. This institution has not worked since shortly after the Boer war.

WESTERN AUSTRALIA

DIVIDENDS PAID.—REPORTS OF PERSEVERANCE AND OROYA LINKS COMPANIES.—AUGUST GOLD RETURNS.

Dividends paid by mining companies of this state in June and July amounted to £99,052 and £55,428 respectively. The total to date from all mines is £24,312,230.

Eleven mines at Kalgoorlie used 32,013,900 gal. of water in June in the treatment of 152,885 tons of ore.

The second quarterly report of the Great Boulder Perseverance company shows that development totaled 1353 ft., and the stock of broken ore in stopes is 222,808 tons. Out of 886 ft. driven on lodes, only 267 ft. was in ore over $4.80 per ton. Work at 2200 ft. failed to show any general improvement, although the lode is promising. The 'D' lode continues to produce fair ore. The mill treated 62,889 tons of ore yielding $5.18 at a cost of $4.12 per ton.

The second quarterly report of the Oroya Links company shows that development totaled 1015 ft. Work at 900 ft. in the Eclipse mine has shown considerable improvement, ore worth from $5.28 to $7.92 per ton being opened for a width of 79 in. The 50-stamp mill and cyanide plant treated 36,400 tons averaging $5.30 at a cost of $3.92 per ton.

In the *Monthly Journal* of the Chamber of Mines for June the geology of the Oroya Black Range mine is discussed by R. C. Wilson. In the July issue is a paper on the repair of the crank-shaft of a gas engine, and which will appear in another issue of the *Press*.

August returns were as follows:

Mine.	Tons.	Value.	Profit.
Bullfinch	6,463	$ 52,000	$ 17,000
Golden Horse-Shoe	25,056	170,000	16,000
Great Boulder Perseverance	....	.....	21,000
Great Boulder Proprietary	17,161	235,000	135,000
Ivanhoe	19,700	152,000	.....
Sons of Gwalia	13,270	97,000	24,000

NEW YORK

The Embargo on Copper to Germany Still Under Discussion.—Old Dominion and Wolverine Outputs.—Rio Tinto Dividend Passed.—Granby Consolidated Report.

Copper producers were worried last week by the diversion of shipments of copper consigned to Holland by the British authorities on the ground that such shipments would merely find their way into the hands of the Germans. The British paid for this copper but they did not pay the price the producers expected to get, and they were naturally loath to see their regular sales to England cut down by the capture of conditional contraband. The principal producers and sellers had repeated conferences last week, and meanwhile it was announced that Mr. W. J. Bryan and Sir Cecil Spring-Rice, the British Ambassador had agreed to meet the situation by endeavoring to obtain from the government of Holland official assurance that that country would only import copper in quantities sufficient for domestic consumption. As Holland is a large consumer of copper, it seems quite probable that such an arrangement can be made. It is evident, though, that copper production in this country will have to be further curtailed. The German market, the largest one, has been completely cut off, and though England and France have so far taken large quantities of copper, it is only reasonable to expect that the emergency requirements of those countries will soon be filled, after which their takings can be expected to be less than normal. This situation can best be met by the shutting down of those companies which are unable to make any profit at the present price of the metal. By keeping going, they merely increase stocks, thereby depressing the price, and when normal times return the price of copper will have just that much higher to climb before they can make profits again. In other words, by operating for a month longer now, it is quite probable that their eventual reopening will be delayed two months, so that they will be losers rather than gainers. Of course, the hope of these companies is that they will be able to tide over the crisis without having to shut down at all, but from present indications that is a vain hope.

The Old Dominion made an output of 2,121,000 lb. in September, and Charles S. Smith, the president of the Company, reports that conditions at the property are entirely satisfactory, costs not having materially increased despite the one-third reduction in the output. A 10% reduction has been made in the wage scale, and the ore now being mined is of better than average grade.——The Wolverine reports an output of 401 tons of mineral in September, which is more than the average of preceding months.——The Rio Tinto company, of Spain, has passed the dividend on its ordinary, but paid on its preferred stock, and the Miami has deferred action on its dividend.——The copper mines in Alaska have cut output to half of normal.

The Granby Consolidated Mining, Smelting & Power Co. has issued its report for the year ended June 30, 1914. The production and income account compare as follows:

	1914.	1913.
Copper, pounds	23,320,097	22,688,614
Silver, ounces	435,275	324,336
Gold, ounces	43,882	47,266
Gross income	$4,504,766	$4,782,691
Operating expenses, etc.	3,882,695	3,568,092
Net profits	622,071	1,214,599
Depreciation, etc.	182,519	81,495
Dividends	899,901	449,955
Deficit	460,349	*683,149
Previous surplus	3,199,270	2,516,122
Total surplus	2,738,922	3,199,271

*Surplus.

GRANBY SMELTER AT GRAND FORKS, BRITISH COLUMBIA. TEMPORARILY SHUT DOWN ON ACCOUNT OF THE COPPER MARKET

Copper for 1914 sold at an average of 14.58c. per pound; silver, 57.74c. per ounce; and gold at $20 per ounce. This compares with 16.04c., 61.18c., and $20, respectively, in 1913. The superintendent of mines, J. B. Smith, reports the following quantities of ore in sight at present: Phoenix, 4,691,531 tons; Anyox, 18,153,000; Midas, 116,344; Mamie, 135,200; and It-Dean, 5000; a total of 23,101,075 tons. Treatment costs increased to $2.73 from $2.65 per ton, owing to the new plant being included. The cost per pound of copper was 11.5c. In the development of the Anyox properties, the Company has expended about $3,000,000, and the normal production from them is expected to average 2,400,000 lb. per month.

WASHINGTON, D. C.

'Conservation' Bills for Next Session.—The Alaska Coal Leasing Bill.

The President is determined to see through the next short session of Congress the so-called conservation bills, which include the 'leasing' bill, which is feared by many in the mining industry as an entering wedge whereby the so-called leasing system will be applied to what remains of the public domain, inclusive of mining lands. To this, mining men are greatly opposed, and possibly on account of the shortness of the session, senators from the mining states may be able to frustrate the determination of the President to obtain this legislation from Congress. As it is, oil lands and coal lands are affected.

Quite to the point on this score is the enactment by this session of Congress of the Alaskan coal leasing bill. One measure was passed by the House, but the Senate, when it got the bill, eliminated all after the enacting clause and substituted a bill after its own ideas. Of course, the bill went to a conference between the two Houses, and the committee has reported a compromise between the two measures, and this is to become a law. It is declared by the House conferees, Congressmen Ferris, Graham, and Lenroot, that the conference has brought the Senate and the House bills into harmony by certain modifications, the provisions of which embody the essential features of both bills. The amended bill, as agreed to in conference, provides for the appropriation of $100,000 to make the surveys necessary to proceed intelligently with the leasing. It was ascertained that the current appropriations for the surveys in the West were made prior to the passage of the bill, and did not contemplate any surveying work in Alaska.

Though the conference committee on the Alaskan leasing bill was quite content with its work, the Senate did not like its report, and debated it for a day, and at the close on Saturday, October 10, led by Senator Lane of Oregon,

it sent the bill back to conference on the ground that the conferees had inserted new matter in the bill not considered in either House of Congress. This rule has not been invoked in a long time, and Senator Myers of Montana protested vigorously. He said as a result the bill probably cannot be enacted at this session. This may or may not be, but in the end the bill will be passed, and it is expected not to differ much from the lines laid out in the conference report.

BRISBANE, QUEENSLAND

MINERAL PRODUCTION AND CONDITION OF THE INDUSTRY.—MT. MORGAN AFFAIRS.—THE GYMPIE GOLDFIELD.

Mineral production of the state, other than gold, coal, or precious stones, in the second quarter of 1914, was valued at £460,274, against £503,649 in the same period of 1913. The gold output for the first seven months of 1914 was 135,578 oz., a decrease of 29,853 oz. for that term of last year.

Speaking generally with regard to Queensland mining, it seems to be suffering from lack of capital. The country is so prosperous that surplus capital has been devoted to a greater extent than heretofore to the staple industries, to the detriment of the mining industry.

The annual meeting of the Mt. Morgan Gold Mining Co. was held at Rockhampton on July 17. The chairman of directors stated that the new plant has been started, to the extent that two of the new furnaces are in commission and are each easily treating 350 tons of Mt. Morgan ore daily. The concentrator has been started, and is now running at about half capacity. It is hoped soon to bring the plant up to full capacity. Basic-lined converters were recently installed to take the place of the silicious-lined converters. These newly-lined vessels have now been running a few weeks, and have proved to be a great success. It is too early as yet to get anything like reliable figures as to the work being done at the new plant; but from what can be seen so far, it is felt that the results, when everything is settled down to smooth working, will be found to be quite as good and probably better than anticipated. The general manager, B. Magnus, stated that the high-grade ore is all for the furnaces, and the medium-grade and unpublished reserves were for the concentrator. The estimated monthly copper output is about 800 tons.

Mining in Gympie is at a low ebb. In July the output from eight mines was 10,241 tons of ore yielding 3577 fine ounces gold. The mines mostly are working from hand to mouth. There are no ore reserves, and nothing was put aside in the fat years to tide the companies over the lean years. The result is there is no money available for prospecting work. The Scottish Gympie is the only mine which makes any pretension to work continuously, and even in this case the net result of monthly operations is very often on the wrong side of the account. The July return was 5000 tons of ore worth $20,200. The Scottish Gympie people are the pioneers of fine grinding and cyaniding, which has only been introduced in this field to a limited extent. Save this Company's plant, the few cyanide plants which exist are of a very primitive character, and are only used in connection with small heaps of old tailing. No doubt the limited application of the cyanide process is due to the graphitic nature of the ore which in some way causes difficulty in extraction, but there can be no question that large sums in value of gold which has found its way into the creek might have been saved by finer grinding of the ore, and the consequent improved extraction on the plates. In order to get a fair output per stamp, a 15-mesh screen is the standard size used, and this has resulted in losses which might have been avoided. The country around Gympie is becoming more settled every year, and as a matter of fact the place is now very much more dependent on its agricultural interests than upon the mining industry.

PLATTEVILLE, WISCONSIN

CONDITION OF THE ZINC, LEAD, AND PYRITE MARKETS OF THIS FIELD IN SEPTEMBER.—DISTRICT PRODUCTION AND BUYERS.

A review of operations in the zinc-lead districts of the Platteville field for September reveals extremes in both prices and production. The high figures reached in the last two weeks of August, under the spur of a sharp but spasmodic foreign demand for spelter, was carried over into September, and for the first 10 days blende ores commanded a price in advance of $50 per ton for 60% grades, stimulating production at all points and establishing a new record for maximum production, as usually reported for this area. But this foreign demand vanished into thin air, and prices steadily receded to the levels obtaining during the long period of depression existing prior to the increases inspired by foreign buying. Spelter closed in the last days of the month at $5 per cwt., East St. Louis quotations, but the well informed insinuated that large consumers of spelter could drive even better bargains, and a feeling of discouragement possessed operators in the field in general, production going back in sympathy with the downward movement of prices for both ore and metal, the month finally winding up dull and featureless in all branches of the industry. The base price reported for blende ores had gone back entirely, quotations ruling unsteadily at $39 to $41 per ton for standard commercial zinc ore. No effort had been made to work off a big surplus that was stored in bins, and the first of October found 6000 tons of all grades in bin in excess of the regular deliveries. Prospecting and development work received a serious setback, and the optimistic tone was supplanted by a feeling of gloom.

The lead markets were dull all the month, pigs declining to a point under $3.50 per 100 lb., East St. Louis, with light business reported. Lead ore was in poor demand, and shipments were almost negligible. Production has fallen away almost entirely, except where secured as by-product, and very little surplus is held in this ore.

Production of pyrite, usually running as high as 2500 tons per month, took a decided slump on account of off prices. In the hope that competition might bring substantial benefits, the leading producers diverted their offerings to new buying interests, but this had little or no effect, and the shipments for the entire month were exceedingly light.

The following deliveries of ore were reported for the month, by districts:

District.	Zinc, lb.	Lead, lb.	Pyrite, lb.
Benton	5,890,000	.....	757,000
Cuba City	4,448,000	.....	.....
Galena	4,188,000	120,000	.....
Hazel Green	2,812,000	.....	.....
Livingston	2,574,000	.....	.....
Shullsburg	2,536,000	60,000	.....
Linden	1,496,000	61,000	.....
Mifflin	966,000	103,000	.....
Highland	812,000	.....	.....
Platteville	752,000	.....	.....
Montfort	260,000	.....	90,000
Mineral Point	210,000	.....	.....
Totals	26,944,000	344,000	847,000

Sales were distributed among the following smelter concerns: Mineral Point Zinc Works, 5800 tons; National Separating Works, 1857; Grasselli Chemical Co., 1282; Campbell Separating Works, Cuba, 1171; Matthiesen & Hegeler Zinc Co., 931; Illinois Zinc Co., 821; Empire Roasters, 659; Linden Zinc Co., 494; American Zinc Co., 230; and American Metals Co., 227 tons. Extensive surveys were made during the month in the Highland district by the New Jersey Zinc Company.

THE MINING SUMMARY

The news of the week by our special correspondents and reflected by the local press

ALASKA

Chisana

The season is over in this district, and about 200 out of 400 will remain through the winter. Miners who recently reached Dawson from Chisana estimate the season's output at between $210,000 and $215,000. Most of this went out through McCarthy and Cordova. Hamshaw and associates recovered about $130,000. He will stay and drill ground this winter. F. Best was the most successful individual miner, followed by C. Whitham, Range and Stone, and A. Taylor. Mail is occasionally sent in by way of McCarthy.

A discovery of copper-gold-silver ore has been made at the head of the Snag river by R. A. Lindsay, F. Farnham, and J. O'Hara, according to W. Steinberger, who recently returned to Dawson from Chisana. The district is 25 miles northeast of the latter place, and in line with the Nabesna copper belt. Sixteen claims have been staked, and include the best ground.

Ketchikan

(Special Correspondence.)—The effect of the European war is being felt in this community as a number of ventures being financed with European capital have been obliged to suspend operations.——Both the Alaska Venture Syndicate and the exploratory work of the Granby company are in this class. The Jumbo and Sulzer are also closed temporarily and Charles Sulzer is campaigning for the position of territorial senator. Rush & Brown are working, the Princeton M. & M. Co. is operating at Dolomi, and the Sea Level mine is being unwatered for examination, but in general things are much quieter here than earlier in the season.

Ketchikan, October 8.

Valdez

The president of the Valdez Creek Power & Mines Co., George W. Sias, recently arrived at Cordova, the trip from the mines taking five days. He stated that a new ditch, 1¼ miles long, 8 ft. wide at the bottom, 15 ft. at the top, and 4 ft. deep, to carry 3500 miners inches per 24 hours, had been constructed; also a penstock, flume, and one mile of pipe. The clean-up will be a good one, although sluicing was only done for a few weeks. A Keystone drill is to be sent in.

ARIZONA

Cochise County

The first annual report of the safety inspector, Wallace McKeehan, of the Copper Queen company, has been issued. The department was organized in the summer of 1913. A rescue-station, in which all necessary apparatus is kept, was erected. The inspector visited various coal and iron mining districts of the country, also the U. S. Steel Corporation's plants, to study safety systems in use, and a great deal of valuable information was collected from other sources. In the meantime, notices were posted at the Copper Queen mines and plants relative to the movement and to interest the men in safety during working hours. Coöperation with the Company was asked. During the year of organized effort against accidents, there were 4 fatal, 4 serious, and 2271 minor or slight accidents, a total of 2279. As no previous records were kept, a comparison is difficult, but there appears to be a decrease in fatal injuries of about 55%, serious ones 40%, and a large reduction in minor troubles. This is no doubt due to 'Safety First.' There was an average of 190 accidents per month. Of the total number, 33 might have been prevented by additional precautions by the Company, 1572 by the injured employees, and 134 by fellow employees. There were 233 infractions of the Company's rules, and 501 accidents were unavoidable. In the mines 160 men were hurt at chutes, 96 by ordinary falls, 187 by mine cars, 298 while using tools, and 152 suffered from strains and sprains. From falls of ground 524 accidents occurred, 4 of these being fatal and 32 serious. In 669 cases, or 46%, there was no loss of time during records of 9 months. Twenty-three per cent of the men received first-aid treatment before leaving their place of employment. Lay-offs from strains and sprains are on the increase, and as it is impossible to say how badly a man feels from these causes, it is suspected that some men are not sincere about it. Mine-rescue work is conducted on the lines proposed by the U. S. Bureau of Mines, and training and equipment is in charge of J. B. Frank. The Draeger oxygen apparatus, of 1913 pattern, is kept in the best condition. The rescue corps has been called upon for work at El Cumbre tunnel, in Mexico, where 51 passengers were burned to death; and at the mines of the Cananea Consolidated Copper Co., Cananea, Sonora, Mexico, where 16 Copper Queen men were constantly employed fighting the fires for seven days, a part of the men remaining for 18 days. At both of these fires the work done by the men was as effective as could be expected under the conditions. There was only one fire in the Copper Queen mines during the year, this being in division No. 2 and being put out after about 10 hours work. Everybody is proud of this corps. Generally speaking, the new safety department is a decided success.

MAP OF ARIZONA, ALSO PART OF MEXICO WHERE FIGHTING IS UNDER WAY.

GILA COUNTY

A proposal has been on foot for some time to split this county, and form a new one from part of it, with the name of Miami county. This is to be voted on at the elections on November 3. While taking only 285 square miles, or one-sixteenth of Gila county, the new county would absorb about half of the revenue.

CALIFORNIA

BUTTE COUNTY

The Pacific Dredging Co., well known in Oroville, has started a new dredge in the Butte Creek district, six miles from Chico.——The Supreme Court of the state has confirmed the decision of the Superior Court of the county, which rendered a judgment of $20,000 for the wife of W. Crabbe against the Mammoth Channel Gold Mining Co., in whose mine, near Magalia, he was killed.

SHASTA COUNTY

The first run of the electric smelter at Heroult on manganese ore produced four tons of ferro-manganese.——The first clean-up from the Mad Ox mill has been sent to Redding. The mine is opening satisfactorily.——Unwatering the Midas mine at Harrison gulch, which was flooded on account of a fire last spring, has reached 12 ft. below the 500-ft. level. Electric pumps at 600 ft. are still 'drowned.' The cyanide plant has been overhauled.

SISKIYOU COUNTY

At the Forks of Salmon company's gravel claims preparations are under way for a busy winter at hydraulicking. The water supply is still good for work on the Salmon river.——The Michigan company is also preparing its Red Hill placers on the same river. L. E. Taggett is superintendent.——The Wike claims are developing well.

TUOLUMNE COUNTY

(Special Correspondence.)—A shoot of ore, which assays from $20 to $60 per ton, has been uncovered in the Golden Slipper mine, in the Knights Creek district, by A. C. Johnson.——At the DeWerdt mine, near Columbia, recently bonded to Clark Sullivan, of Berkeley, a cross-cut is being driven from the shaft to cut the vein. Some good ore was taken out of the property by former operators.——One hundred tons of ore from the property of A. E. Caldwell, on Five-Mile creek, yielded $1160. A few small pockets, aggregating several hundred dollars, were taken out recently, in addition to the above sum mentioned.——The William Scattergood ranch, on Bald mountain, has been bonded to W. F. King, of Sonora, who intends to prospect it for gold. The price is $4750, payable within three years.——R. W. Steckel and associates, who are leasing a portion of the Jumper mine, at Stent, have uncovered rich ore, stringers of gold running through the rock in all directions. Chunks of the ore chiseled out during the past week were on exhibition here. The ore is of the same character as that which made the mine famous a number of years ago, when more than $6,000,000 was extracted.——The F. J. & M. Mines Co. has secured a bond on the Wise mine, situated near Tuttletown. An air-compressor has been installed.

Sonora, October 9.

COLORADO

SAN JUAN COUNTY

A new mining district, known as Cow Creek, is being prospected, and a number of well known men from Ouray have inspected the place. The ores contain silver, gold, lead, and copper.

SUMMIT COUNTY

Breckenridge is extremely active and prosperous. The last gold shipment of the Tonopah Placers dredges was valued at $41,000. No. 1 boat is cutting through ground used by a branch of the Colorado & Southern railway, and all traffic is suspended to Dillon, a distance of 10 miles. The French Gulch company's Reiling dredge is attacking a 50-ft. bank, and recovers up to $33,000 per month. The Wellington Mines Co. is making regular shipments of zinc concentrate. There are a number of gold, gold-silver-lead, lead-silver, and zinc claims to be had under lease and option.

TELLER COUNTY (CRIPPLE CREEK)

From its Eclipse and Carbonate Queen properties on Battle mountain, the El Oro company sent out approximately 2950 tons of ore in September, worth $35,400. This was mainly from the Mullen vein, which is developing well. About 100 miners are now employed.——Ore production of the Vindicator in September was 75 carloads, that on Company account averaging $35 per ton. The Company will pay 3c. per share, equal to $45,000, on October 25. The total to date is $2,947,500.——The Granite output was 65 cars of $25 ore. The Dillon shaft is down 1316 ft., and will be sunk to water-level, or 1500 ft.——There are between 25 and 30 sets of lessees working on the Stratton estate, as well as several prospecting permits with lease options.——The top 40 ft. of the Jo Dandy shaft is being concreted.——The Abe Lincoln mine lessees shipped 525 tons of ore last month.——To date the Mary McKinney mine has produced $8,122,610, and paid $1,169,306 in dividends.——The Ajax company treated most of its 3918-ton output in September at the Colburn mill. The average value was $6.89 per ton. Twenty sets of lessees are at work.——From No. 13 level the Beacon Hill Leasing Co. will sink the winze to water-level.——The Jerry Johnson ore-house has been destroyed by fire.

IDAHO

The mineral product of chief value in Idaho, according to the U. S. Geological Survey, is lead, which forms about 60% of the state's total mineral production, having somewhat more than twice the value of its silver output, which ranks second among the state's mineral products. The total value of the mineral products of Idaho increased from $21,816,390, in 1912, to $24,565,826, in 1913. In 1913 the recoverable lead content of the ores mined amounted to 158,936 short tons, valued at $13,986,366, against 142,093 short tons, valued at $12,788,355, in 1912. Idaho ranks second among the states in the production of lead ores, its output of this product being exceeded by that of Missouri. The recoverable silver content of the ores mined in Idaho in 1913 was valued at $6,033,473, against $5,101,268 in 1912. Copper, gold, and zinc are also produced in significant quantities in Idaho, the output of each having a value of over $1,000,000 in 1913. The total value of the metals contained in the ores mined in Idaho in 1913 was $24,168,339. Non-metallic products were valued at $397,487.

BOISE COUNTY

(Special Correspondence.)—The Gold Hill & Iowa Mines Co. is enlarging its plant with a large compressor, Nissen stamps, and Willley tables. The first grade of concentrate is being shipped and the second cyanided. Ore is extracted from the 250, 400, and 500-ft. levels. E. E. Carter is manager.——The Mountain Chief company has changed its method of treatment, and is now depending entirely upon cyanidation. A power-line is being built to connect with the Gold Hill line.——The Golden Age mine at Grimm's Pass will be operated this winter.——The Boston-Idaho company has purchased the Edna mine.

Quartzburg, October 6.

LEMHI COUNTY

(Special Correspondence.)—The Lemhi county fair at Salmon was a great success. The mineral exhibits were excellent, this department being in charge of A. C. Ludwig, assisted by E. Hill, O. E. Kirkpatrick, and T. Pope. There were 70 samples of ore, coal, building stone, and stream tin, also some of the rarer ores. The tin was from Eli Minert's claim in Prairie basin. The exhibit of W. H. Shoup contained

over 1000 nuggets of placer gold and other specimens. Some of the collections will be sent to the Idaho building at the Panama Pacific Exposition.

Development at the Wickham and O'Heness gold mine 10 miles down the river from Salmon is encouraging, and machinery has been installed.——According to the manager of the Musgrove Mining Co. the September profit from the Chilean mill and cyanide plant was $5000.

Salmon, October 7.

SHOSHONE COUNTY

For many years the Washington Water Power Co. has had practically a monopoly of the supply of electric power for mines and mills in the Coeur d'Alene district. But now it is reported in *The Wallace Miner* that the Montana Power

MAP SHOWING POWER-LINES OF THE WASHINGTON WATER POWER CO.

Co., whose plants are at Great Falls and Thompson Falls, is to enter the field as a competitor for business. Men are now clearing space for the transmission line which will enter the district near Mullan.

The Stewart Mining Co. has declared a dividend of 10%, and an extra one of 2½%. A shaft is to be sunk from the 400 to the 1000-ft. level. Most of the ore mined comes from above 600 ft., the daily output being about 500 tons. Also about 600 tons of 45% lead and 50-oz. silver ore is sent per month to the East Helena smelter, as is the concentrate. A flotation plant is doing good work in the mill. Net earnings for the first half of the current year were $537,230.

The 7500-ft. adit of the Montana-Idaho Copper Co. has been started from Adair station, on the Chicago, Milwaukee & St. Paul railroad, to connect with the shaft of the Monitor Mining Co. A water-power plant is being erected to supply air for drills, instead of hand work as at present. Otis Hill is manager of the first-named Company.

The Idora mine shows improvement, and the mill will soon be started by C. F. Mallette, of Spokane, who is endeavoring to clear the Company's debt.——The Paragon mill is again working and producing zinc and lead concentrate.——Mining on the north side of the Cœur d'Alene is better than ever. This may also be said of the area on the Montana side of the divide, of which Saltese is the commercial centre. Promising mines here are the Hemlock, Meadow Mountain, Tarbox, Bald Mountain, Last Chance, and others. Silver-lead and copper ores are mined. The Montana Power Co.'s line may pass through the district.

MISSOURI

JASPER COUNTY

Under the direction of Otto von Schlichten, of the State Geological Survey, and assisted by G. B. Corless, a topographic map of the Joplin district is being made. Developments up to date will be recorded.——Good results have been secured by C. A. Wright in experimenting on local mill products with flotation methods.——The Hercules Powder Co.'s fifth annual drilling contest was held at Joplin on October 4. Fourteen teams entered, and were watched by 4000 people. The winners were H. Haines and E. Haines, who drilled 37.5 inches in 15 minutes, followed by O. L. Seagraves and B. Anderson with 36.4 in., and C. E. Smock and H. Van Horn with 35.1 inches. Prizes were $100 and $50 for first and second places. The winners also got the trophy hammer with previous records engraved on it.——Zinc ore prices are down to $40 per ton for 60% ore.

NEVADA

ESMERALDA COUNTY

The Nevada Engineering Works of Reno is preparing plans for a 5-stamp mill for the Diamondfield Black Butte Reorganized Mining Co. of Goldfield. The plant will also contain a tube-mill, agitators, and decantation tanks. The superintendent, A. J. Canavan, estimates ore above 100 ft. in the mine and on dumps as 20,000 tons averaging $7 per ton. A net profit of $51,000 is expected. Past production is over $600,000.

The Silver Pick Consolidated 500-ft. level is being sampled by the general manager, E. S. Van Dyck, and the superintendent, Walter S. Norris.——Preparations are complete for installation of pumps at 1800 ft. at the Merger.——The Golden Arrow company, operating 47 miles northeast of Goldfield, has bought 10 stamps from the Florence Goldfield company. A 75-hp. gasoline engine has arrived from Los Angeles. E. M. Kieron is manager, and S. O. Jones, mill superintendent.

HUMBOLDT COUNTY

Extraction of high-grade ore from the Nevada Packard claims continues. Shipments from the Kraner-Hampton lease for the last half of September totaled 74 tons, worth $4697; and from Company workings 50 tons valued at $2559.——During the 18 days of last month that it was operated, the Seven Troughs Coalition mill yielded $37,000. At 1200 ft. in the vein shows 3 to 8 ft. of rich ore.——The Davey 5-stamp mill at Dantown, in the Awakening district, produced $20,000 in gold in 50 days. A 50-ton cyanide plant may be erected. H. S. Chapman is mill manager.

NYE COUNTY

The White Caps Mining Co. at Manhattan has arranged to use part of the Manhattan Milling & Ore Co.'s 10-stamp mill and cyanide plant. This will allow of a large tonnage of oxidized ore being treated.——Lessees at the Litigation Hill mine have recently crushed 50 tons of $48 ore at the Associated mill. This mill has started on a 1000-ton lot of $12 ore from lessees at the Manhattan Consolidated.

In the Bullfrog district, the Sunset Mining & Development Co. has nearly finished erecting a cyanide plant and other equipment. With the 10 stamps in the mill, there is now a 5 by 18-ft. tube-mill, four Pachuca agitators, four Dorr thickeners, and a Portland filter. An Overstrom centrifugal crusher is to be installed, which may eliminate the stamps. The mine shows 50,000 tons of $5.50 ore, which may yield a profit of $2 per ton.

At Tonopah the Jim Butler company has had an attachment for $1,500,000 served on the West End company, to cover the value of 25,000 tons of ore alleged to have been wrongfully extracted, or $500,000; also for exemplary damages allowed under the statute.——So far the Egyptian vein at 400 ft. in the Extension has been opened for 400 ft.——The Montana mill treated 1034 tons of ore last week, and 846 lb. of bullion and 20 tons of concentrate were shipped.——Ore production of the district last week was 10,482 tons, worth $214,636.

WHITE PINE COUNTY

At the Nevada Consolidated plant at McGill four of the eight units of the concentrator are operated for four or five days, then the other four are given a similar run. Only one of the four reverberatory furnaces is in blast. The September *Safety First* of the Company shows that there were only six disabling accidents during the month, one at the Veteran mine, four at Copper Flat, and one at the smelter, the mill having none to report.

OREGON

Baker County

The Greenhorn camp is showing increased activity. A stamp-mill is being erected at Tipton; the West Side mine is shipping ore. F. Roberts is milling ore from the Snow Creek mine; while assessment work is being done on the Don Juan, Bi-Metallic, and other claims.

UTAH

Beaver County

The Moscow company's output in September was 750 tons of silver-lead ore worth $15,000. This came from the 800-ft. level.——A mining committee of the Salt Lake Commercial Club has visited the new gold district of Fortuna, mentioned in this journal last month. It reports that automobiles can be driven all the way to the camp; mining claims are up Rocky hollow, and strong veins were found to outcrop prominently; dikes of eruptive rock occur; country rock is monzonite; the ore is a quartz containing gold and silver; some free gold is visible in stringers; work is being done faithfully; and the outlook is so favorable that capital should be invested to determine the merits of the properties.

Juab County

The Eagle & Blue Bell company's new shaft is down 90 ft. below the 1550-ft. level. The output is about 100 tons per day.——The Iron Blossom company has declared a dividend of 10c. per share, equal to $100,000. Development at 1900 ft. is being continued.

Summit County

The Snake Creek tunnel is now in 9436 ft. Owing to hard rock, water, and low air-pressure, the advance in September was 350 ft., compared with 419 ft. in August. Water at the portal is flowing at the rate of 9.87 second-feet.——A dispute has arisen between Solon Spiro, president of the Silver King Consolidated Mining Co., and prominent shareholders, owing to a request of Mr. Spiro for extra compensation.

Tooele County

After being dressed by concentration, a shipment of high-grade gold-silver-bismuth product will be shipped by the Wilson Consolidated Mining Co., operating in the western part of the county. This will be the first carload shipment of such ore from any Utah mine.

WASHINGTON

Okanogan County

The Palmer Mountain tunnel, and the Summit and Copper World mines near Loomis, have been bonded to Ernest Barton, of Los Angeles, California. An electric smelter is proposed capable of handling all ores from the county.

CANADA

British Columbia

Shipments of zinc ore from Nelson to the zinc smelters at Bartlesville, Oklahoma, amounted to 1012 tons during September, as follows: Utica, 33 tons; Standard, 453 tons; Hewitt, 353 tons; and Rambler-Cariboo, 173 tons.

Near Skeena Crossing, the Juniper Creek Mines Co. is developing the Great Ohio copper mine, and an adit is in 365 ft., which should soon cut the vein.

Ontario

Insurance rates on bullion from Cobalt to England are said to have been doubled on account of war risks.——During September the Nipissing high and low-grade mills treated 155 and 6404 tons of ore, respectively, while the bullion shipped was 666,027 oz. silver. Of this, $202,243 was on Company account, and $149,181 from custom ore. Mine development was satisfactory.

It is proposed to consolidate the Crown Porcupine and North Thompson claims at Timmins, and adjoining the Hollinger on the south.

Yukon

'Lode Mining in the Yukon,' an investigation of quartz deposits in the Klondike division, by T. A. MacLean, is the title of a 205 page, well illustrated publication, just issued by the Department of Mines of Canada, at Ottawa. In the season of 1912 the gold areas of Dawson, Duncan, and Conrad, and the copper belt of White Horse, were examined. Great assistance was given by D. MacLachlan. Lode mining has been attracting considerable attention in these parts for some years past, quartz claims being staked as early as 1899. Total gold output of the Klondike, including the last season, is about $180,000,000, mostly from placers. In 1900 the population was 30,000, with a yield of $22,275,000; in 1912 it was 8500, with $5,500,000, of which $9500 was from gold lode mining. With the decrease of placer gold, miners have turned to lodes, but results have been indifferent. This is partly due to the fact that prospectors were not familiar with lode mining, little or no high-grade ore had been found, capital was difficult to secure, and considerable expenditure had been made inadvisedly on certain properties. The local government has aided prospectors by road making, an assay office, and diamond-drills. Early in 1912 the Yukon Miners' Association asked the Dominion government for assistance. Mine operators are

OPEN-CUT AT LONE STAR MINE, NEAR DAWSON.

handicapped by the heavy charges for transport of supplies. The weather from June to September is splendid, and underground work may be done through the winter. Plenty of timber is available. The various mines visited are described in the volume, with the geology of the districts. The Lone Star mine is situated on a tributary of Bonanza creek, near Dawson. The Boulder lode here is an irregular formation of quartz lenses through a mass of micaceous schist, much crushed, folded, and metamorphosed. In the 1912 season, 2495 tons of ore was crushed by the 4-stamp Joshua Hendy mill, averaging $3.79 per ton. Concentrate assayed $12 per ton or more. Cost of mining and milling was $2.75 per ton. At White Horse, the Pueblo orebody, and practically all the copper ores of the district, are ordinary contact metamorphic deposits, but they are composed of cupriferous hematite in contrast to the others, which are composed of copper minerals

associated with magnetite. The Pueblo ore is in limestone near the contact of this and granite. The deposit is very irregular in shape. In the Wheaton and Windy Arm areas of the Conrad district below White Horse and north of Skagway are gold-silver quartz veins, antimony-silver veins, silver-lead veins, contact metamorphic ore deposits, and coal seams. Quartz is predominant. Only the highest grade ore could be shipped. The publication should be in the hands of all interested in Alaska and the Yukon.

COLOMBIA

The Pato dredge of the Oroville Dredging Co. turned over and sank on September 11. It was righted on the 17th, and was expected to be repaired by about the first week in October.

MEXICO

According to *The Mexican Herald* of October 5, there are now no metal refineries in operation in the republic, the two which were worked being closed. That of the Compañia Afinadora y Refinadora de Metales de Monterey was partly burned last April, while the French company, Société d'Afinage de Metaux, at Nonoalco, shut down its plant at the outbreak of war in Europe. A hoard of $200,000 of silver has been found in Mexico City and confiscated.

According to a *Daily Consular Report*, from Tampico, of September 10, practically all field operations in the oil regions have been suspended. This is due to local conditions, and also because there is no market for the grade of crude oil produced in this district. At the beginning of September there were only 27 rigs at work, against 83 actually drilling on April 20, 1914. Only 5 of the 27 are making fast time on holes. The latest national decree on oil from the port of Tampico makes the tax 8c. per barrel, against 6c. a year ago. Oil from Tuxpam escapes the Tampico 'bar' dues, which are about 25c. per ton. Oil shipments to the United States in July and August were 1,607,210 and 680,042 bbl., respectively, and a total of 2,460,008 and 1,168,340 bbl. to all points from the two ports mentioned. Oilmen in Tampico are generally depressed with the state of affairs.

CHIHUAHUA

(Special Correspondence.)—Mining in Chihuahua is very quiet at present, and until the political entanglement is settled, there is little hope for a 'Mexican boom.' In this district the only mines operating are out at Santa Eulalia. At the present time the Domingo and Potosi properties of the Chihuahua Mining Co. are operating. This Company is controlled by More and Schley, of New York. The Mina Vieja is being operated by the American Smelting & Refining Co., and the Buena Tierra by an English company. All work is on a limited scale owing to the scarcity of labor and the companies being unable to market their ores to the smelter here, which is only operating four stacks. There are no mills in the district, and the mines are producing from 300 to 350 tons per day.

The Cusi Mining Co., which is working the old Promontorio mine in the Cusihuiriachic district, has continued right through the Mexican revolutions, and is producing a very high grade of silver ore. The Company, however, can only dispose of 900 tons per month; this, it is said, being all that the smelter will take. The ore assays upward of 300 oz. silver per ton. It belongs to the Potter Palmer estate of Chicago.

Chihuahua, October 6.

HIDALGO

As the result of a fire in the Barron mine of the Real del Monte company, an explosion of 500 cases of dynamite occurred on October 3. This mine is between La Blanca and Santa Gertrudis, and is connected with the latter on No. 16 level. Smoke entered the Santa Gertrudis, which was abandoned. The total amount of damage done is not yet known.

PERSONAL

J. Kojima is in New York.

B. J. Padshah is in London.

C. S. Haley has gone to Nevada.

A. H. Brookes was at Dawson recently.

Robert H. Redcomb is in San Francisco.

E. H. Leslie was at Chihuahua last week.

Thomas T. Read was at Pittsburgh last week.

Sumner S. Smith is expected in Oakland for his annual vacation.

F. H. Morley has settled at El Molino, Olive Mill road, Montecito, California, for the winter.

Edwin E. Chase has returned to Denver from California and resumed his consulting practice.

A. C. Bailey has been appointed manager of the Porcupine Pet mine in Delora township, Ontario.

C. S. Newcomb returned to Mexico on October 15, after several months' stay in the United States.

G. C. Bateman has been appointed consulting engineer to the Long Lake Gold Mines near Sudbury.

W. Spencer Hutchinson passed through San Francisco on his way from British Columbia to Arizona.

R. H. Channing, who was in France and saw some of the fighting on the Marne, was in Utah last week.

Lionel Lindsay has a commission in the King's Royal Rifle Corps, one of the well known English regiments.

George W. Sias, president of the Valdez Creek Power & Mines Co., Alaska, has returned to Boston from Valdez.

Richard Phillips has returned from the East and is now at his property, the Old Glory mine, near Oroville, California.

R. B. Lamb has moved his office from room 703 to rooms 501 and 502 in the Traders Bank building, Toronto, Ontario.

James E. Russell has been appointed assayer in charge of the United States assay office at Deadwood by the President.

A. W. Allen is revising Julian and Smart's 'Cyaniding of Silver Ores,' but is hampered by the fact that Edgar Smart is in the Belgian Congo, where fighting has interfered with ordinary pursuits.

Carl A. Allen and C. Lorimer Colburn have left Denver for Breckenridge, Colorado, where they will be employed for the next few weeks in unwatering and examining the Country Boy and Juniata mines.

The Pennsylvania Railroad Co. has named its new line south from Burgettstown, Pennsylvania, eventually to connect with Wheeling, West Virginia, the Langeloth division, in honor of the late Jacob Langeloth, after whom the new town of Langeloth has also been named. Mr. Langeloth left a bequest of over $150,000 to be devoted to social and welfare work in the new town.

Obituary

John Wesley Boileau, who shot himself on October 7 at his home in Pittsburgh, was born October 27, 1873, in Athens county, Ohio. Beginning as a clerk in a store, and later becoming a school-teacher in Pennsylvania, he took up engineering and contract work, finally specializing in coal lands, of which he made large sales. He was an officer and director in many coal and coke companies, and was prominent in the life of Pittsburgh. Depression caused by ill health and the recent suicide of a friend is supposed to have prompted his act.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, October 15

Antimony	13 —13¼
Electrolytic copper	13⅝—13⅞
Pig lead	3.75—4.70
Quicksilver (flask)	$55
Tin	36 —37½
Spelter	6½— 6¾
Zinc dust 100-kg. zinc-lined cases	10

EASTERN METAL MARKET

(By wire from New York)

NEW YORK, October 15.—The markets are weak. Lead is quoted at 3.75c and spelter at 4.55c per pound. While there has been no regular market for copper, settlements on October 2, 6, and 9 were 11.75, 11.15, and 11.50c. respectively. Exports for the first seven days of the month were 1895 tons, a small gain. Reduced freight rates will be granted to American imports by way of Vladivostok to Russia. Low rates obtain for American tin, nickel, copper, aluminum, zinc, and medicated cotton, according to a telegram from the consulate at Moscow. Platinum in London is $44.40 per ounce, and molybdenite $27.60 per unit.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The tendency of prices has been downward, and New York and London quotations are 51.5c. and 23d. per ounce respectively. Pixley and Abell of London, on October 1, stated that business continues restricted, and transactions are for cash only, being limited to actual demand, there being no speculative account. Exports of silver from London to India, China, and the Straits for the current year total £4,563,500, against £6,841,000 for the same period of 1913. The Nipissing company sent 315 bars, weighing 365,051 oz. silver, to London last week. The Crown Reserve sent 16,197 oz. During the last half of September the Tonopah Belmont mine yielded 76 bars weighing 155,016 ounces.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending		Oct.	
Sept. 17	55.00	Oct. 1	55.00
" 24	55.00	" 8	55.00
		" 15	55.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mch.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

Quicksilver producers faced a slump in prices last week, a result of the importation of 1000 flasks from Italy. As that amount represents about six months output for that country and Italy is likely, furthermore, to need its own supply if the country decides to engage in the luxury of war, further importations are not likely to be large for some time. The Austrian mines are working full time to supply Austrian and German demands. Spanish quicksilver goes to England, and the American market is left to the American mines without the fear of importations which has long acted as a regulator of prices. For the present there is little trading and producers and consumers are watching each other closely.

The Nevada Cinnabar Co. at Ione is producing 60 flasks of metal per week. A recent shipment to the East amounted to 375 flasks.

COPPER

Prices of electrolytic in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.25	13.26
Feb.	14.93	14.46	Aug.	15.42	12.31
Mch.	14.72	14.11	Sept.	16.27	....
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.98	....
June	14.71	13.60	Dec.	14.25	....

The market is stagnant at 11.40 to 11.50c. per pound. It is stated that the Western Electric Co. bought 5,000,000 lb. at 12c. a week ago. Germany has paid 20c. for a shipment. The visible supply of copper in England on September 30 amounted to 24,146 tons, as follows: stocks in England, 18,610 tons; afloat from Chile, 475 tons, and afloat from Australia, 5050 tons, according to Henry R. Merton's report of October 2. On August 31 the total was 21,397 tons. Prices are about £55 per ton, the average for electrolytic metal in September being £56 19s. 4d. The Elmore plant at Sulitjelma, Norway, recovered 1480 tons of copper concentrate in September.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Oct. 8	3.75	Aug. 26	3.87
" 9	3.75	Sept. 2	3.90
" 10	3.75	" 9	3.85
" 11 Sunday		" 16	3.85
" 12	3.75	" 23	3.85
" 13	3.75	" 30	3.75
" 14	3.75	Oct. 14	3.75

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.79	3.82
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

Lead is firmer at St. Louis at 3.37½ to 3.40c. per pound. A large business has been done in England, mostly for shipment to Russia. American supplies lowered prices, which averaged £18 16s. 3d. per ton in September.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Oct. 8	4.55	Aug. 26	5.77
" 9	4.55	Sept. 2	5.75
" 10	4.55	" 9	5.50
" 11 Sunday		" 16	5.25
" 12	4.55	" 23	5.00
" 13	4.55	" 30	4.88
" 14	4.55	Oct. 14	4.55

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.37	5.16
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

The Platteville, Wisconsin, letter of this week, on page 616, should be studied for a better understanding of the spelter situation. The metal is lower at St. Louis at 4.5c. to 4.60c. per pound. Zinc ore prices at Joplin, Missouri, are weak at $34 to $38 per ton. Pressing offers from the United States have weakened the English market. The average in England in September was £25 14s. 9d. per ton.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.55	30.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	48.00	36.10	Oct.	40.61	....
May	48.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.37	....

The tin market is stagnant, sales having gone down to 30.30c. per pound. A total of 2880 tons was due by steamer to New York up to October 14. Buying by consumers for November to March has stopped. In London, in September, standard metal fluctuated between £139 10s. and £133 per ton.

MINING DECISIONS

COAL MINES—STATUTORY REGULATION OF WEIGHING COAL

The Ohio law providing that the regulation of weighing of coal before screening has been upheld by the Federal Court as a valid exercise of the police power.

Rail & River Coal Co. v. Yaple, 214 Federal, 273. May 20, 1914.

OIL LEASE—VOIDABLE PRIOR TO DEVELOPMENT

Held, that where under an oil lease the lessee has the option at any time of refusing to comply with the contract and surrendering the lease without exploring and developing the land, upon the payment of a purely nominal consideration the contract is unilateral, and may be avoided at the option of the lessor.

Owens v. Corsicana Petroleum Co. (Texas), 169 Southwestern, 192. June 27, 1914.

ADVERSE CLAIM—PROOF INSUFFICIENT

Where plaintiff, in an ejectment suit brought to substantiate an adverse claim in patent proceedings, proved the recordation of a copy of a prior location notice, but submitted no further proof of the acts necessary to validate a location, it was held that the showing was insufficient to support plaintiff's case. Proof that assessment work was performed continuously for ten years is not sufficient to support title by prescription, as such proof does not establish open, notorious, or continuous adverse possession for said period.

Childers v. Laham (New Mexico), 142 Pacific, 924. August 4, 1914.

ROADS AND TRAILS AS PATENT IMPROVEMENTS

Where some mining claims, for which patent was sought, were situated on the side of a steep mountain, and the construction of a trail was absolutely necessary for properly working the same, such trails may be properly counted as patent improvements. But a road or trail, no portion of which is on the claim, and which is not intended to be used in connection with such claim, cannot be accepted as compliance with the legal requirement. There must be a necessary connection between the construction of the road or trail and the proper development of the claim. Cases reviewed.

Tacoma & Roche Harbor Lime Co. (Land Decisions), 43 Land Decisions, 128. February 21, 1914.

FINAL ENTRY—EFFECT OF ERRONEOUS CANCELLATION

The legal effect of the allowance of an entry upon application for a patent to a mining claim by the local land officer issuing the final receipt is a determination that the original locations were valid and that everything necessary to keep them in force, including the annual assessment work, had been done, and the effect of such determination is not destroyed by an erroneous cancellation by the Land Department of such final receipts and entry. Where such cancellation is based on the fact that the affidavit of posting the notice of application for patent was executed outside of the mining district wherein the claim was situated instead of inside the district as required by law it was erroneous, the defect being a mere irregularity which could be cured by the subsequent filing of a properly-verified affidavit, and not a jurisdictional matter as claimed by the Land Department.

El Paso Brick Co. *v.* McKnight (U. S. Supreme Court), 58 U. S. L. Ed., April 6, 1914. Reversing New Mexico Supreme Court decision in 120 Pacific, 694.

RECENT PATENTS

1,110,896.—ELECTROSTATIC SEPARATOR. Harry Comstock, Mineville, New York. Filed June 9, 1911. Serial No. 632,184. In a static separating apparatus, and in combination, a belt of non-conductive material; an electrostatically charged plate supported above the lower stretch of said belt; means for moving said belt; and an electrostatically charged belt.

1,110,790.—APPARATUS FOR MAKING AND FILTERING SOLUTIONS, APPLICABLE IN THE EXTRACTION OF METALS FROM ORES AND FOR LIKE PURPOSES. Percy Claude Cameron Isherwood, Bushley Heath, England. A rotatable casing divided longitudinally by a partition into compartments, a solution discharge outlet on each of said compartments, a filter plate for each of said compartments, and man-holes to each compartment on the outer side of such plate for charging and discharging the compartments.

1,109,485.—ORE-PULP CLASSIFIER. Joseph T. Terry, Jr., San Francisco, California. A hydraulic classifier including a weight yielding adjusting frame, an automatically leveling supporting frame movably mounted therein, a main receptacle movably mounted in the supporting frame, said receptacle being formed with a valved discharge opening and means connected to the valve and operating in the movement of the receptacle under the accumulation of material therein to actuate the valve to free the discharge opening.

1,109,533.—MACHINE FOR REMOVING SLAG, ASH, OR OTHER RESIDUE FROM THE RETORTS OF ZINC FURNACES. Edward W. Keith, Denver, Colorado. The combination of an electric motor having a shaft supported in hubs and provided with a drill-receiving bore in its forward end and an axial passage extending from said bore to the opposite end of the shaft, a cap on the rear hub of the motor having a chamber communicating with and providing an unrestricted inlet to the axial passage in the shaft, and a valved hose connected to said cap.

1,110,660.—PROCESS FOR ARRESTING SULPHUROUS GASES AND FUMES AND UTILIZING THE HEAT AND GASES CONTAINED THEREIN. Charles S. Vadner, Salt Lake City, Utah. Filed October 29, 1913. Serial No. 797,949. The process which consists in recovering zinc and other metals from naturally oxidized or sufficiently roasted sulphide ores containing zinc and other metals by spraying the finely ground pulp of said ores into smelter fume containing sulphurous gases, eliminating the copper contained therein by passing the solution over metallic iron, oxidizing the solution and eliminating the other metals except zinc by precipitating same in the cold by means of a sufficient quantity of finely pulverized calcium carbonate, reheating the solution and precipitating the zinc as a basic carbonate.

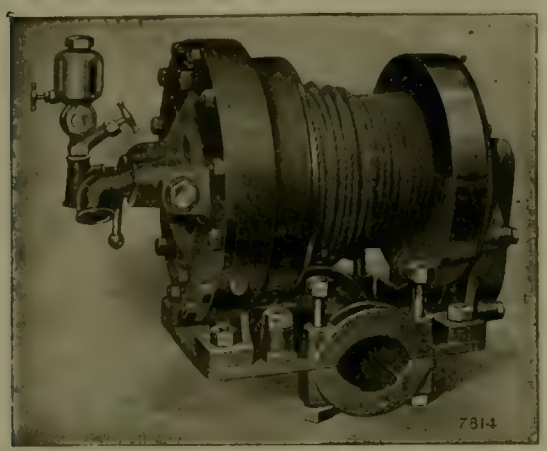
1,100,971—Concentrating apparatus. Peele T. Hambric, Drytown, California, assignor of one-half to Wilton E. Darrow, Sutter Creek, California.

A revolving frame having a series of radially disposed superposed independent concentrating tables, a mechanism for subdividing and distributing the pulp comprising a stationary pulp receiving launder mounted above the frame, an annular distributing launder centrally mounted in the frame and revoluble with same, radially disposed and downward inclined flumes connected with the annular distributing launder, vertically disposed flumes connected with the outer ends of said flumes and divide into a plurality of ducts, a series of distributing plates secured in the revolving frame adapted to deliver and distribute the pulp to the concentrating tables.

New Machines and Devices

The Little Tugger Hoist

A new hoist has recently been perfected and placed upon the market by the Ingersoll-Rand Co., which is intended for light lifting. It has a capacity up to a half-ton, and because of its light weight, which is under 300 lb. complete, it is recommended particularly for use as a portable hoist for mines, for contract work, for manufacturing plants, for powerhouses, and in railroad shops and shipyards. In the mines it can be used in winzes, stopes, and rises, clamped to a drill column, stretcher bar, shaft-bar, or timber, for raising and lowering drilling machines, mountings, drill steel, timbers and



LITTLE TUGGER HOIST, REVERSE VIEW.

miscellaneous material, for hauling cars in drifts and tunnels, for hoisting and lowering ore and water buckets in shallow shafts, for placing light machinery, and for numerous other purposes.

The main base of the hoist is arranged so that it can be bolted to a timber and by means of a cap which comes with the hoist it can be clamped to a circular member, as a mine column or arm, shaft-bar, or pipe. The adjustment can be made quickly. The dimensions of the hoist are 21¼ by 16½ in. and the height is 20⅛ in. The drum is of 6 in. diameter, with a space of 7 in. between flanges. This will accommodate 700 ft. of ½-in. rope or 450 ft. of ⅝-in. The capacity is 1000 lb. at a rope speed of 85 ft. per minute and a pressure of 80 lb. It operates with either compressed air or steam. The motor or engine is of the reversible square piston type, giving four impulses per revolution. There are no dead centres. The drum is mounted independently of the engine shaft and is operated through a clutch and gears. There is a powerful worm-operated band brake lined with 'Raybestos.'

The accompanying illustration shows the reverse view, the engine being on the left. Separate levers control the gears and clutch, the direction of operation, and the brakes. These are at the front of the hoist. When the operator releases the throttle it returns automatically to central position, shutting off the power and stopping the hoist. Thus the hoist may be used for haulage purposes and this release feature enables one man to handle it. He can leave the control lever and carry the rope to the car. Hoists without this feature require two men, inasmuch as the rope has to be released under power. There are no moving parts exposed on the 'Little Tugger,' except the drum, all gears and shafts being covered. This is an especially desirable feature for underground operation where the light is none too good and where there is constant danger of workmen's clothes or bodies getting caught in machinery.

A New Ventilating Fan

A new type of ventilating fan, suitable for mills and factories, that is said to be especially effective, has been recently put on the market by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pennsylvania. The fan differs from the older style in having a large number of blades which are mounted on a wide central disk and have the ends abruptly turned up. The manufacturer states that this design has been adopted after careful study and many experiments, because it is so quiet in operation and so highly efficient. The air is thrown straight forward at high velocity, instead of being widely spread out, and no air can flow back through the centre of the fan, which often happens with the older design. The motor is specially designed for this particular service. It is entirely enclosed and protected from dust, dirt, moisture, etc. It has a high overload capacity, and readily drives the fan even against a strong back pressure from wind. This little blower can produce considerable pressure, and is suitable for forcing air out of underground and inside rooms, and other purposes.

A New Portable Drill

The Union Construction Co. has developed a new portable prospecting drill which is marketed under the name 'Type B Union Drill.' It is designed for general prospecting, well sinking, foundation tests, and similar work. The four legs of the frame are steel angle-bars properly braced and tied. This frame is balanced upon two wheels so that it can be tipped to a horizontal position for moving or a vertical when drilling. The power is furnished by a Cushman 4-cycle gasoline engine of which the heaviest piece weighs 135 lb. The heaviest part of the frame weighs 90 lb. The speed and ease with which the drill can be moved and erected are especially noteworthy. Drilling speed is 42 strokes per minute and the length of the stroke is adjustable. As the drill is the outgrowth of experience in prospecting of the engineers who build it, it is well worth investigation by those who have need for such a machine.

A Rotary Air-Compressor

Light, portable compressors are often necessary in mining districts, and one of the rotary type has been devised by the Wernicke-Hatcher Pump Co., of Grand Rapids, Michigan. It may be driven by a direct-connected high-speed motor or by belt. The rotor and rotor case both revolve, one within the other and at the same number of revolutions, and each revolves on its own axis in balance. Pockets are provided with intake and discharge valves, with suitable passages to the hollow rotor shaft. Claims for the machine are that the cooling system is reliable, a rotary motion is advantageous, and there is effective sealing of air at high pressure.

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EDITORIAL

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PIG IRON production of the United States during September amounted to 1,882,577 tons, compared with 2,347,867 tons in March, and 2,505,927 tons in September of last year.

"THE question of cyanide supply for gold and silver extraction," says a contemporary, "has already had much attention from those particularly interested." Thanks. We have devoted considerable space to the matter, for a fact.

EFFICIENCY engineering is a new name for an old but too much neglected branch of engineering work. Inspection and planning have always been part of an engineer's duties, but often great gain is made by devoting specific attention to one such phase of the engineer's duties. In this country, Mr. F. W. Taylor led the way in this particular. That his work has been obtaining recognition abroad is pleasant to record, and on another page Mr. H. N. Stronck gives interesting details as to the application of the 'Taylor system' in Germany and France.

NO news would be more welcome these days than of the discovery of a new and important gold district. Unusual interest therefore attaches to the announcement made this week of the finding of rich gold ore in the suburbs of Tonopah. We print in our news columns a summary of the situation, written by an experienced mining engineer. It is evidently too soon to estimate the find accurately, but in view of the favorable situation geologically and the history of the development of Tonopah, Goldfield, National, and other bonanza districts in Nevada, it is permissible to hope.

ONE of the great problems of man is the securing of both liberty and security, for the two are to a large degree incompatible. If all men have perfect liberty, then the strongest is free to strip the others of all they possess; if every man is absolutely secure in what he possesses, then he is largely cut off from opportunity to improve his position. Herein lies the fundamental problem of the labor union, for in endeavoring to secure for laboring men both more liberty and more security it comes face to face with the fact that the two can only be simultaneously obtained through class legislation which denies to the other groups of society the privileges which it confers on workmen.

DREDGING for coal is unusual, and it is even more unusual to dredge for it in a mill pond. Nevertheless the 'Laurel Line' railway is obtaining its coal in this way from the pond behind its dam in Roaring brook, near Scranton, Pennsylvania. According to a recent number of *The Colliery Engineer*, a dam was built across the brook to impound its waters for a cooling pond. After a few years it was discovered that the pond had been filled to the top of the dam with coal washed down by the rain from the mines on the watershed. A dredge was employed to clear out the pond, the coal recovered being used for the power house.

OPERATIONS of the Oriental Consolidated Mining Company in Korea are always of interest, and on page 663 of this issue is an abstract of the report of the general manager, Mr. Alf. Welhaven, for the past financial year of the Company. A great deal of interesting work is accomplished at the nine mines and many prospects. The five stamp-mills, five cyanide plants, the hydro-electric power plant, problems of fuel and reforestation, the medical department, and many other branches of a large concession, would appear to offer plenty of problems, yet the past year showed an increased profit of $51,396 over that of the previous year. The output to June 30, 1914, totals 3,537,378 tons, valued at $21,919,903, of which $5,576,995 has been paid in dividends. The Oriental Consolidated is the pioneer American enterprise in the Far East.

JOPLIN ore producers are disturbed at the arrangements under way to treat Australian zinc ores in this country. It is natural enough that our leading zinc producing district, one which, moreover, long enjoyed a virtual monopoly, should prefer not to see a newcomer enter the lists. In this case, however, we think there is little to fear. The Broken Hill district is already in the field and it has been one of the most surprising features of recent metal production that the great increase in spelter due to successful treatment of Broken Hill tailing, has been absorbed with so little disturbance of the world's markets. Smelting Australian ore in the United States rather than Germany will not increase the total amount of metal produced, though it will temporarily emphasize the effect of German consumers being cut off from the market. We wish we could hope to see the smelting continue in this country. However, plans

are already under way for the building in Wales of the largest and most modern zinc smelter in the world, to treat Australian ores mainly and to supply metal to the English market especially. Mr. Theodore J. Hoover, who some years since conducted important experimental tests on treating these ores in a small plant, is even now in the United States arranging for assistants. If any Australian ore continues to come here after the war, it will probably be smelted in bond and the spelter exported. Joplin will always have advantages due to the grade of concentrate produced and will continue indefinitely to be a large factor in the zinc industry.

PROGRESS OF ELECTRICAL PRECIPITATION

Announcement that the International Smelting & Refining Company had decided to commute by cash payment the future royalties on use of electrical precipitation at the Tooele plant, calls attention to the rapidity with which that process is finding place for itself. Some months ago a cash payment of $45,000 was made to the Western Precipitation Company, which controls the rights in California and Arizona, for use of the process at the new plant at Globe. While the amount paid for the Tooele rights has not been made public it is currently reported that, with the future payments, the total will be about $75,000. An interesting feature of the case is the fact that this money, together with that subsequently realized from plants in states other than the two excepted, will go to the Research Corporation, a unique organization under the patronage of the Smithsonian Institution and designed to promote research through perfecting and securing adoption of useful inventions. It is a scientific institution endowed through the generosity of Mr. F. G. Cottrell and other inventors who have conveyed to it important patent rights.

The Research Corporation already has several Cottrell plants working or under construction. At Perth Amboy a plate plant is operating on fume from the slime furnaces and a pipe plant is under construction. One pipe 24 inches in diameter and 20 feet high, the largest yet built, is being erected for testing. The Bethlehem Steel Company has a test plant of seven pipes 10 inches in diameter. The Pennsylvania Salt Manufacturing Company is using the treater on acid gases between the Glover tower and the lead chambers. The Grasselli Chemical Company has a small pipe treating hot burner gases at a sulphuric acid plant. The American Smelting & Refining Company is building a large plant at Garfield, Utah, has plate treaters working on sulphuric acid fumes from parting kettles at Omaha and Baltimore, is testing electrical precipitation against bag-house work at Murray, Utah, and is experimenting at various other plants. The Company, by the way, was the pioneer in adopting this process for smelting plants, the Selby being the first big works to be equipped. Among companies that are investigating the system may be mentioned the Balbach Smelting & Refining, International Nickel, Dusquesne Reduction, Chase Rolling Mill, Union Carbide, National Lead, Metals Refining, and the American Steel & Wire. Some of these have small test plants in operation while others are as yet merely collecting data as to character and amount of gases to be handled. The Anaconda company has a plant precipitating arsenic and is conducting tests on the main flue gases. The arsenic plant is interesting. The heated gases are first run through one pipe in which the solid particles of dust are precipitated, then cooled so that the arsenic becomes a solid, and run through a second pipe where the pure arsenic is precipitated. Another odd use of the process is for throwing down milk powder in the north side plant of the Milk Flour Company at Chicago. The Development & Foundry Company at Niagara Falls uses it to precipitate calcium chloride, and a number of detinning plants have found it useful. The U. S. Bureau of Mines at Pittsburgh is carrying on elaborate studies to find further fields of usefulness. In Germany electrical precipitation has been adopted in the acid works at a number of the larger metallurgical plants, and Mr. W. G. Schmidt has just returned from a trip to that country, where he was pressed into service in equipping plants rushed to completion after members of the regular staff had gone to war. The use in California of electrical precipitation in dehydrating crude petroleum and to clear the dust out of cement kiln gases has been previously noted. It is evident that the process has already conquered a wide field and that it probably will be used even more widely as its possibilities become better known.

THE HOUGHTON MEMORIAL

Upon a hill overlooking the waters of Lake Superior where they touch the shore of Keweenaw point at Eagle river, there now stands an impressive and permanent monument to the memory of Douglass Houghton, scientist, explorer, and Michigan's first state geologist.

It is rarely that man in his lifetime accomplishes as much as did Douglass Houghton in his short life of 36 years. When but 19 years old he was appointed assistant professor in chemistry and natural history at the Renssaeler Scientific School at Troy, New York. Before his twentieth year he was called to Detroit and began his public lectures on the sciences of chemistry, botany, and geology. A few months after his arrival in Detroit, he received the appointment of surgeon and botanist to the expedition to discover the sources of the Mississippi. It was on this expedition that Houghton acquired his first knowledge of the upper peninsula of Michigan. For four years he practised as a physician, surgeon, and dentist in Detroit. In 1837 Houghton planned the geological survey of the state of Michigan. He proposed organization of departments of geology, zoölogy, botany, and topography, each having its official head, and all united under the general direction of the State Geologist. The survey was created by law and Houghton immediately made geologist. Beginning with a reconnaissance of the state in 1837, four seasons were spent in exploring the lower peninsula, portions of the

upper peninsula on Lakes Huron and Michigan, and the southern coast of Lake Superior. Houghton's brief but clearly and cautiously prepared reports to the legislature attracted wide attention to the Lake Superior mineral lands then an uninhabited wilderness. His last report, published in 1841, gave to the world the first definite information of the occurrence of native copper on Keweenaw point. Houghton also discovered the possibilities of the saline deposits of the lower peninsula. When the limited funds of the state compelled a suspension of the geological survey, Houghton conceived the idea of a thorough geological, mineralogical, topographical, and magnetic survey of the United States in connection with the government linear survey. He undertook this work in Michigan and his plan was tested with success before his death. Soon after his appointment as geologist, the regents of the State University appointed him professor of geology, mineralogy, and chemistry. He was twice elected mayor of Detroit and was proposed for governor.

It was on October 13, 1845, while returning to Eagle river from a visit to his surveying party, in an open boat during a heavy gale and snowstorm, that Douglass Houghton lost his life. When the news reached Detroit, a bill was introduced in the legislature asking for an appropriation for a monument to be erected on the shore of Lake Superior near Eagle river. Because of the financial condition of the state no action was taken on the bill. Alvah Bradish, in his 'Memoir of Douglass Houghton,' 1889, says: "If it is surprising, it is hardly creditable, that the monument contemplated by the legislature of '46 has not been followed up by some popular action. One would expect among the enterprising and intelligent citizens of the upper peninsula especially, that almost a spontaneous expression in this direction would have been seen before this date. A few years hence passengers traversing the waters of Lake Superior, from the deck of steamers will scan the southern shore along the coast near Eagle river—they will look for some sign that the memory of such a man has not been forgotten. The time is soon to come when they will discover some monument looming through the mist, perhaps a single granite shaft, broken midway, as the life of Houghton was shattered and broken."

Today a monument stands within a mile of where Houghton lost his life, erected by popular subscription through the efforts of the Keweenaw Historical Society. The base is made of pieces of characteristic rocks of the copper and iron country. Upon the base rests a large mass of the Keweenawan greenstone, imbedded in which is a tablet, made of Lake Superior copper, with a relief reproduction of the painting of Houghton by Bradish. Houghton is seen standing on a rocky shore with a geological pick in his hand and his dog Meme at his feet. The ground for the monument was deeded to the Keweenaw Historical Society by the Cliff Mining Company, and the construction work was done by the Keweenaw Copper Company. The dedication of this monument was the occasion for one of the greatest gatherings in history of the early pioneers of the 'copper country.'

FERRO-MANGANESE

During 1913 over 128,000 tons of ferro manganese, of an average declared value of about $45 per ton, was imported into this country, for the simple reason that it can be bought abroad to better advantage than it can be made in this country. When the war cut off foreign supplies the quoted price jumped, in a little while, to $140 per ton, but soon afterward declined to less than $70 per ton. The *Wall Street Journal*, in a recent editorial, uses this circumstance to point a moral and adorn a tale, as follows:

"Ferro-manganese is used in the manufacture of steel. The total amount consumed here is not large—about 240,000 tons per year. But, like the salt in the soup, it is essential. Steel manufacturers must have it. Russia, India, and Brazil are the sources of supply. The first shock of the war sent the price up to $140 per ton. Later it climbed down, and now is around $68. With a prospect of shortened demand, it bids fair to go lower. Why is it declining? And why did the U. S. Steel Corporation dispose of a part of its stock at around $100 per ton?

"Taken by itself, the declining price of a commodity of which so little is used might be only a cloud no larger than a man's hand. But if we were not so much absorbed in whistling (not hustling) for foreign trade, forming government mercantile marines, and cotton panhandling schemes, we might see how it reflects danger to our greatest industry and to the country in general.

"Before this war the steel business was far from encouraging. Today the mills are running at an average of one-half their capacity. They are not stocking up with fuel, ferro-manganese, and raw materials when the prospects of marketing their finished products are dark. The railroads are the greatest consumers of steel. When they cease to buy, the steel industry must slow down.

"The railroads did not quit buying steel because they did not want it or need it. They are more like the people who look in the shop windows and wish they had the money. They want the steel, and need it. If they could buy according to their needs, it would be one of the best panaceas ever administered to a sick and depressed business community.

"Why can't they buy? Aren't they rich and powerful? No. A railroad's buying and borrowing capacity is dependent upon its earning power.

"Their present predicament is rather like that on Mount Carmel, when a deluded priesthood prayed from morning till afternoon to the god they had mistakenly worshipped, 'Oh, Baal, hear us.' In this case 'Baal' failed to recognize the country's need.

"Meanwhile the railroads wait, and unemployment is on the increase. This is what is meant by the decline in ferro-manganese."

This sounds like a powerful argument, but a little real knowledge of the situation gives the matter a somewhat

different aspect. The prosaic fact is that the steel companies when they no longer could get ferro-manganese at a reasonable price, soon found that they were not nearly so dependent on it as they had supposed. Thus one of the largest steel companies, which had been making 50,000 tons of open-hearth steel per month, and using a correspondingly large quantity of ferro-manganese, found that by making a slight change in its practice it could cut down its ferro-manganese consumption to only 300 pounds per day, using instead the spiegeleisen of which it had a large stock lying in its yards. Ferro-manganese can easily be made in this country, and the Noble Electric Steel Company has already begun its manufacture in its plant at Heroult, California. There are ample reserves of manganese ore in this country; they will be developed as soon as, and no sooner than, it is possible to secure the necessary adjustment between production cost and sale price.

SELLING MINING PROPERTIES

A mining engineer who spends nearly all his time in the valuation of mining properties for large financial interests recently expressed the belief that the chief reason why the business of financing mining properties is so dull is because in nearly every instance mining properties are submitted to possible investors under circumstances and on terms which would not merit a moment's consideration with any other form of investment. In selling real estate, for example, no one would expect to gain even a hearing from investors unless he were able to produce a valid and properly guaranteed title to the land in question, accurate surveys of the property, a map showing its exact situation, and a set of verifiable statements as to the reason why the property is of value. The title to mines offered for sale is all too frequently open to doubt, an assay map of the workings is rarely available, and any exact records of width stoped, metal content, and amount recovered from such ore as has been mined are as rare as snowballs in midsummer.

There comes to mind the case of a good sized mine which had been paying dividends for some time, but which did not regularly employ a surveyor. When it was proposed that the recent workings should be mapped it was found necessary to survey the whole mine, since the preceding surveyor had made a very attractive map of the workings, but had not established anywhere, in or about the mine, any permanent marks to which the survey could be referred. Needless to say, there were no records of the tonnage stoped in past years or its assay value, and development work in that district was frequently guided by the recollections of miners who recalled that in abandoned workings good bunches of ore appeared to pitch in this direction or that. The record in the books of such a company showing the operating expenses and the net profit could not be relied on as an indication of the probable value of the mine, since a period of good profits might indicate the mining of rich ore and the expenditure of large sums in development work, or the mining of low-grade ore without doing development work.

Suppose such a property were offered to an investor at a price of $500,000. No one could decide from an examination of the records whether the property was worth $500,000, $750,000, or $250,000, and it might easily cost the prospective investors $5000 or more to determine the probable value of the mine. From the standpoint of the investor, this is exactly like asking him to bet $5000 to nothing that the valuation put on the mine by the owner is conservative. No bond salesman of a banking house would approach a possible investor with the proposal that he should spend $10 per each $1000 bond in order to learn whether the bonds were worth $1000, $1500, or only $500 each. Some reasonable assurance would have to be given that the bonds were worth the price asked before the investor could be expected to spend any money in assuring himself that the investment was a good one. In years of mining excitement people can be found to pay large sums for mines, in exactly the same spirit in which they will bet 10 to 1 that their favorite horse will win a race, but when it comes to selling developed or partly developed properties to investors who have made fortunes through the exercise of business skill and foresight a different set of conditions must be observed.

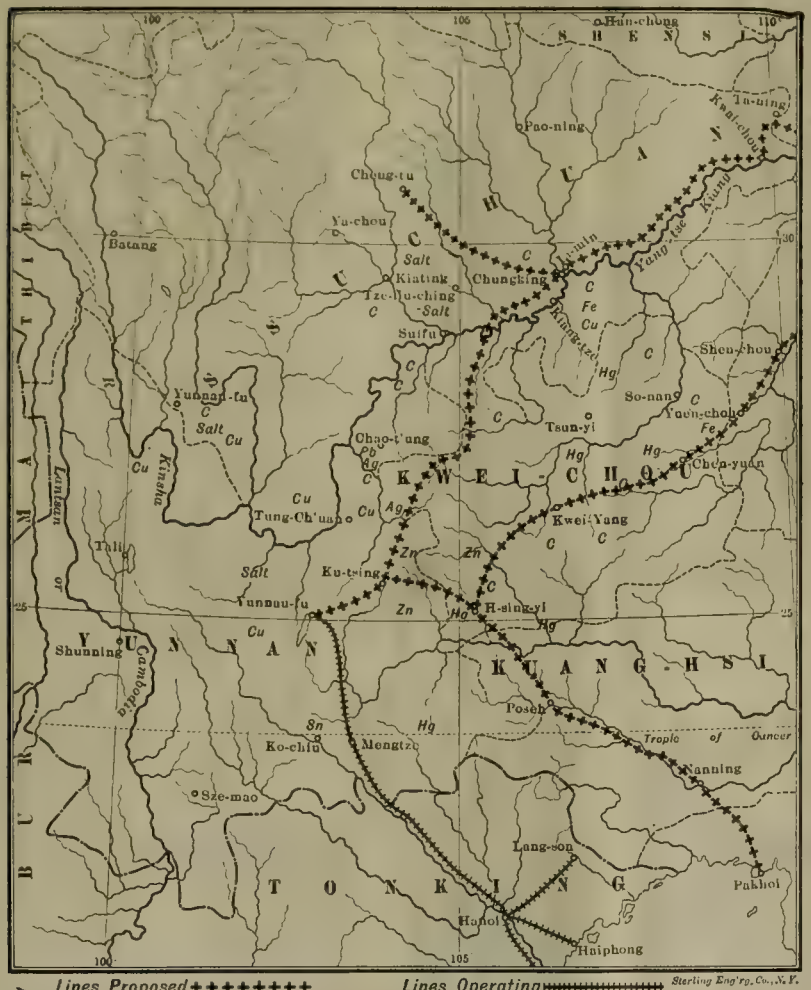
Recently one of our correspondents remarked that one of the best uses to which the Harrimans and Morgans of the financial world could put their ample funds is to expend a part of them in developing mining properties. But the miner is rarely able to get the investor's viewpoint regarding this. The small mine owner who has often skimmed the narrow edge of bankruptcy throughout years of struggle and whose cash assets only slightly exceed the month's payroll, is almost certain to think that any man with a million dollars ought to be willing to spend from $5000 to $25,000 to convince himself that the mine is worth as much or more than is asked for it. The experienced investor, however, knows that an owner is as apt to overvalue his mine as a man is apt to overvalue his dog. The millionaire who has made his money by careful investment is less likely to risk several thousand dollars on a long shot (except at the occasional solicitation of a personal friend) than is a man with only a little money. When a mine owner approaches such a man with the proposal that he spend $10,000 to $25,000 in development work, with the option to purchase the mine at an agreed price if the development work proves encouraging, he is commonly received in the same spirit that he would be if he brought into the investor's office an oil painting which he offered to sell for $10,000, claiming it to be a genuine 'old master.' Unless the mine owner can produce definite and accurate data that indicate a reasonable probability that his mine is worth somewhere near the price asked, he is not likely to be able to awaken the interest of possible investors. Records of the necessary data can be made at a slight additional cost during the progress of development work; the mine owner who neglects to make them is spoiling his chances of selling his mine at a fair figure.

Petroleum, Gas, and Brine Wells of Ssu-chuan, China

By THOMAS T. and M. CARLETON READ

The agreement made last year between the Republic of China and the Standard Oil Co. of America for the exploration and development of the petroleum resources of the provinces of Chih-li, Shansi, Shensi, Kansu, and Ssu-chuan has led to an awakening of interest in deposits which are comparatively little known. One of us has elsewhere summarized[1] the data available as to petroleum in China, which is naturally somewhat vague, as it was not until recently that petroleum has been an object of search. The best known district is in Ssu-chuan, where in drilling wells for brine, gas and petroleum are also found in less amounts, and the gas is utilized for evaporating the brine. The most famous district is that west of Tze-liu-ching, in east-central Ssu-chuan, about 100 miles west of Chungking, the chief port on the Yangtze, and an equal distance south of Cheng-tu, the capital of the province. From Tze-liu-ching, which takes its name from an old brine spring, the salt belt stretches about 20 miles southwest and has an approximate width of 10 miles. Salt is found in a great many other places in Ssu-chuan, as shown on the accompanying map, but a description of this single district will suffice. It has been briefly discussed by Alexander Hosie,[2] who visited it in 1882, and also by E. H. Parker, who has described it in the *Journal* of the Royal Asiatic Society. The most detailed description is that of Louis Coldre, who during his many years of service as *missionaire apostolique* in that part of Ssu-chuan had ample opportunity to secure accurate information which he has embodied in an important paper.[3] What follows is based on a translation of this paper which one of us has made. The illustrations are taken from M. Coldre's paper, and the notations as to the distribution of minerals, on the map, are those of Alexander Hosie, with some additions of our own.

[1] 'Mineral Resources of China,' *Trans.* Amer. Inst. Min. Eng., Vol. 43, p. 1.



MAP OF SOUTHWESTERN CHINA.

paper, and the notations as to the distribution of minerals, on the map, are those of Alexander Hosie, with some additions of our own.

Ssu-chuan is the largest of the 18 provinces of China, having an area of over 200,000 square miles or almost exactly that of France. Its population is about 70,000,000 people, or almost double that of France. The western half of Ssu-chuan borders on Thibet and is so elevated and mountainous that it is highly inaccessible and supports but a scanty population. Compared with this rugged region the eastern half is more in the nature of a Piedmont plateau or, more strictly, an elevated basin, of a roughly triangular shape, with mountains on the three sides. The surface of the basin consists generally of Tertiary sediments, chiefly thick deposits of red clayey sandstones and sandy clays, from which Von Richthofen named the region the Red Basin. The geology is much more complicated than this brief statement would indicate, for much of mountain-making movement is post-Tertiary, but for present purposes this will suffice. The region is far distant from the

[2] 'Three Years in Western China,' by Alexander Hosie, London, 1897.

[3] 'Les Salines et les Puits des Feu du Se-Tchouan,' L. Coldre, *Ann. de Mines*, Vol. 19, p. 441, 1891.

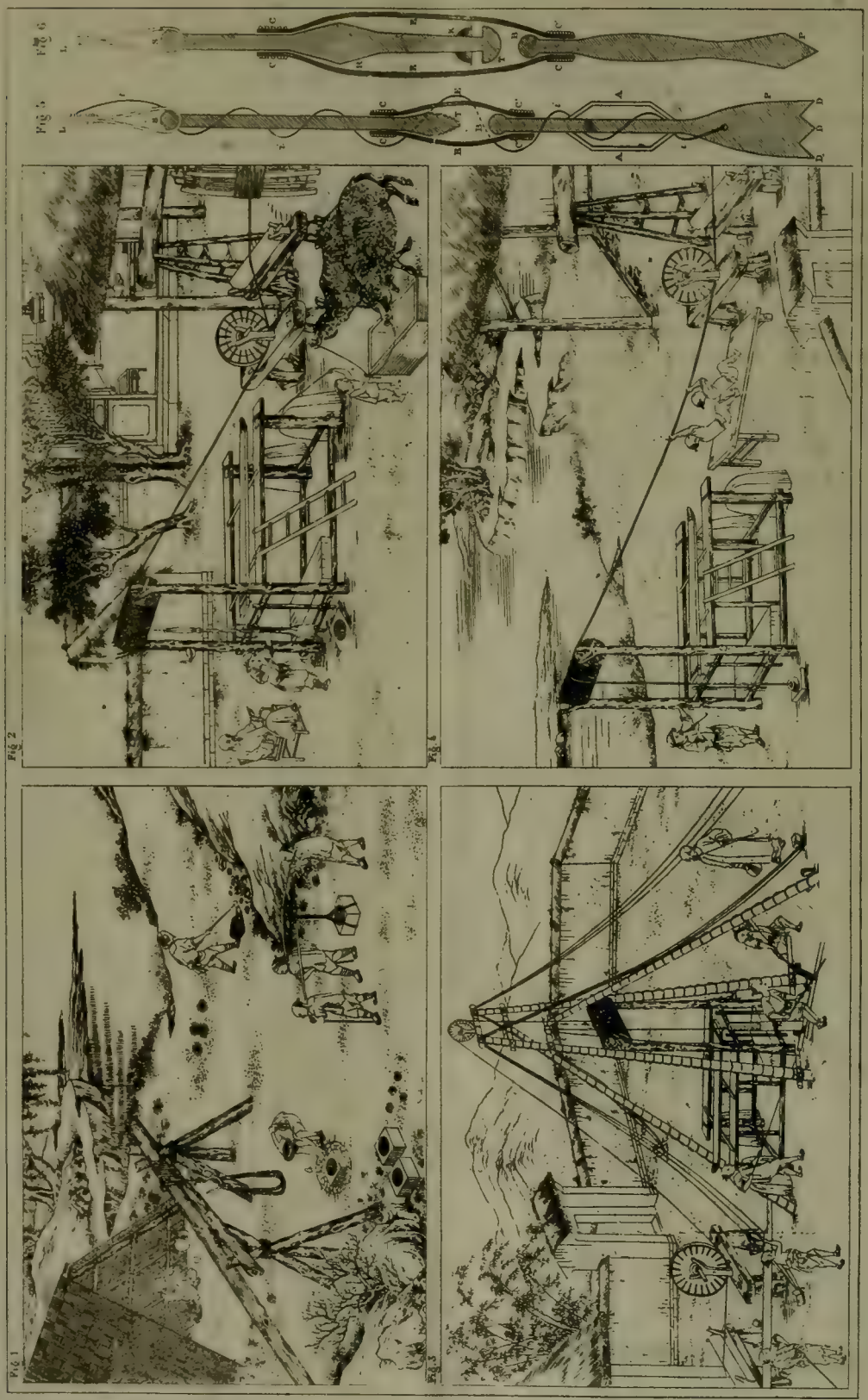


FIG. 1. LINING THE WELL TO THE SURFACE. FIG. 2. STARTING DRILLING. FIG. 3. PLACING BAMBOO CASING IN PLACE. FIG. 4. FILLING THE SAND PUMP.
FIG. 5. STRING OF TOOLS FOR SHALLOW DRILLING. FIG. 6. STRING OF TOOLS FOR DEEP DRILLING.

seacoast, and being difficult of access because of the mountain barriers already mentioned, salt, that universal necessity of human diet, can only be obtained from the seacoast at high cost. The tribes living between this area and the seacoast have at many periods in history been at war with the Ssu-chuanese, and as the region is a rich and fertile one, supplying almost every other human necessity, the people naturally proceeded to develop a local salt supply; which they did at an early period, probably earlier than the third century, A.D. Salt springs, appearing at the surface, doubtless gave the suggestion of boring down to increase their flow, and as a very profitable trade in salt with adjoining regions was built up, an elaborate technology was developed which is somewhat astonishing to anyone who is inclined to believe that nearly all really useful technology has been developed by Anglo-Saxons in the past few centuries.

In most places the brines are found in Triassic sediments, but in the Tze-liu-ching district the strata seem to be much faulted; at any rate the brines are found beneath the Carboniferous strata and even deeper in the series. The petroleum occurs high in the series, while gas in strong flow is found well below the top of the Carboniferous, just before reaching a thin seam of coal. The following typical section at Tze-liu-ching is given by M. Coldre.

Tertiary sandstone, yellow, 100 to 300 ft. thick.
Limestone, gray.
Sandstone, red.
Oölite, orange colored, ferruginous, with petroleum at 600 feet.
Limestone, earthy white, fossiliferous.
Limestone, yellowish, fossiliferous, with weak flow of gas at 800 feet.
Marl, bluish gray, irridescent, white Permian chalk, with brine, 12 to 15%, at 1000 to 1800 feet.
Carbon or coaly, calcareous sandstone.
Brilliant brown Silurian sediments.
Schist, black, slaty.
Schists, greenish (Cambrian), with strong brine and strong flow of gas at 2500 to 3300 feet.

The strongest flows of brine and gas are found at these greater depths in the Tze-liu-ching district, and the upper brines, elsewhere important, are quite inconspicuous in this region. Owing to the disturbed condition of the strata, layers of basalt or red porphyry are sometimes encountered in drilling, and cause much difficulty.

Petroleum

Petroleum, gas, and brine all three, two, or only one of them may be found in any given well. Where the gas flow is strong the well is capped as noted later, when the gas is unimportant the petroleum and brine are drawn off together into reservoirs. The petroleum rises to the surface of the brine and is skimmed off. It is of a variety of colors. Some is milk white, pure enough to burn with a good light; a greenish white variety is less useful; a darker yellow still less; and a viscous black variety gives little light and much smoke. The Chinese know nothing of the art of refining this petroleum, and burn it just as it is in crude lamps, made so as to have no opening except that which is plugged by the wick, as the volatile hydrocarbons which remain in the oil are very inflammable. The Chinese also use the petroleum as an ointment in certain skin diseases and for rheumatism, just as the crude petroleum of Pennsylvania was at one time used. There are 30 to 40 of the petroleum wells in the Tze-liu-ching district and about 50 in the whole province of Ssu-chuan. It must be remembered that neither the petroleum nor gas are the objects of search by the Chinese, but are merely incidentally discovered in drilling for brine. It is quite possible therefore that petroleum may be found in much more abundant amounts if exploration is directed toward its discovery.

Gas

The gas is of more importance to the Chinese, as it is used in evaporating the brine. The gas is found at two horizons. The flow at 600 to 800 ft. in depth is not very strong and the gas from a single well, burning with a white flame, will only serve to heat 15 evaporating pans. But that which comes from a depth of more than 2000 ft. comes out in a strong flow, so that a single well will serve for heating 600 to 1200 of the evaporating pans, which are shallow segments of a sphere, 4 ft. in diameter and weighing about 1600 lb. each. The gas is not rich in carbon and burns with a blue flame, giving much heat and little light. The gas sometimes contains sulphur compounds. When the drill breaks through into the gas zone the pressure of the gas hurls it out of the drill hole, and occasionally the gas ignites, if any fire happens to be nearby. The putting out of a burning well calls for great ingenuity on the part of the Chinese, and is only accomplished with much expenditure of effort.

In order to use the gas supply of a well the drill-hole casing, described later, is removed to a depth of 10 ft. Then a truncated cone of heavy beams, the apex at the top, is placed over the drill-hole and earth mixed with lime is rammed down hard around it. This is covered with a lid of beams with a large spigot in the centre to allow the gas to escape while the arrangement is being connected. From beneath the lid numerous conduits made of hollow bamboos cemented together lead off to distributing reservoirs set about on the surface. These are made of lime cement, and are hemispherical in shape, a salt cake being used as the centre for the crown of the arch. From the side walls of this reservoir bamboo tubes lead off to the evaporating pots. Beneath these are conical stones with a hole in the centre through which the gas escapes, burning at the top. A good deal of gas escapes unburned into the air, and not a little leaks out at various places. Beggars sometimes dig a little hole at a crack in the ground near a gas well, light the gas which escapes, and do their cooking over it. In some places the flow of gas is more abundant than there is use for and the excess is led to a safe distance and there allowed to escape through a large burner, the flame rising to a height of 8 or 9 ft.

In those cases in which the gas burns with a luminous flame it is used to some extent to illuminate the sheds where salt-making operations are carried on. It is not used for lighting the streets of the villages, as has sometimes been asserted. Some of the wells cease to yield gas after a time, in the ordinary way; others have been choked by the materials thrown into them by the rebels in a local rebellion. In this way one of the best wells has been ruined. By careful management, more efficient apparatus, and arrangements for piping gas and brine, so that the proportionate amounts of the two available at any one place come to be better adjusted to each other than at present, it would be possible to evaporate much more brine with the present supply of gas. M. Coldre has estimated that five times the present output could thus be made. At present other forms of fuel are used at those points where the gas is not convenient. All sorts of dried vegetable material are used for this purpose, corn stalks, pea and bean vines, marsh hay, and other materials of the same sort. Wood is not used much, since, as elsewhere in China, it is comparatively expensive. Coal, which is abundant in this province, but which usually occurs at some distance from the salt wells, is, however, used to a considerable extent.

Salt Wells

As already stated, the production of salt in this province is very great, and has been estimated at 1,000,000 tons per year, sufficing to meet the needs of the 70,000,000 people of the province and permit a brisk trade with adjacent regions. Those familiar with the salt industry in this country will at once notice that the Chinese do not use as much salt per capita as we do. M. Coldre has estimated the total number of salt wells as 10,000. The yield of brine from these wells is very unequal; thus the best well at Tze-liu-ching yields nearly 500 times as much salt as some of the other wells of the district. In some districts the wells average enough brine daily to keep five or six evaporating pans going. In other districts several wells are required to furnish brine enough to keep one pan going.

Drilling the Wells

The method of drilling and pumping these wells is so ingenious, and is so obviously the crude prototype of modern oil-well drilling that it is worth while to describe it in some detail, and the accompanying illustrations, reproduced from M. Coldre's paper in the *Annales des Mines*, will be of much interest in this connection.

Location of Wells.—There does not appear to be any scientific basis upon which the Chinese fix the location of proposed wells. The first wells were drilled near salt springs to increase their flow, and have spread outward, drilling having been done only in the vicinity of productive wells. The local wise men say they draw their inferences from the direction of the hills and the slope of the hillsides. It is quite possible that intelligent study of the areal geology would reveal one or more valuable unknown districts.

Drilling.—In starting a well a small round shaft is sunk to rock which is hard enough to stand the friction of the rope in drilling and the subsequent bailing. In the district we are discussing this shaft is commonly 100 ft. deep. This is then cased up with square rocks 2 or 3 ft. on a side through which a 10 or 12-in. hole has previously been cut. This is shown in Fig. 1, where three men are carrying such a casing stone toward a well which has just been cased to the top. As the stones are set in place the space between them and the shaft is filled with stones and well rammed earth. The hole is then rigged for the rope drilling which is to follow. A horizontal roller is rigged up at a convenient height to serve as a crown sheave. The winding drum, seen to the right in several of the pictures, is built of bamboo and is 8 to 12 ft. high and often 20 ft. in diameter. The construction of the wheel and the purpose of the sheave set midway between it and the hole is evident from the illustrations. The drilling is done with a 1-in. hemp rope and the construction of the drill bit is evident from Fig. 5 and Fig. 6. It is interesting to notice the double jars in Fig. 6, the sinker bar descending through them strikes a blow on top of the drill bit after it has struck its blow and comes to rest. The cord seen twisted about the string of tools in Fig. 5 is used to prevent loss of the drill bit, which weighs 200 to 300 lb., in case the jars break. The method of drilling is seen by referring to Fig. 7. The string of tools is hung from the key, which may be seen just above the mouth of the hole, which is suspended from a hook on the end of a lever made out of a thick plank. This is so adjusted that the lever is horizontal when the bit just touches the bottom of the hole. The four workmen then jump on the plank, depressing it and raising the bit a couple of feet. When they jump back on the side benches the bit falls. The man at the hole twists the string of tools in the usual way, and pours water into the hole when necessary. By jumping two at a time and passing from one side to another the men are able to drill at the rate of 12 to 15 strokes per minute. As the hole becomes deeper and the work harder, the number of men is increased up to 10 per shift. Two shifts are always on hand; each works 10 minutes while the other rests. The workmen were given their food and lodging and were paid 1200 cash (about $1.25) per month in 1891. The wages are probably somewhat higher now.

The operation of removing the sludge with a sand-pump, made of hollow bamboo weighing about 65 lb., is seen in Fig. 4. The men seen hanging on the rope are working the pump up and down to make it fill. Water is cased off with a bamboo tube. Fig. 9 shows the workmen making this tube, and Fig. 3 shows them lowering a section into the hole. This is 10 to 30 ft. in length and the joints are made water-tight with a cement made of tung oil and chalk. The rest of the drill rig is also built at this time. When the casing is securely in place, drilling is resumed with a smaller bit which makes a 3½ to 5-in. hole in some cases, but more often one which makes a 6½ to 8-in. hole. Deep drilling re-

FIG. 7. REGULAR DRILLING OPERATIONS.

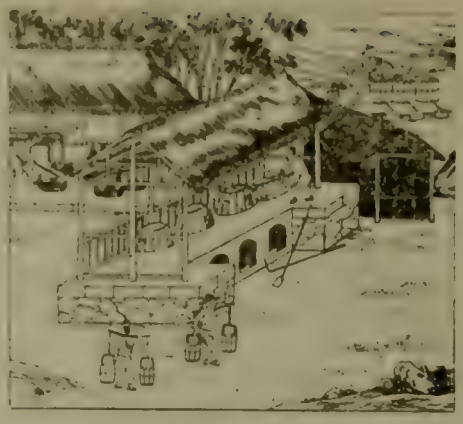


FIG. 8. EVAPORATING PANS FOR BRINE.

FIG. 9. MAKING BAMBOO CASING.

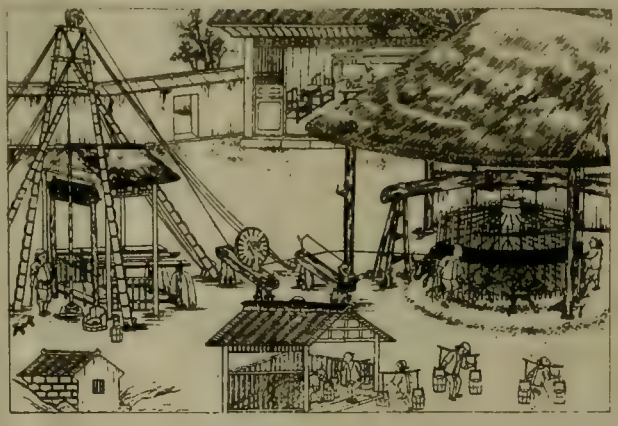


FIG. 10. HOISTING THE BRINE IN BAILERS.

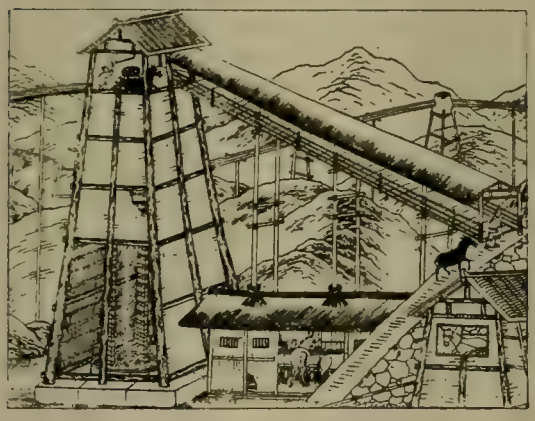


FIG. 11. ELEVATING WITH A CHINESE PUMP.

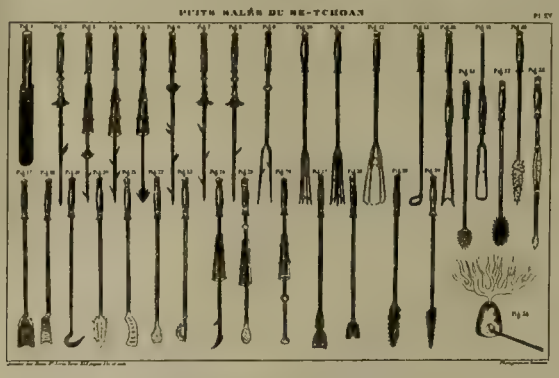


FIG. 12. FISHING TOOLS AND GAS BURNER.

quires the bit shown in Fig. 6. This is so constructed that the sinker bar, weighing 130 to 165 lb., strikes the top of the bit at each stroke, thus giving a double blow. At *K* is seen a small clapper which gives a sound which can be distinctly heard at the mouth of the well. When it is not heard, the man at the top knows it is time to let down more rope. Drilling continues in this way till the well is finished. The shallowest well in this district is 600 ft., the deepest 3500 ft.; most of them are 2500 to 2800 ft. deep. The cost of drilling a well is $6000 or more, according to the depth and the difficulties encountered, and is usually financed

by a sort of joint stock company, which calls assessments as more funds are needed. Fig. 12, which shows some of the tools used in case of accident, needs no explanation.

SALT MAKING

The brine wells almost never flow, and they are pumped by the continual use of the sand-pump, using a special one, often nearly a hundred feet long, for this purpose. This is hoisted by the windlass, worked by water buffaloes, seen to the right in Fig. 8. These beasts are driven at a gallop by the liberal use of a rope's end, but they are poorly suited to moving at anything except a very slow rate. The cost of their keep is rather high for China, and they do not make a very efficient power plant. It would seem that a light, cheap steam hoist would be more satisfactory, or even an air-lift pumping plant for the most productive wells. The clarification of the brine, its evaporation in open pans, and the marketing of the salt would carry us too far from the limits of our theme, but it involves many interesting details and ingenious methods of procedure. The cast iron pans used for evaporating the brine are, for instance, not owned by the salt works, but are rented from the iron mongers, who replace them as soon as they show cracks or any other defects.

Marco Polo visited this part of China in his travels, about the year 1290, and in describing customs in this portion of Ssu-chuan makes the following observations: "The money matters of the people are conducted in this way. They have gold in rods which they weigh, and they reckon its value by its weight in *saggi*, but they have no coined money. Their small change is made in this way. They have salt which they boil and set in a mold (flat below and round above), and every piece from the mold weighs about half a pound. Now, 80 molds of salt are worth one *saggio* of fine gold, which is a weight so called. So this salt serves them for small change." As a *saggio* is ⅛ oz., this would make the currency value of 1 lb. of salt at that time about 8½c. in our money. It is interesting to notice that Polo gives the rate of exchange there as 8 oz. silver for 1 oz. gold.

MINING IN CEYLON is limited to graphite and gem production. Plumbago exported in 1913 amounted to 28,997 long tons, against 32,563 tons in 1912. The average price was $103 per ton. There were 1335 pits and small pockets worked, employing 9553 men. Rubies, sapphires, garnets, and moonstones are recovered from mines, and pearls from the sea. Gem mining is carried on in a primitive manner, evidently better than hydraulicking, as an English and a French company, which failed, found out.

COAL OUTPUT of Alabama last year, 17,678,522 tons, worth $23,083,724, was about 66% of the total mineral output. The pig iron made was 1,924,762 tons, worth $23,242,374; coke, 3,323,644 tons, valued at $9,627,170; and total output of all products, $34,660,545.

Getting Land for Taxes in California

When the taxes on real property have not been paid for five years or more, the land is sold to the state and the deed filed with the Controller. The state may thereafter dispose of such land in the following manner: the Controller, by written authorization, directs the Tax Collector of the county in which the property is situated to sell said property at a public auction. Notice of said auction sale must be published for at least three successive weeks in a newspaper in that county, and a copy thereof mailed to the party to whom the land was last assessed next before the sale at his last known post-office address. At the time set for the sale the Tax Collector must sell the property at public auction to the highest bidder for cash, and thereupon execute a deed to him conveying all the right, title, and interest of the state in and to said property, provided that the amount paid must equal the amount of accrued taxes, delinquencies, interest (at the rate of 7%), and expenses of the sale. Persons desiring to buy property which has been sold to the state for taxes should make written application to the Controller of the State at Sacramento, requesting him to authorize the county Tax Collector to sell the land. He should be given such a description as will enable him to identify the property in his records.

The Nevada One-Man Carry

At the Labor Day first-aid and mine-rescue celebration at the University of Nevada in September, one of the interesting events was the demonstration made by E. P. Cullinan, chief electrician of the Tonopah Belmont company, of his method by which one man can carry two unconscious men from a mine, although the burden may be more than twice the weight of the rescuer. To illustrate his method, Mr. Cullinan, who weighs 140 lb., placed two men on the ground, the first on his stomach and the other in the same position on top of him, with arms extended forward over and beyond the shoulders of the first man. Taking a position at the head of the two men, Mr. Cullinan raised their heads and bodies to an angle of about 45°, then loosening his hold he ducked under them as their bodies fell, and caught them on his back. Then securing a lock hold at the knee and arms, he rose with the two men on his back, and in that position was able to carry them a considerable distance. The combined weight of the two men whom Mr. Cullinan carried was 335 lb. The method has been named the 'Nevada one-man carry,' and is a distinct innovation in mine-rescue work.

BULLION received at the San Francisco Mint during September amounted to 240,143.834 fine ounces of gold, and 181,088 fine ounces of silver, valued at a total of $5,060,222.25. Coinage executed was $4,549,270, in gold, nickel, and bronze. Coin, bullion, etc., on hand at the end of the month was $249,393,587.41.

The Function of Lead Salts in Cyanidation

By G. H. CLEVENGER

Lead salts are used in cyanidation, either for the purpose of increasing the extractive power of the solution or as an aid to precipitation. The addition of a lead salt for either of these specific purposes does not necessarily mean that lead will be present to function in the other capacity, for, when the proper proportion is used to give the maximum extraction, there may be little or no lead present in the solution when it reaches the precipitation stage; and, when used to aid precipitation, metallic lead is precipitated by the zinc, and, therefore, remains with the precipitate.

Lead Salts and Precipitation

The zinc-lead couple for the precipitation of gold and silver from cyanide solutions was first proposed by MacArthur[1] in 1894, but, except where there was copper in the solution, it was found to be of so little advantage with the strong solutions then in use for the treatment of sand that it was rarely used.

In 1898 Betty[2] developed a method for precipitating very weak cyanide solutions containing gold through the revival of the use of the zinc-lead couple, as proposed by MacArthur, and the addition of a drip of strong cyanide solution at the head of the precipitation boxes. This method came into general use on the Rand, South Africa, for the precipitation of the weak solutions resulting from the treatment of slime, and finally entirely superseded the electrolytic method of precipitation.

Julian and Smart[3] state that the general method of preparing the zinc-lead couple is to immerse the zinc shavings in a 1 to 5% solution of lead acetate prior to packing them in the precipitation boxes. Carter[4] calls attention to the importance of the proper preliminary preparation of the zinc for this method of precipitation. He suggests[5] stirring the freshly cut zinc shavings in a 10% solution of lead acetate. If the shavings are not thoroughly stirred in the solution, only the outside of the mass becomes properly coated with lead. After preparation the shavings should be placed in the precipitation box at once, as exposure to the air results in rapid oxidation of the zinc. Another less favored method is to introduce a drip of lead acetate solution at the head of the precipitation boxes. According to Johnson,[6] the drip of strong cyanide solution is not generally found necessary in present-day practice.

Sharwood[7] states that the presence of 2 to 3% of lead in the zinc dust to be used for precipitation is an advantage. Clark and Sharwood[8] state that it is the general practice at the Homestake to maintain a drip of lead nitrate solution at the feed pipe carrying the zinc emulsion, but that this can be dispensed with when the silver content of the solution is above normal. (In this case a gold solution is precipitated.)

In use, the zinc-lead couple gradually becomes less and less active until a point is reached where it no longer properly performs the function of precipitation. This makes necessary more frequent clean-ups and the destruction of a greater proportion of zinc by acid than where the couple is not used. After a short time, the head compartments of the precipitation boxes begin to precipitate less, and this goes on until, after about ten days, the zinc in the head compartments becomes dead and rises to the surface of the solution. The longest period recorded by Carter[9] for running a precipitation box, using the zinc-lead couple, with continued good results without cleaning up, was twenty-two days. It has been suggested that this difficulty might be overcome by using the inactive zinc from the slime precipitation boxes for precipitating the stronger solutions, as, for example, where a sand plant was also operated. At present, in South Africa, according to Johnson,[10] the interval between cleaning the precipitation boxes is seven days. In large plants, the clean-up takes place three times per month.

Résumé

1. The zinc-lead couple is of particular value in precipitating solutions containing copper or gold solutions containing a low percentage of cyanide.

2. In the majority of cases where the solution contains an appreciable amount of silver, the lead couple is unnecessary, although the presence of a small percentage (2 to 3%) of lead in the zinc dust, if this method of precipitation is used, is generally favored by most operators. The most of the commercial sheet zinc from which zinc shavings are cut contains upward of 1% of lead, so that, to a greater or less extent, the zinc-lead couple is involved in all systems of zinc precipitation.

3. For forming the zinc-lead couple, it is necessary to use a soluble lead salt. Most generally the acetate has been used for this purpose on account of being the most readily available commercial salt, but the nitrate has

[1] U. S. Patent, 592,153, October 19, 1897.

[2] 'A Zinc Process for Precipitating Gold from Weak Solutions,' T. Lane Carter, *Proc.* Chem., Met. and Min. Soc., South Africa, Vol. 2, p. 445.

[3] 'Cyaniding Gold and Silver Ores,' H. Forbes Julian and Edgar Smart, London, 1907, p. 138.

[4] *Loc. cit.*, p. 441.

[5] *Ibid.*, p. 442.

[6] 'Precipitation,' E. H. Johnson, 'Rand Metallurgical Practise,' Vol. 1, p. 249.

[7] 'Zinc Dust Tests,' W. J. Sharwood, *Jour.* Chem., Met. and Min. Soc., South Africa, Vol. 12, p. 332.

[8] 'The Metallurgy of Homestake Ore,' Allan J. Clark and W. J. Sharwood, *Trans.* Inst. Min and Met., Vol. 22, p. 126.

[9] *Loc. cit.*, p. 442.

[10] *Loc. cit.*, p. 249.

been used at times on account of its higher lead content.

4. The zinc-lead couple necessitates the frequent removal of the inactive precipitant, which is a decided disadvantage, even when used for precipitating stronger solutions, for inevitably some oxidation takes place in handling the decomposed zinc. On account of the constant addition of fresh precipitant and the comparatively small excess of precipitant remaining in the precipitation press, zinc dust precipitation seems to more readily lend itself to precipitating coppery solutions or for the use, in general, of the zinc-lead couple.

Lead Salts and Extraction

In 1893, MacArthur and Ellis[11] were granted a patent for the use of lead, plumbate, carbonate, acetate, and sulphate, mercuric chloride, sulphate or chloride of manganese, ferric hydroxide or oxide, as well as various zincates and other oxides, in connection with cyanide solutions. They mention the compounds of lead and mercury as being especially effective in increasing the extraction of the precious metals. It is evident, from their specification, that they considered the sole function of these compounds to be that of removing soluble sulphides from the solution.

Despite the fact that Clennell,[12] Hamilton,[13] Clevenger,[14] and others[15] have shown that soluble sulphides do not exist in mill solutions, especially when zinc precipitation is used, at the time that they come in contact with a fresh charge of ore, there are still those who adhere to the idea that the principal function of lead salts in cyanidation is to remove soluble sulphides from the solution. While it is true that lead salts will remove soluble sulphides from cyanide solutions, yet the fact that, only in exceptional cases, do such solutions contain soluble sulphides renders the addition of lead salts for this purpose superfluous. The futility of adding a remedy for a condition which does not exist does not require further comment. The absence of soluble sulphides in mill solutions is readily understandable when it is considered that there are at least three reactions which prevent their accumulation in the solution, if indeed not their actual formation, except perhaps momentarily: (1) zinc taken into solution during precipitation appears to be as effective for their removal as lead salts added intentionally; (2) sulphides rapidly form sulphocyanates, with the simple alkaline cyanides which are always present; (3) alkaline sulphides rapidly oxidize to thiosulphates, which in turn probably largely oxidize to sulphates which cannot rise above a small percentage on account of the slight solubility of calcium sulphate. To illustrate the instability of soluble sulphides in cyanide solutions, attention is called to an extreme case recorded by Hamilton[16] where sodium sulphide in considerable amount was added to a cyanide solution for the purpose of another experiment. This solution gave a distinct brown coloration when a solution of lead acetate was added, indicating the presence of soluble sulphides. Merely decanting the solution from one tank to another caused this reaction to disappear.

Holt[17] has shown that the presence of the proper proportion of a lead salt greatly accelerates the solution of silver sulphide in cyanide solutions, but that the lead salts retard the solution of the antimonial compounds of silver. My own experience with lead salts in the cyanidation of silver-gold ores in which silver predominated, has shown that, even in cases where there was no gain in extraction through the use of lead salts, there might be a distinct saving in the time necessary to effect the maximum economical extraction. Curve No. 4 in the experimental part of this paper will illustrate this point.

At the Montana-Tonopah mill,[18] Tonopah, Nevada, a saving in cyanide is noted when lead acetate is used. At the West End mill,[19] Tonopah, Nevada, it has been noted that the solution showed more sulphocyanate when lead acetate was not used. Mr. von Bernewitz[20] makes the general statement that lead salts retard the formation of sulphocyanate. The following reactions given by Kühn[21] show the possible formation of elemental sulphur in a cyanide solution when treating a sulphide ore through reactions which may take place with alkaline sulphide formed during the solution of silver sulphide:

$$Na_2S + Ca(OH)_2 = CaS + 2NaOH$$
$$2CaS + 2H_2O = Ca(SH)_2 + Ca(OH)_2$$
$$Ca(SH)_2 + 2O_2 = CaS_2O_3 + H_2O$$
$$CaS_2O_3 = CaSO_3 + S$$
$$CaSO_3 + O = CaSO_4$$

An anonymous[22] discussion of Clennell's paper upon 'Lead Salts in Cyanide Treatment' calls attention to a special case where, when lead salts were not used, large amounts of free sulphur formed in the solution, which interfered with extraction. Megraw[23] also records the same condition as occurring in treating a silver ore when lead acetate was not used; elemental sulphur separated out and poor extractions and a heavy consumption of

[11] New Zealand patent, June 29, 1893; U. S. patent 555,463, February 25, 1896.

[12] "Soluble sulphides are not stable in cyanide solutions and can be seldom, if ever, detected," 'Lead Salts in Cyanide Treatment,' J. R. Clennell, *The Eng. and Min. Jour.*, Vol. 94, p. 597.

[13] "I have never succeeded in finding soluble sulphides in any solution used for treating a silver ore, although sulphocyanate is almost invariably present," 'Lead Acetate in the Cyanidation of Silver Ores,' E. M. Hamilton, *The Mexican Min. Jour.*, Vol. 11, p. 47.

[14] "I have very rarely detected soluble sulphides in a mill solution," private reports, G. H. Clevenger.

[15] Anonymous discussion of 'Lead Salts in Cyanide Treatment,' by J. E. Clennell, *The Eng. and Min. Jour.*, Vol. 94, p. 921.

[16] *Loc. cit.*, p. 47.

[17] 'Cyanidation of Silver Ores,' Theo. P. Holt, *Mining and Scientific Press*, Vol. 98, p. 546.

[18] 'Lead Salts in Cyanidation,' M. W. von Bernewitz, *Mining and Scientific Press*, Vol. 107, p. 758.

[19] *Ibid.*

[20] *Ibid.*

[21] 'Chemische Betrachtungen zur Cyanlaugerei von Silbererzen,' Von E. Kühn, *Metallurgie*, Vol. 8, p. 465.

[22] *The Eng. and Min. Jour.*, Vol. 94, p. 921.

[23] 'Cyaniding Troubles and Remedies,' Herbert A. Megraw, *The Eng. and Min. Jour.*, Vol. 94, p. 360.

cyanide resulted. High cyanide consumption resulting from elemental sulphur is readily understood when it is known that elemental sulphur forms, with solutions of the alkaline cyanides, sulphocyanate. In the one case of the treatment of a silver-gold ore where I have had an opportunity of making a complete investigation of this subject, I found that the use of lead acetate resulted in a lessened cyanide consumption. It is impossible to say just how generally the statement that lead salts retard sulphocyanate formation and thereby diminish cyanide consumption holds true, but that it does, in certain cases, there is quite conclusive evidence.

Hamilton[24] is of the opinion that the advantages of lead acetate have been considerably over-rated. In some cases he has noted a slight gain in silver extraction, which is counteracted by a loss in gold extraction. He considers lead acetate to be of particular value in starting a new plant when there is no zinc in solution. At the Tonopah Belmont mill,[25] a 3 to 5% better extraction of the silver is realized when lead acetate is used. At the MacNamara and West End mills,[26] in the same district, no benefit to extraction is noted. In Western Australia[27] lead salts are especially useful in treating the telluride gold ores when there has been a bad roast. In treating the telluride gold ores of the Cripple Creek district, Colorado, lead salts are said to be of no benefit. Mr. von Bernewitz[28] is at a loss to account for this difference in behavior, but it is possibly due to the fact that Cripple Creek ores contain a small percentage of lead while, so far as I am aware, the ores from Western Australia do not. Lindgren and Ransome[29] state that galena in small quantities, although not always perceptible to the naked eye, is probably almost universally distributed in Cripple Creek ores. Crowe[30] states that a streak of galena is invariably to be observed upon the tables when concentrating Cripple Creek ores.

Clennell[31] has shown, in the case of a Mexican silver-gold ore, that, when copper was added to the solutions, extractions were better when lead salts were used. My results which follow in the experimental part of this paper, show very conclusively the effect lead salts may have in decomposing copper-silver minerals.

Clennell[32] has shown that almost any lead compound, either soluble or insoluble, may be used, except certain of the salts of the organic acids or possibly salts in which the lead is combined in the acid radical of the salt. He also shows the rather surprising fact that finely ground galena may be effective for this purpose. A possible explanation for this is Caldecott's[33] contention that the action of the lead salt is cyclic and that a small amount is as effective as a large amount on this account. Thus a small amount of lead passes successively through the stages of oxide and sulphide according to the following equations:

$$Na_2S + PbO = PbS + Na_2O$$
$$PbS + NaCN + O = NaCNS + PbO$$

Frequently, as has already been pointed out, the formation of sulphocyanate is decreased by the addition of a lead salt, so that this is only partly true.

As early as eight years ago, I[34] emphasized the importance of using the correct proportion of the lead salt. Since that time, Clennell[35] has also called attention to the same point. At the Tonopah Belmont mill,[36] Tonopah, Nevada, they use between 0.4 and 1 lb. of lead acetate per ton of ore. Between these limits there is little change noted in extraction. It has been proved at this plant by actual mill experience that too much lead salt gives no better results than none at all. The amount used is governed by the proportion of zinc in solution; when the zinc rises above 0.05%, the proportion of lead acetate is reduced. The effect of using too great a proportion of lead acetate was illustrated at this plant by the case of a slime charge where both shifts had added lead acetate by mistake. Only 50% extraction was indicated upon this charge, but when the charge was divided and one-half new material added, an 80% extraction was realized. The importance of using the proper proportion of lead salt is also shown in the experimental part of this paper.

Clennell[37] states that an excess of lead in a soluble form in an ore may exert a harmful influence upon cyanide treatment. He[38] also states that the alkaline carbonates or bicarbonates precipitate lead from cyanide solutions without precipitating gold or silver. This would seem to indicate a method of overcoming this difficulty should it ever arise.

Experimental Investigation

In 1908, I had the opportunity of investigating the effect of a lead salt upon the cyanidation of a certain Central American silver-gold ore, where the beneficial effect arising from its use had been confirmed by several operators and was, therefore, unmistakable. The investigation was carried on at the mine and comprised many small scale tests, as well as large scale tests in the mill upon the regular slime charges.

Character of Ore.—The ore treated had a gangue consisting largely of quartz, clay, and calcite, with a small amount of manganese minerals and pyrite. One prop-

[24] *Loc. cit.*, p. 46.

[25] von Bernewitz, *loc. cit.*, p. 758.

[26] *Ibid.*

[27] *Ibid.*, p. 759.

[28] *Ibid.*, p. 760.

[29] 'Geology and Gold Deposits of the Cripple Creek District,' Waldemar Lindgren and Frederick L. Ransome, *Prof. Paper* No. 54, U. S. Geol. Surv., p. 121.

[30] Crowe, Thomas, personal communication.

[31] 'Lead Salts in Cyanide Treatment,' J. E. Clennell, *The Eng. and Min. Jour.*, Vol. 94, p. 598.

[32] *Ibid.*, p. 597.

[33] 'Some Features of Silver Ore Treatment in Mexico,' W. A. Caldecott, *Jour.* Chem., Met. and Min. Soc., South Africa, Vol. 8, p. 267.

[34] Clevenger, G. H., private reports.

[35] *Loc. cit.*, Vol. 94, p. 598.

[36] von Bernewitz, *loc. cit.*, Vol. 107, p. 758.

[37] *Loc. cit.*, p. 598.

[38] *Ibid.*

erty, from which ore was not mined at this time, but which has since become a producer, contained considerable manganese. Silver occurred largely as the sulphide (argentite) and more rarely as the haloid minerals. Finely divided native silver was also at times observed. There may have been other silver minerals present, but their identification was difficult, if not impossible, on account of being finely disseminated, if they occurred at all. Gold occurred native in a finely divided state and also probably intimately associated with certain of the other minerals. Copper was present in a very small percentage, scarcely more than a trace; under ordinary conditions not enough to affect cyanide treatment in the slightest degree, but, as will be pointed out later, this small amount of copper had an important influence upon the solution of a portion of the silver. Although arsenic and antimony were especially looked for upon several occasions, they were never detected in more than traces in the ore, solutions, or precipitate. It is well, however, to bear in mind that these elements could be combined with a part of the silver and still escape detection on account of the minute quantities which would be involved. Evidence of selenium was noted when melting the precipitate by the characteristic rose colored sublimate which condensed upon the cooler parts of the melting furnace. The ratio of silver to gold varied somewhat, but, at this time, the average was not far from fifty parts of silver to one part of gold. The average value of the ore was about $8 per ton of 2000 pounds.

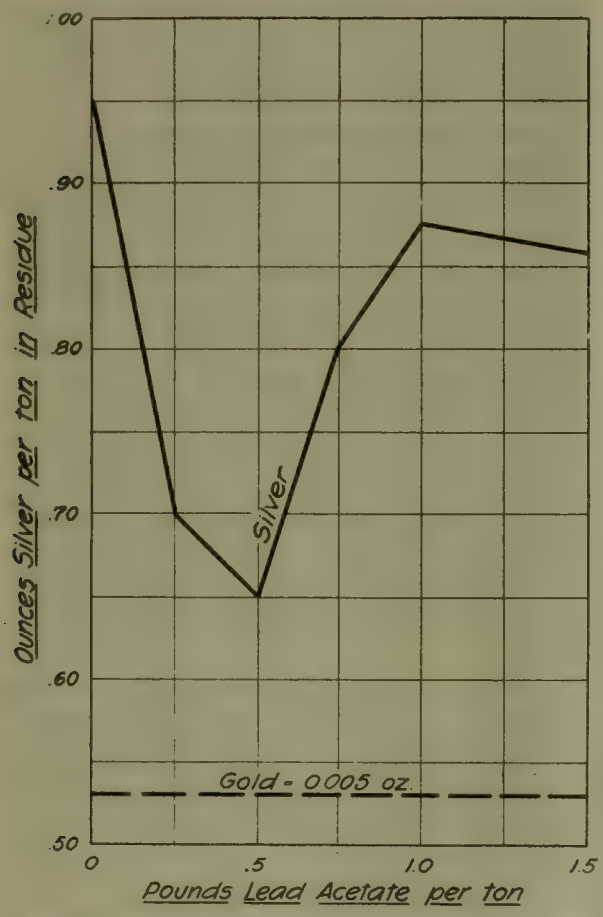


FIG. 1. EFFECT OF LEAD ACETATE UPON THE SOLUTION OF GOLD AND SILVER IN SLIME CHARGE, No. 1160.

System of Milling.—Briefly, the system of milling employed was to crush the ore in cyanide solution by stamps and a closed circuit of classifiers and tube-mills to approximately 100 mesh. The total product was treated by agitation in mechanical agitators, followed by filtration in a Butters filter. Later the practice was varied to the extent of crushing to approximately 80 mesh, separating the leachable sands and treating them by percolation. Treatment of the slime portion was continued by the same method as formerly used for the total mill product. As the acetate was the particular lead salt which had been previously used in the plant, it was used throughout this investigation. The small scale tests were made upon slime pulp removed from the agitators at the end of collection and after agitation had commenced, so that a uniform sample would result. As the crushing was in cyanide solution, a considerable extraction had been made at this stage. A moisture determination was made upon the pulp and from this was calculated the volume to give in each case 100 grams of dry slime. The dilution, lime content, and other factors were the same as the large charge undergoing treatment in the plant, the only variable in the small tests being the amount of lead acetate added. Open bottles agitated by a roller agitator were used in making the tests. On account of the perfect control of the various factors of treatment, the small scale tests formed a valuable guide to the making of the large scale tests in the plant. They were especially valuable in that all the samples in a series of tests could be taken from the same lot of pulp.

TABLE I

TYPICAL ANALYSES OF SOLUTIONS

	Head of zinc-boxes, per cent.	Tail of zinc-boxes, per cent.	Milling solution, per cent.	Decanted solution from slime, per cent.
*Simple cyanide	0.169000	0.108000	0.108000	0.137000
*Total cyanide	0.295000	0.328000	0.246000	0.263000
†Protective alkali	0.085000	0.110000	0.114000	0.070000
Silver	2.940000‡	0.030000‡	1.080000‡	3.140000‡
Gold	0.064000‡	0.000500‡	0.064000‡	0.072000‡
Copper	0.002045	0.000682	0.001948	0.001558
Lead	faint tr.	faint tr.	faint tr.	faint tr.
Zinc	0.057230	0.097390	0.056220	0.054210
Calcium oxide	0.051890	0.054510	0.080160	0.056250
Ferrocyanide	small amt.	small amt.	trace	none
Sulphocyanate	0.031490	0.040580	0.035200	0.032670
Total solids	0.686000	0.686000	0.607000	0.598000
Solids after ignition	0.529000	0.527500	0.528000	0.496500
Organic matter	0.157000	0.158500	0.079000	0.101500

Note.—Chlorides were present in marked amount. Apparently no sulphates.

*In terms of potassium cyanide.

†Expressed in terms of caustic soda.

‡Ounces.

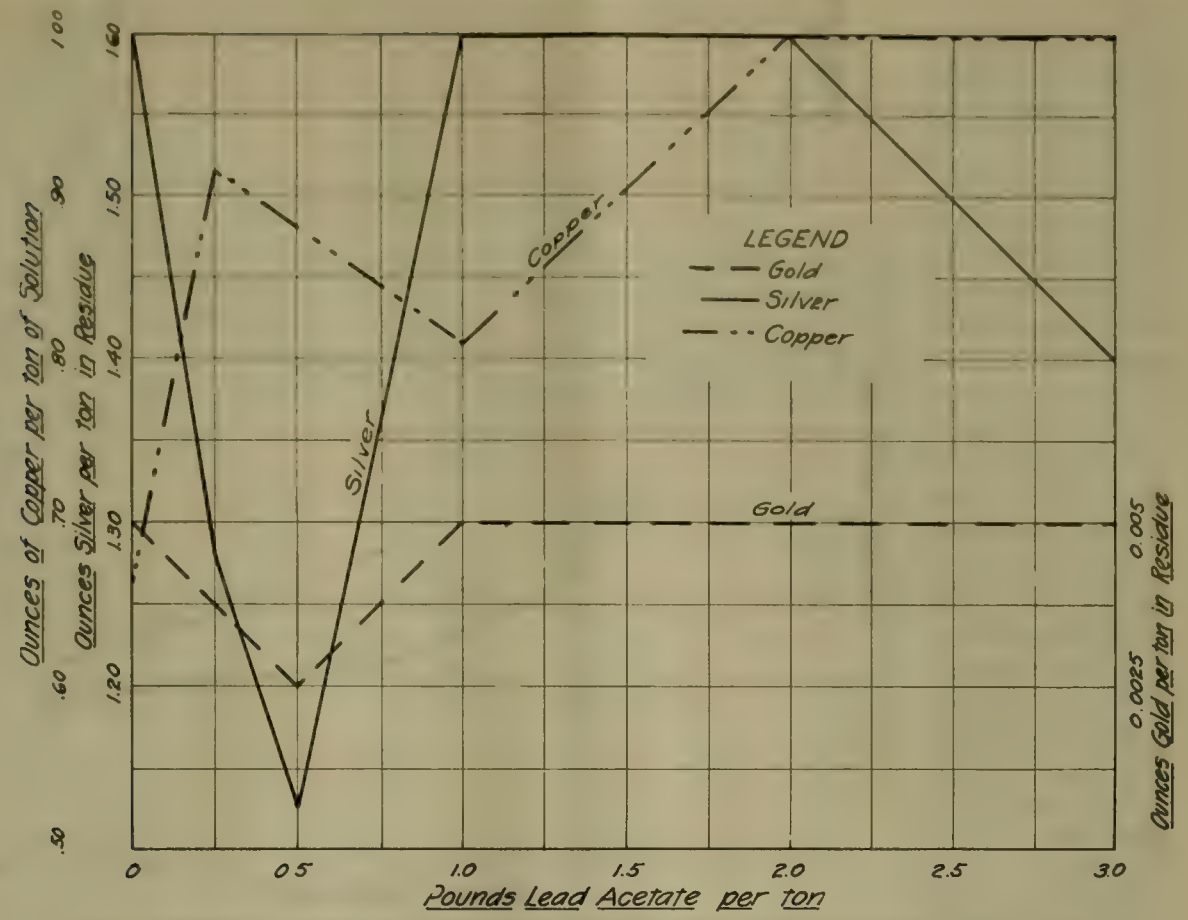


FIG. 2. EFFECT OF LEAD ACETATE UPON THE SOLUTION OF GOLD, SILVER, AND COPPER IN SLIME CHARGE, No. 1330.

TABLE II

TYPICAL ANALYSIS OF PRECIPITATE

	Per cent.		Per cent.
Gold	1.38	Magnesium oxide	trace
Silver	78.05	Silica	1.68
Copper	2.58	Sodium oxide, Potassium oxide	0.75
Total zinc	7.84	Carbon dioxide	1.41
Metallic zinc	0.75	Water	0.57
*Lead	0.46	Oxygen, organic matter, and not determined	0.67
Mercury	none		
Ferric oxide, Aluminum oxide	1.35	Total	100.00
Calcium oxide	2.51		

*Lead probably from lead in zinc.

TABLE III

TYPICAL ANALYSIS OF BULLION

	Per cent.		Per cent.
Silver	91.800	Zinc	1.204
Gold	1.534	Iron	trace
Copper	2.924		
*Lead	2.630	Total	100.092

*Lead probably from lead in zinc.

By making a series of tests upon several different lots of pulp, a very good general line of attack could be formulated for making the large scale tests. In every case, the small scale tests were verified by large scale tests in the plant.

The analyses of solutions given were made upon samples of solution which were all taken at the same time and when there was being used in the mill 0.5 to 0.6 lb. of lead acetate per ton of dry slime. The analysis of bullion was not made upon the bullion produced from the particular lot of precipitate of which analysis is given. Although the results are not directly comparable, they may be taken as being typical.

Effect of Lead Acetate Upon Slime Charge No. 1160. —Solution from pulp after adding cyanide, titrated: cyanide 0.091%, alkali 0.077%, dilution 3.76 to 1. Assay of pulp at beginning of treatment after washing with water: silver 2.96 oz., gold 0.03 oz. A considerable extraction had been made during milling.

All factors were the same in this series of tests, except the proportion of lead acetate added. The lead acetate used contained 54.3% metallic lead.

No.	Lead acetate per ton dry slime, lb.	Cyanide in solution, %.	Alkali, %.	Assay of residue: Ag, oz.	Au, oz.
1	none	0.052	0.091	0.95	0.005
2	¼	0.081	0.083	0.70	0.005
3	½	0.076	0.078	0.65	0.005
4	¾	0.068	0.085	0.80	0.005
5	1	0.057	0.090	0.88	0.005
6	1½	0.083	0.085	0.86	0.005

Inspection of the extraction curve, Fig. 1, shows in a most unmistakable manner the beneficial effect upon the silver extraction of the proper proportion of lead acetate and the lack of advantage of more than this correct proportion. The extraction of the gold is unaffected throughout this series. The large apparent saving of cyanide with the addition of a small amount of lead acetate, together with the rapid falling off as the proportion of lead acetate increases, is interesting, but gives a greatly exaggerated idea of the saving possible in mill practice. The titrations for free cyanide were made as carefully as possible with standard silver nitrate solution without the use of an indicator, but the determination of free available cyanide in solutions containing zinc is at best only an approximation.

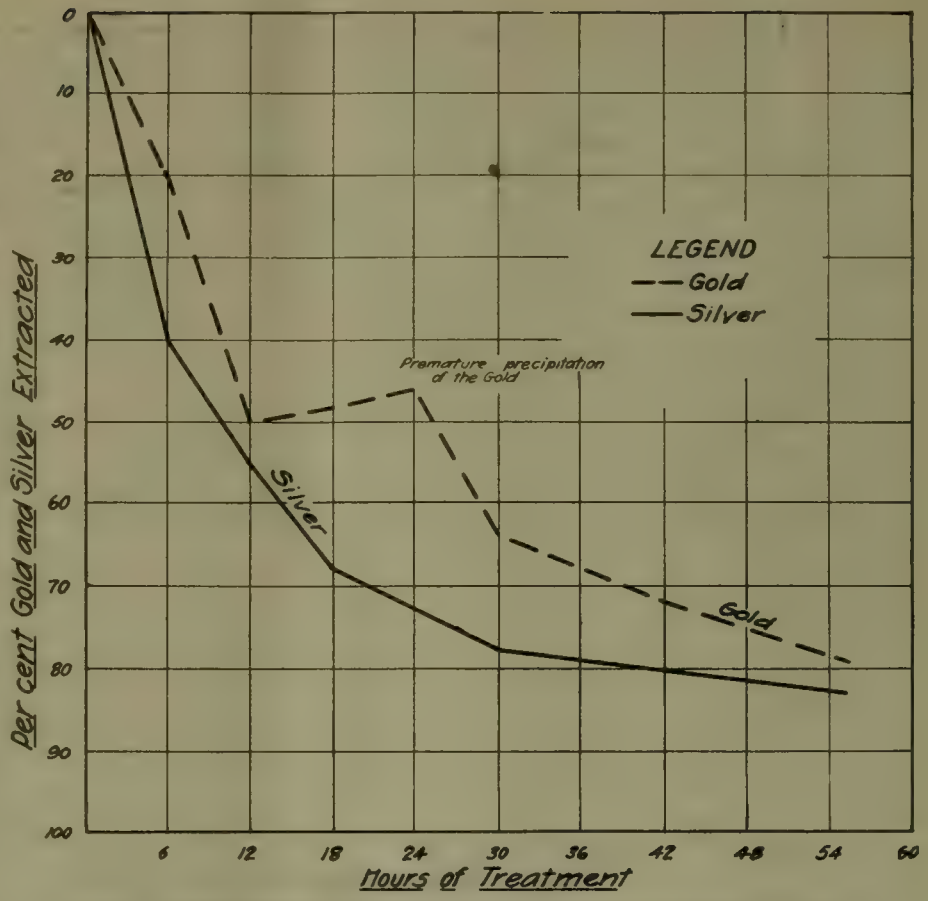


FIG. 3. AVERAGE EXTRACTION CURVES FOR GOLD AND SILVER OF THREE SLIME CHARGES.

Effect of Lead Acetate Upon Slime Charge No. 1330.—After the series of tests upon slime charge No. 1160, and several others similar to it, had been made, it was accidentally discovered that, in all cases where there was a gain in the silver taken into solution, or in other words an increase in the silver extraction, there was also a gain in the copper taken into solution. When lead acetate was not used, there was apparently no copper taken into solution, when mill solution was used in making the tests. It must be remembered that the amount of copper involved is very small; in the one case critically investigated it was not in general as great as the additional silver taken into solution. The general conditions were the same as with slime charge No. 1160. (For analyses, see p. 641.)

The accompanying extraction curves, Fig. 2, for slime charge No. 1330 show a very noticeable improvement in both the silver and gold extraction up to 0.5 lb. per ton of lead acetate. At 1 lb. the extraction of both is the same as when none is used. The fact that the maximum gold extraction occurs at 0.5 lb. per ton, the same proportion which gives the best result with silver, would seem to indicate that at times the last of the gold was very intimately associated with the refractory silver. The proportion of copper taken into solution is somewhat irregular, but, in general, increases as the proportion of lead acetate added increases.

This test seems to indicate that the small amount of copper occurring in this ore is in combination with a portion of the silver in the form of a definite mineral. Dana[39] describes the mineral stromeyerite, for which the formula $(AgCu)_2S$ or $Ag_2S{\cdot}Cu_2S$ is given. Although specimens of this mineral could not be isolated from the ore and identified on account of the minute quantity involved, yet all the evidence indicates that, in this case, the additional silver dissolved, as a result of the use of lead acetate, probably occurred in this combination. As this mineral occurs in various parts of the world, it is a factor not to be neglected in the cyanidation of silver ores.

In Fig. 3 are shown characteristic gold and silver extraction curves. These curves are an average of three curves plotted from the results obtained from the treatment of three separate slime charges. The symmetrical form of the silver extraction curve will be noted, as well as the irregular form of the gold extraction curve. In the case of the gold, very well defined premature pre-

[39] 'A System of Mineralogy,' J. D. Dana and E. S. Dana, 6th Ed., New York, 1904, p. 56.

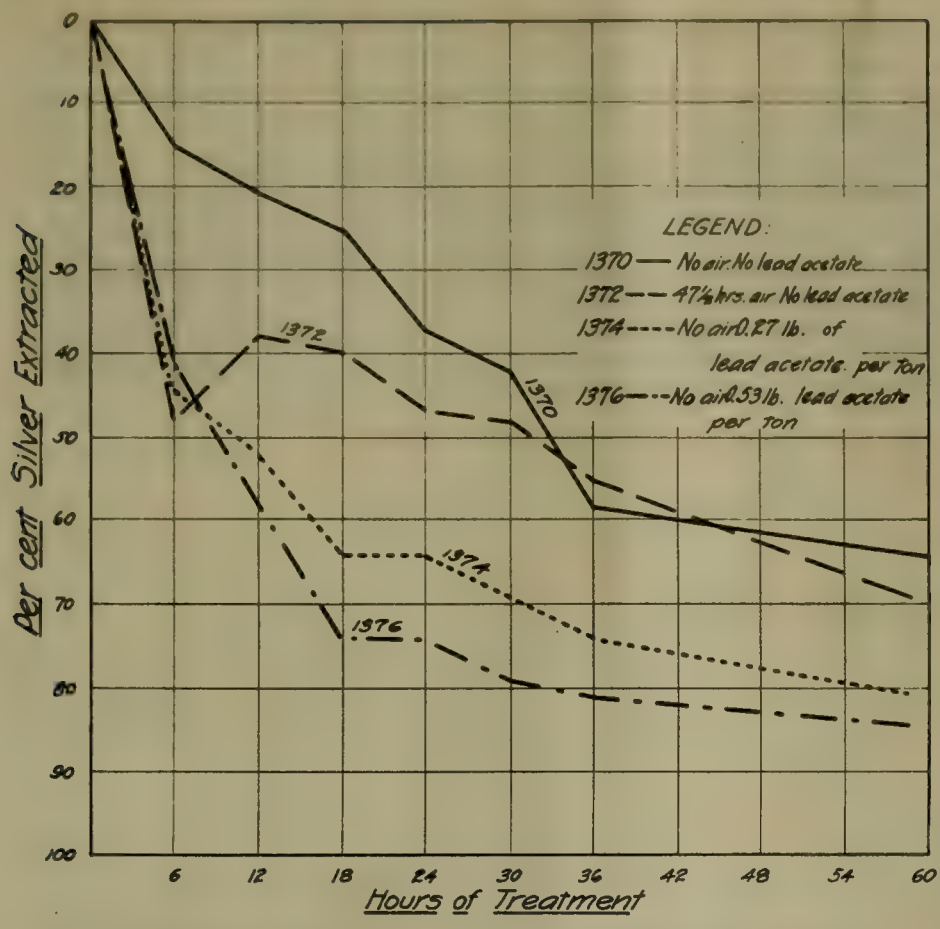


FIG. 4. EFFECT OF LEAD ACETATE AND AIR UPON THE SILVER EXTRACTION OF FOUR SLIME CHARGES.

cipitation took place between 18 and 24 hours after agitation began. As the treatment proceeds, the gold extraction becomes normal.

Fig. 4 shows the silver extraction curves for four separate slime charges treated as follows: Agitated mechanically without the addition of air or lead acetate; agitated mechanically and with 47½ hours of air; agitated mechanically and lead acetate added at the rate of 0.27 lb. per ton of dry slime; agitated mechanically and lead acetate added at the rate of 0.53 lb. per ton of dry slime. The charge with which the air was used shows an acceleration of the silver extraction at the end of 6 hours, but at the end of 12 hours a noticeable premature precipitation of the silver has taken place. At 35 hours the extraction is the same as when no air was used. At the end of 60 hours the extraction is 6% higher than when no air was used. The addition of 0.27 lb. of lead acetate has the effect of making the extraction curve more regular and of giving a considerably higher ultimate extraction at the end of 60 hours. The addition of 0.53 lb. of lead acetate shows a better extraction from 9 hours on than when 0.27 lb. is used. This curve more nearly assumes the ideal form.

Fig. 5 shows the gold extraction curves for the same four slime charges of which the silver extraction curves are shown in Fig. 4. Definite evidence of premature precipitation is only shown in the two cases where lead acetate was not used. These curves are erratic. However, it is worthy of note that after 60 hours there is not a great deal of difference in gold extraction, the higher proportion of lead acetate showing rather the poorest result of the four.

CONCLUSIONS

1. Lead salts may serve to keep down the concentration of soluble sulphides in solution, but they seldom function in this capacity for the reason that soluble sulphides are rarely present in mill solutions.

2. They may accelerate the dissolution of silver from ores in which silver occurs as sulphide, through the more prompt removal of the sulphur ion from the system.

3. They may in certain cases with sulphide ores effect

No.	Lead acetate per ton dry slime, lb.	Cyanide in solution, %.	Alkali, %.	Copper in solution, %.	Lead in solution, %.	Assay of residue: Ag, oz.	Au, oz.
1	none	0.100	0.019	0.002313	trace	1.60	0.005
2	0.27	0.100	0.010	0.003165	none	1.28	0.00375
3	0.54	0.100	0.016	0.002191	trace	1.12	0.0025
4	1.08	0.104	0.006	0.002800	trace	1.60	0.005
5	2.16	0.098	0.016	0.003652	....	1.60	0.005
6	3.24	0.104	0.006	0.003531	(*)	1.40	0.005
Original solution...	....	0.129	0.048	0.002435	trace	...	....

*Lead present, but not determined.

a saving of cyanide through retarding the formation of sulphocyanate or preventing the separation of elemental sulphur from the solution.

4. They may be a benefit when a portion of the silver is intimately associated with copper; also when the concentration of copper in the solution rises to a dangerous point, they may mitigate its fouling tendency. However, this statement does not mean that the use of lead salts is a universal panacea for all the ills due to copper cyanidation. So far as we know, it is only where the effect is not too great that this remedy is useful.

5. A great variety of the compounds of lead may be used for this purpose. The compound used should depend upon the cost of its lead content as well as its convenience in use. The compound most generally used in the past has been the acetate, although litharge has been claimed equally satisfactory. The cost of the lead content of litharge is perhaps lower than any of the other compounds, but it is more difficult to apply, as it is necessary to grind it very fine and exercise care to see that it is thoroughly mixed with the charges undergoing treatment. However, an excess of litharge appears to be less detrimental than an excess of a soluble salt.

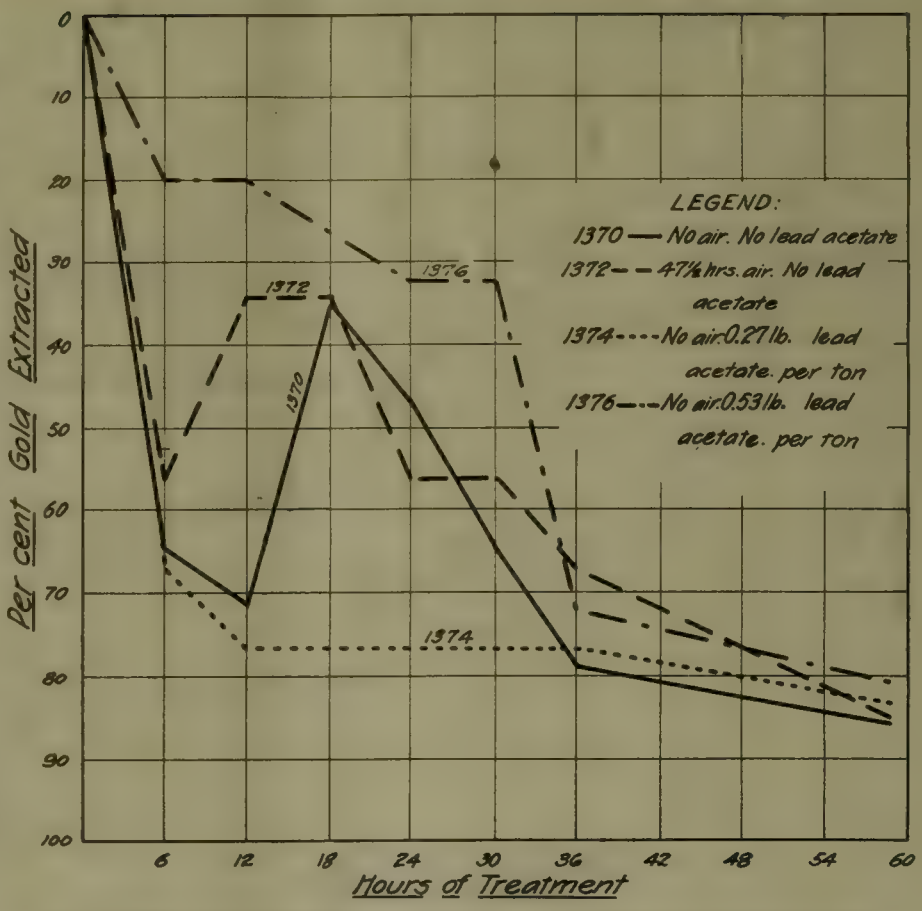


FIG. 5. EFFECT OF LEAD ACETATE AND AIR UPON THE GOLD EXTRACTION OF FOUR SLIME CHARGES.

6. Too great care cannot be exercised in adding the proper proportion of lead salt. This can only be determined by careful experimentation in each particular case, and should be checked at frequent intervals.

7. A number of those who have written upon the subject are of the opinion that lead salts may be of advantage in starting a new plant with fresh solution, but that this advantage disappears after the solutions have been in use for some time. This clearly points to the fact that there are a number of substitutes which may perform the same functions that the lead salt would. Perhaps chief among these is zinc taken into solution during precipitation. On the other hand, my own experience in at least one case, in treating a silver-gold ore was that the use of a lead salt was more advantageous with the mill solution than with fresh solution. Although there might be other factors which might enter in, the presence of copper in solution possibly explains this contradictory behavior. Small amounts of mercury escaping from amalgamation processes preceding cyanide treatment would more or less function in the same way that lead salts do. Aëration might also at times be an efficient substitute.

8. On the whole, the advantages arising from the use of a lead salt are more apparent in treating silver ores, or silver-gold ores in which silver occurs in combination with sulphur, than in treating gold ores. In ores in which the silver is combined with antimony it is likely to be a detriment. It may be said that the advantageous use of lead salts is one of the finer points of the game, and, even in cases where its use might be advantageous, unskilled application may spoil the whole effect.

PLATINUM PRODUCTION of the United States in 1913 was 482.87 oz., worth $18,477, from California and Oregon. From refining gold and copper bullion the recovery was 650 oz. Imports were valued at $5.040,210. Russia produces 250,000 oz. per year.

THICKENER TANKS ORE-BINS BEFORE COMPLETION.

Cyanidation at Shafter, Texas

The Presidio Mining Co., operating the famous silver mine at Shafter, in western Texas, treated its ore until recently by pan-amalgamation. Last year the mill was rebuilt under the supervision of the superintendent, Edgar M. Gleim, and cyanidation adopted instead. Through the courtesy of W. S. Noyes, the manager, we are enabled to present the accompanying flow-sheet, cross-section, and description of the mill. The design of the mill is worth note, since the delay in adoption of cyanidation has enabled the Company to take full advantage of the most recent developments in the art.

The Shafter ore is a silicious limestone. The silver, which occurs mainly as the chloride and bromide (embolite), has apparently been introduced into the common limestone of the region in connection with the intrusion of basic eruptive dikes. The orebodies are large but irregular, and systematic persistent development alone has permitted the continued operation of the mine. The property was purchased in 1881 by the late General Shafter and his associates, and in 1882 turned over to California operators for development. The control of ownership has remained closely held by the few friends who early joined the enterprise.

The ore averages in value about 18 oz. per ton. One analysis shows: silica, 61.8%; lime, 11.8; iron, 4.5; magnesium, 2.4; zinc, 2.4; manganese, 0.4; lead, 0.5; sulphur, 0.2; carbon dioxide, 13.2; undetermined 2.8; and silver, 20 oz. In part it is soft and talcy, and in part extremely hard. The mill is now treating between 130 and 140 tons per day, the total for July 1914 being 3782 tons. Ore from the mine is crushed and transported to the mill ore-bin by an aerial tramway having a track rope of 1⅛ in. diameter for loaded skips and ⅞ in. for 'empties,' and a traction rope of ⅝-in. diameter.

Challenge feeders supply ore to three batteries of five stamps each. There are five driven by one, and ten by another cam-shaft, at 108 drops per minute, crushing about 8.4 tons per stamp-day each. Consumption of steel in shoes and dies is 1.18 lb. per ton crushed. The counter-shaft driving the cam-shafts runs at 106 r.p.m. and has driving wheels 14 by 35 in., bull-wheels on the cam-shafts being 16 by 69 in. The ratio of cyanide solution to ore in the mortars is 7 to 1, and 29% of the silver is dissolved at this point.

Three sizes of screens are used at times, and the following grading tests are average samples of battery pulp:

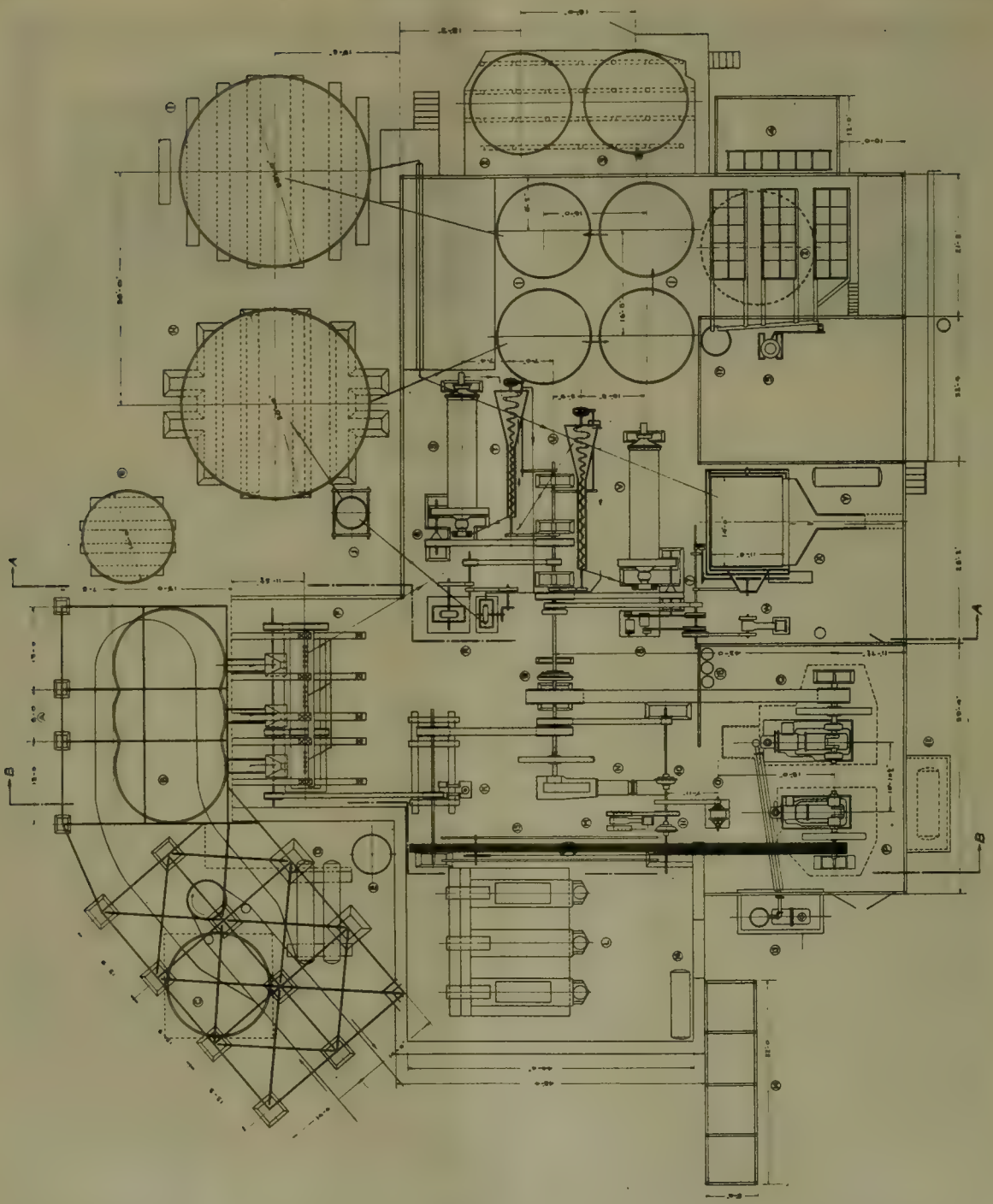
	20-mesh.	10-mesh.	4-mesh.
Size of opening, inches	0.027	0.094	0.125
Size of wire, inches	....	0.062	0.094
+40 per cent	23.50	33.50	51.00
+60 per cent	10.05	8.40	7.10
+80 per cent	7.10	7.50	4.50
+100 per cent	10.80	8.50	6.40
+150 per cent	8.30	3.30	5.50
+200 per cent	6.07	5.00	3.50
—200 per cent	33.20	33.40	22.00
Classification of pulp:			
Sand, per cent	65.82	66.20	78.00
Slime, per cent	33.20	33.40	22.00

Pulp from the batteries flows to two screw classifiers working at 13.3 r.p.m., discharging the coarse material through 9-in. screw conveyors at the end of these classifiers to two 4½ by 18-ft. tube-mills, running at 28.8 r.p.m. The usual closed-circuit system is observed. Feed and discharge of the mills is as follows:

Screen. Per cent.	Feed.	Discharge.	Final product.
+ 40	56.00	1.70	...
+ 60	9.50	1.20	0.10
+ 80	8.00	2.50	0.80
+100	13.50	9.10	1.60
+150	7.00	11.70	8.30
+200	2.00	23.60	10.30
—200	4.00	51.10	80.60

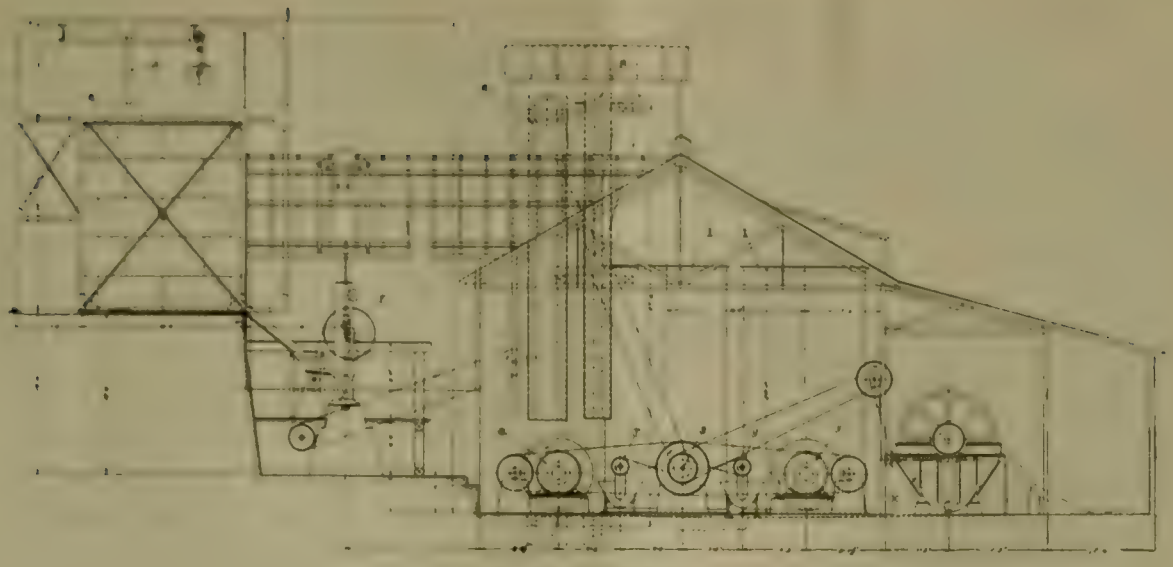
Pebble consumption is 3.4 lb. per ton of ore milled. There is 16.6% of the silver dissolved in the mills.

Slime from the classifiers is lifted by bucket elevators to a 5-ft. diaphragm cone classifier and then to a Dorr 10 by 30-ft. thickener. The elevators consist of 12-in.



PLAN OF THE MILL.

A. Tramway terminal. B. Mill-bin, 550 ton. C. Water tank. D. Condensers. E. Hot-water tank. F. 15-stamp battery. G. Battery storage tank. H. Dorr thickener. I. Dorr thickener. J. Diaphragm cone classifier. K. 9 by 4 by 10 in. double cylinder Worthington fire pump. L. Three 54-in. by 16-ft. boilers. M. 10 by 10-in. Ingersoll Rand N. E. I. compressor. N. 16 by 36-in. Reynolds Corliss engine, 125 hp. O. 20-kw. 115-volt G. E. generator. P. 100-hp. De la Vergne crude oil engine, type FH. Q. 150-hp. De la Vergne crude oil engine, type FH. R. Bucket elevators. S. Tube-mill, 4 ft. 6 in. by 18 ft. T. Screw classifier and conveyor. U. Screw classifier and conveyor. V. Tube-mill, 4 ft. 6 in. by 18 ft. W. 10 by 14-in. Goulds wet vacuum pump. X. Oliver continuous filter, 11 ft. 6 in. by 14 ft. Y. Ferrous sulphate storage tank. Z. Sump tank. 1. Pachuca agitators, 14 by 28 ft. 2. Clarifying tank, 16 by 4 ft. 3. Clarifying tank, 16 by 4 ft. 4. One 6-compartment and three 5-compartment double 30 by 30-in. zinc-boxes. 5. Donaldson tilting furnace, No. 275. 6. One 42-in. Plamondon clutch. 7. One 42-in. Plamondon clutch. 8. Two 4 by 6-in. Deming triplex pumps. 9. One 48-in. Dodge quill clutch. 10. 28-in. Dodge split friction clutch. 11. 28-in. Dodge split friction clutch. 12. Oil storage tank for De la Vergne engines. 13. Muffler pit for De la Vergne engine exhausts. 14. Bath rooms. 15. Dodge rope drive. 16. Air receiver. 17. Clean-up. tank. 18. Air-supply tanks for engine self-starter.



CROSS-SECTION OF MILL.

by 8-ply belts with 6 by 11-in. buckets, traveling at 298 ft. per minute.

Thickened slime flows to four 14 by 28-ft. conical-bottom Pachuca tanks in series. By the time this is in agitation in No. 1 tank a total of 75% of the silver has been dissolved, so that only 13.8% is further recovered by agitation. Average specific gravity of the slime is 1.31 or 38.45% dry ore. Strength of solution is maintained at 2 lb. sodium cyanide per ton of solution, consumption being 0.9 lb. per ton of ore treated. Lime is 11.13 lb. per ton.

From No. 4 Pachuca the slime goes to another 10 by 30-ft. Dorr thickener, which is used as a diluter to lower the value of solution going to the filter, an 11½ by 14-ft. Oliver. Vacuum is maintained by a 10 by 14-in. Oliver dry pump. Residue is neutralized with ferrous sulphate, and then flows to a pond.

Silver-bearing solutions are clarified in two 4 by 16-ft. tanks, and then pass through one 6 and three 5-compartment double 30 by 30-in. zinc-boxes. The clean-up room contains a 5 by 5-ft. clean-up tank, precipitate drier, and No. 275 Donaldson tilting furnace. An average month's run results in over 5000 tons of solution flowing through the zinc shaving. Solution heads assay 3.29 oz. and tailing 0.35 oz. per ton, 1.4 lb. of zinc being consumed per ton of ore milled. Precipitate averages about 30% silver, and, in melting, about 25% borax glass and 11% bicarbonate of soda are used as fluxes.

A feature of the Presidio mill is the power plant, which consists of one 100-hp. and one 150-hp. De la Vergne crude-oil engine, type FH, working at 200 and 164 r.p.m. respectively. These give great satisfaction, the running time being 100% for two months and not under 99% for a period of 5 months. The oil consumption is 0.4 lb. per brake horse-power hour.* The smaller engine drives the stamp counter-shaft by a rope drive. This rope also drives a counter-shaft in the engine-room from which the air-compressor and electric generator are driven by belts. The larger engine drives the main mill counter-shaft (which is a prolongation of the crank-shaft of the old Corliss engine), and from this shaft the tube-mills, classifiers, pumps, and filter are driven. The counter-shaft and stamp counter-shaft, before mentioned, are also belted from this shaft, and by means of suitably arranged clutches can be driven by either of the two oil-engines. As a stand-by there is a battery of 54 in. by 16-ft. boilers and a 16 by 36-in. Reynolds Corliss engine of 125 hp. The mill may be driven by this engine and by either of the oil-engines, or by the two oil-engines alone. The equipment also includes a 20-kw. General Electric generator and a 10 by 10-in. Ingersoll-Rand straight-line compressor and the usual accessories.

MILL TERMINAL OF TRAMWAY BUILT OVER THE ORE-BINS.

*See 'An Internal-Combustion Oil-Engine,' by W. S. Noyes, *Mining and Scientific Press*, December 14, 1912.

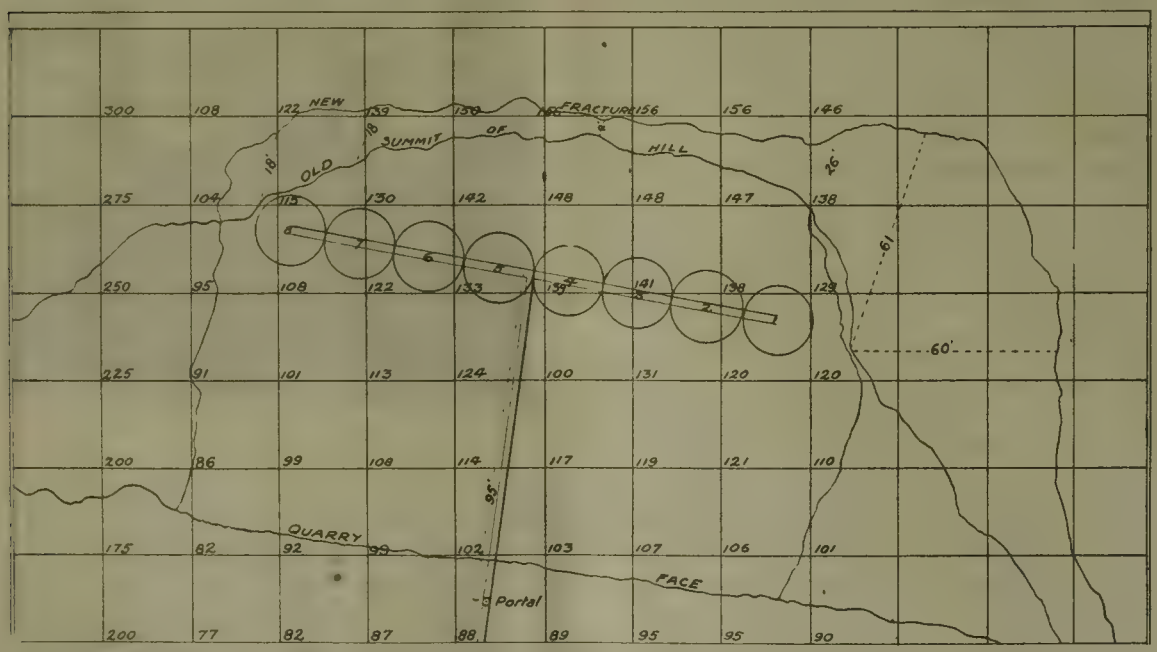
Blasting by Wholesale

By M. W. von BERNEWITZ

A large quantity of rock is quarried from various points in the north part of San Francisco bay, California. This is used for concrete construction, roads, filling for the waterfront, and other purposes, being loaded on skip and hopper barges and towed to various points as desired. For filling in part of the waterfront on the San Francisco side of the bay, and constructing part of the new two-mile mole for the Key Route electric train system on the Oakland side, the Daniel Contracting Co. is supplying about 1,000,000 tons of rock. This is excavated at the firm's quarry at McNear's point, about an hour by water from the city. Here is a fully equipped plant consisting of three Bucyrus steam-shovels, each capable of handling 1000 to 1300 cu. yd. of rock in 10 hours, a railroad system with light locomotives and side-dump cars, and electric dumping apparatus which can fill a skip barge of 250-ton capacity in about an hour. Hopper barges carry up to 900 tons each, and may be filled at a greater proportionate rate.

PART OF SAN FRANCISCO BAY. THE QUARRY DESCRIBED IS AT SAN PEDRO POINT.

In order to have plenty of rock for the shovels, large quantities of material are broken at the two faces being worked. One is a brown and the other a blue metamorphic sandstone, the latter being the hardest. On July 11, 1914, a large blast was made at the brown face, which kept the shovels supplied for over two months. As will be seen from the plan, an adit was driven into the hill 95 ft., from which cross-cuts were driven 70 ft. each way. These were only large enough to enable a machine-drill to be worked, and to wheel out the rock broken. The cross-cuts were divided into four sections each, and were charged with powder. This is received in 12.5-lb. bags, with 4 bags to a 50-lb. case, and is special powder for such large blasts. Three No. 7 electric exploders were inserted in each charge, making 24 in all. Leads to convey the electric current for exploding consisted of No. 14 insulated wire, laid in 2 by 4-in. grooved boards and connected in straight series.



PLAN SHOWING ELEVATIONS, ADITS, CROSS-CUTS, POWDER ARRANGEMENT, OLD AND NEW SUMMIT OF HILL. THE FIGURES GIVE ELEVATIONS ABOVE SEA-LEVEL.

The charges were well tamped with fine and large rock, and the adit filled to the portal. Laying the powder and tamping took about four days, and was supervised by J. C. Costello of the California Trojan Powder Co. Each section was charged with powder made by this Company, as follows:

Load.	No. 2 powder, pounds.	No. 4 powder, pounds.	Total, pounds.
1	2,250	....	2,250
2	2,300	....	2,300
3	2,500	....	2,500
4	....	2,250	2,250
5	....	2,250	2,250
6	....	1,900	1,900
7	....	1,900	1,900
8	450	1,700	2,150
Total	7,500	10,000	17,500

To help the main blast by cutting away the foot of the hill, so as to allow the broken rock to slip down, eight 22-ft. holes were bored at equal distances by a machine with 1¼-in. drills. These 'toe-blasts' were fired first, and so loosened the bottom. In setting off the large charge, a 220-volt, 110-ampere electric current was switched on to the leads. At the moment of disruption, as shown by the halftone, the whole hill was lifted out several feet, fell back, and then the broken rock started to roll down. There was only a dull thud heard, more noise being caused by rolling of rocks than the actual explosion. In the plan will be seen the old summit of the hill and new line of fracture, in one place 61 ft. apart. The blast was an excellent one, and a total of 166,250 tons of rock, well broken up and requiring no secondary blasting, has since been moved by the steam-shovels, and dumped into San Francisco bay. Each pound of powder broke 9.5 tons of rock.

In wholesale mining, where the conditions are similar, this system of blasting, known as the 'coyote,' should be satisfactory.

ACCORDING to the California State Mining Bureau, there were 182 quarries operated in 42 counties of the state in 1913, and probably an equal number were idle. The output was valued at $6,168,020, against $5,473,928 in 1912. The quantities of crushed rock were as follows:

Classification.	Tons.	Value.
Macadam	1,533,330	$ 885,638
Rubble	686,983	361,079
Concrete	931,098	607,194
Unclassified	3,268,142	1,988,876

Marin county, in which is the quarry described in the article on blasting on the preceding page, produced 421,032 tons of rubble in 1913.

Sand and gravel produced totaled 3,393,268 tons, worth $972,694; paving blocks, 6,364,000, worth $363,505; and granite for various purposes, 1,324,835 cu. ft., worth $729,277.

TIN IMPORTS into the United States last year totaled $47,295,050, or 40.8% of the world's production. The domestic output was 84 short tons of 60% ore, worth $36,970, from Buck creek, Alaska.

THE BLAST AT THE MOMENT OF DISRUPTION. ENLARGED FROM A MOVING PICTURE FILM. ROCKS CAN BE SEEN IN THE AIR.

Scientific Management in the German Industries

By H. N. STRONCK

When F. W. Taylor presented his paper, 'Shop Management,' at the June 1913 meeting of the American Society of Mechanical Engineers, it aroused much interest not alone among the industries of the United States, but also in the great industrial nations of Europe, especially Germany and France. He advocated high wages and low production costs, therefore, it is but natural that in countries where industrial competition is as keen as in Germany, engineers should become interested and investigate scientific management. Taylor's writings have been translated into many languages, and they have gained a large circulation in both Germany and France.

One of the most ardent enthusiasts over the Taylor system in France, is the distinguished engineer Henri Le Chatelier, who wrote a lengthy introduction to the French edition of Taylor's work. He deals especially with the political economy of scientific management, and has aroused wide interest. Taylor's 'Principles of Scientific Management' were translated into German by Roesler. 'Shop Management' was recently translated into German by Wallich, and this edition has gained a very wide circulation. A treatise on the practice of the Taylor system was published last February by Rudolph Seubert. This book describes the practice at the Tabor Mfg. Co., Philadelphia, including a few later developments. Herr Seubert spent several years in the United States, studying the system at various factories where it has been introduced, with the intention of introducing it in Germany.

At the joint meeting of the Vereins Deutscher Ingenieure and the A. S. M. E. at Leipsic, June 1913, James M. Dodge, of the Link Belt Co., presented a paper on 'Industrial Management.' At the same meeting, Professor Schlesinger of the Charlottenburg Technische Hochschule, Berlin, presented a paper on the same subject, analyzing German conditions and showing why this system could be successfully introduced in the German industries. A large number of magazine articles have also appeared on the subject, both by advocates for and by antagonists of the system. These writings aroused great interest and Taylor is one of the most widely known men in German engineering and industrial circles.

Many German industries have actively taken up the work of installing scientific management and efficiency methods, but none of them have the system as complete as it is at the Tabor Mfg. Co. and at the Link Belt Co., Philadelphia. A number of German engineers have come to the United States to study the practical side of the work, and American engineers have gone to Europe to aid in the introduction. German mining and metallurgical men are as much interested in this work as are the men of the manufacturing industries. The difficulty, and small headway that has been made, is due to the fact that, although they have heard of such work, very few really know what scientific management is. A lengthy paper was presented at the July annual meeting of the German Society of Miners and Metallurgists, on 'Scientific Management in the Mining and Smelting Industries,' which paper explained the principles of scientific management, analyzed the present mining situation, and showed how these principles could be applied to mining and smelting. This paper created great interest in the work, and the authors were requested to give lectures to the directors and chiefs of various concerns, analyzing more especially their particular problems. The metallurgical-chemical industries have been especially interested, and concerns of that kind were making plans to take up such work, when the war broke out, which indefinitely postponed its introduction.

Mining in Venezuela

There was considerable mineral development in 1913. Prospecting for petroleum near Lake Maracaibo was carried on with encouraging results by one American and two English companies. The copper deposits near the Aroa mines, denounced by a new company, were partly developed. The gold deposits near El Callao were worked by new companies, and give promise of adding considerably to the output from that region after the installation of machinery. The iron mines at Imataca increased their shipments in 1913, but were closed at the end of the year on account of the financial troubles of the company.—*Daily Consular Report.*

ARSENIC PRODUCTION of the United States in 1913 was 2513 tons, valued at $159,236. Imports of arsenical compounds were 4701 short tons, worth $410,446, and 99,692 lb. of 'Paris green' and 'London purple,' worth $4431. There is not much profit in the manufacture of white arsenic, smelters saving it on account of the poisonous fume which would be otherwise emitted into the atmosphere.

GOLD AND SILVER BULLION AND ORES exported from Salvador, Central America, in 1913, were valued at $1,479,805, an increase of $83,075 over 1912. The Butters Salvador Mines Co. is the principal operator. Save $100,000 of gold slime, all the bullion went to the United States.

THE PRODUCTION of carnotite-bearing ores in the United States in 1913 was a record, being 2269 short tons, containing 34.8 tons of metallic uranium, and 8.5 grams of metallic radium, worth $1,020,000.

WOLFRAM EXPORTED from the Rosario district, Argentina, to Germany, was 539 tons in 1913, compared with 637 tons in 1912.

FELDSPAR PRODUCTION of Maine in 1913 was 38,248 tons, valued at $347,499.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Laboratory Study of Secondary Enrichment

The Editor:

Sir—An editorial under the above title appeared in the *Press* for September 19. I can find little to support the main contention of the article, that the scientists connected with our great institutions of learning are not capable of investigating the difficult subject of 'secondary enrichment,' and am loath to believe with you that our universities and colleges are employing a set of men so inferior that they are no longer fit to be leaders in scientific research. I find equal difficulty in accepting the other conclusions reached by you. The gist of the editorial, as it appears to me, may be stated as follows: (1) The study of 'secondary enrichment' has become so popular that it has degenerated into a mere scientific fad; (2) the results of this sudden "crescendo of interest" is to "incite many people to join in the chorus of repeating what is old or disproved, or by making statements which are not substantiated by valid evidences or fundamental principles"; (3) college professors are not fitted to investigate the difficult problems, and many contributions concerning this subject from college laboratories are merely "obfuscations of knowledge"; (4) to obtain results, we must employ subsidized scientists furnished with elaborate equipment.

The editorial has to do, I infer, with the chemical study of sulphide enrichment, although the laboratory study includes the microscopical investigation of ores and other phases. The determination as to whether or not there has been a flood of inaccurate and popular writing on this phase of the subject involves a review of the recent literature of the sulphide enrichment. Such a summary and review of the literature for the year 1913 appeared in the January 24, 1914, issue of your periodical. I find here 25 articles listed, of which eight present results of experimental chemical work, and three others contain general discussions of the chemical principles involved. The eight purely chemical contributions include A. D. Brokaw's (University of Chicago) work on the precipitation of gold by manganese salts, H. C. Cooke's (University of Chicago) work on the enrichment of silver ores, F. F. Grout's (University of Minnesota) work on the precipitation of 'secondary' sulphides by alkaline solutions, Palmer and Bastin's (U. S. Geological Survey) study which determined the chemical formulæ according to which certain native metals and sulphides are precipitated from sulphate solutions, A. C. Spencer's (U. S. Geological Survey) important work on chalcocite enrichment, R. G. Wells' (U. S. Geological Survey) note regarding the measurement of currents developed during the solution of sulphides, which may or may not prove to be of importance in regard to sulphide enrichment, and A. R. Whitman's (University of California) article describing his successful experiments in the solution and reprecipitation of pyrite. Of all the articles cited, there is not one which does not contain a contribution to knowledge, and while a few of the theoretical chemical discussions lack accuracy, the contributions of the same are none the less real.

During the present year only two articles of a purely chemical nature have come to my notice. One is by Stuart Croasdale,[1] who described his attempt as a metallurgist to make use of the principles of sulphide precipitation on natural minerals. His results were well worth recording. The second is by J. D. Clarke,[2] who proves the importance of colloidal dispersion and precipitation, and this is one of the important contributions to the chemistry of ore deposition.

In addition to these two contributions, George Nishahara has discussed informally certain chemical points. Surely we are not as yet prohibited from discussing informally a subject of such importance to students of ore deposits, even if we have no formal contribution to make!

In looking over the list of publications on this subject prior to 1913, I find only about fifteen papers which may be considered as formal contributions to the chemistry of the subject founded on experimental work.

I conclude therefore that there has been no flood of literature on the chemistry of sulphide enrichment; that the experimental work which has been reported has been singularly productive of knowledge. What we need is more discussion, more experimental work, and more light. Only that of value will live under the attack of critical and continued discussion.

All will admit that geologists are seldom trained chemists, and the suggestion is a sound one that geologists and chemists should coöperate for the solution of problems in ore genesis. It is absurd to intimate that we do not have chemists, especially physical chemists, in our colleges competent to do this work, or that graduate students and ambitious instructors, working in well equipped chemical laboratories of our universities, are

[1] *The Eng. and Min. Jour.*, April 11, 1914, pp. 745-749.

[2] 'A Chemical Study of the Enrichment of Copper Sulphide Ores,' *Bull.* Univ. of New Mexico, Chemical Series, Vol. I, No. 2, 1914.

not capable to carry on these investigations under the inspiration and direction of the professors of chemistry. Are we incapable of obtaining the results reached in Germany by the coöperation of professor and advanced students?

One difficulty which some geologists have encountered, who have been interested in these problems, has been that there is too little team work between the geological and chemical departments in our universities, and for this reason some of the geologists have been driven to attempt the work within their own departments. Even under these conditions the results obtained have not been without value, and certainly do not deserve to be characterized as "obfuscations of knowledge." Such coöperation is destined, I believe, to solve many of the problems. The geologist must continue the microscopic examination of ores, a study which is only beginning to be taken seriously, to find out what minerals are produced in nature's laboratory and in what sequence they are formed. He must continue to gather field data in order to find out something as to the physical conditions (depths, relation to the weathered zone, etc.) under which the precipitation of a given group of minerals takes place. The more definitely these conditions are formulated, the better the chance for the solution of the problems in the laboratory.

We cannot present all the varied problems of ore deposition to a single small group of scientists and expect a satisfactory solution of them all. Exact data, such as have been furnished by the chemists of the geophysical laboratory at Washington, are of value and to be desired, but all of the problems do not admit of exact solution, and today, for example, we need further simple experimentation to determine the effect of acid, neutral, and alkaline environment on the formation of 'secondary sulphides.'

As an example of the fact that it is impossible for any one investigator to speak the final word in regard to the subject he is investigating, I would call attention to the excellent work done by E. T. Allen[3] and his associates on the sulphides of iron, zinc, cadmium, and mercury. Here is a piece of work done with such care and skill, with every advantage of equipment, that we might expect it to be final. The fact, however, that these sulphides may be dispersed by the action of hydrogen sulphide, and subsequently be precipitated and recrystallized by the loss of hydrogen sulphide, was not recognized by these investigators. This fact opens up again the question as to genesis and temperature of formation of these minerals. It may be noted also that the recognition of the importance of this process of dispersion of sulphides by action of hydrogen sulphide was recognized by a graduate student while working in a college laboratory.

Progress in science is not to be expected by submitting all questions to a single supreme court, and accepting its decisions without verification or discussion. I believe that the paths of research are still open to the earnest student, and can never be preëmpted by a single body of scientists, however accomplished.

C. F. Tolman, Jr.

Stanford University, September 23.

[Such a vigorous protest emanating from Leland Stanford University, where C. F. Tolman, Austin F. Rogers, J. D. Clark, and other workers have made some of the most notable and valuable contributions to the exact knowledge of mineral chemistry reminds us, only in a reverse way, of the minister who preached a vigorous sermon on the sins of his congregation, with the result that after the service the men whom he particularly had in mind congratulated him on his powerful sermon, which they thought should greatly benefit those to whom it applied. It can scarcely be necessary to say that we were not referring to the notable papers which Mr. Tolman has judged worthy of discussion and abstract. Nor is it possible to twist our mild statement that few professors of geology are fitted to perform the painstaking experimental work necessary in investigating such chemical problems, into a statement that "our universities and colleges are employing a set of men so inferior that they are no longer fit to be leaders in scientific research." The college professor is perforce a sort of general practitioner, and if it chances that inclination leads him to become a specialist in some line of investigation it is only under special circumstances and somewhat to the disadvantage of the work he is paid to do, namely to teach classes of students, rather than to devote his mental energies to the direction of one or two graduate students. While agreeing in the main with what Mr. Tolman has to say, it is quite possible to use his own evidence in support of our generalizations. Thus the fact that in 1913 eight papers on the chemical study of secondary enrichment were published, while in all the preceding literature there were but fifteen, apparently indicates that there is a marked crescendo of interest in the subject, and if the tide continues to rise at the indicated rate it would seem not unreasonable to expect a flood. Mr. Tolman's instance of the work done by E. T. Allen at first seems convincing, but the force of it disappears with closer scrutiny. In the same way a well equipped party often makes its way nearly to the summit of a mountain, cutting paths and establishing camps, only to be obliged to turn back before reaching the top. With the aid of these a later expedition can easily attain the summit. It is to be expected that clear headed and keen witted geologists will often be able to utilize the elaborate chemical researches to which we referred for the brilliant solution of geological problems. What the other members of our congregation will meanwhile do must be left in the lap of the gods.—Editor.]

[3] *Am. Jour. Sci.*, Vol. 183, pp. 169-236, Vol. 184, pp. 301-396.

Gold output of British Guiana to August 31 was 37,766 oz., compared with 50,653 oz. in the same term of 1913. The diamond production was 9517 carats worth $86,185, against 4637 carats and $44,419.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

PHOSPHATE DEPOSITS near Georgetown, Idaho, are estimated to contain 2,663,290,000 long tons of rock, according to the U. S. Geological Survey.

ELECTRICITY was first used in Pennsylvania anthracite coal mines in 1887. According to H. M. Warren, in a paper read before the Engineers' Society of Northeastern Pennsylvania, the total electric generating capacity and power purchased for use at the mines is 79,811 kw., or 105,400 hp. Besides this, there is 440,279 hp. produced by steam for direct use. There is 754 miles of trolley wire underground, and 951 electric locomotives, using over 60,000 hp. The other electrically operated equipment consumes 19,170 hp. for breakers and miscellaneous machinery, 23,280 hp. for electric hoists, 38,500 hp. for electrically driven pumps, 2920 hp. for coal-cutting machines, 3650 hp. for lighting, and about 100 hp. for heating. There are now five breakers equipped with individual motor drives, and others are under course of construction.

A PREMATURE EXPLOSION of a charge of powder in a drill-hole at the Nevada Consolidated company's Copper Flat mine occurred on August 4, whereby five men were killed and three seriously injured. The suspected cause was an obstruction in the hole caused by rocks caving in from surrounding walls. To prevent a recurrence of such an accident, a collapsible loading tube has been designed. When the hole is bored the required depth, 50 or 60 ft., and tools are drawn, the tube, of stitched canvas, rubber lined or coated, and six inches diameter when spread open, is lowered the full depth from a reel. The powder is then poured down, after which it is withdrawn. The tube protects the walls of the hole, and prevents rocks from falling in, also from damaging the walls by water when a tamping charge of water is poured in on top of explosives used for springing or chambering the bottom of the hole.

RICH GOLD AND SILVER ORES often contain metallics, which are collected during screening of samples for assay, and should be assayed and calculated separately from the rest of the sample. The following method is recommended by A. M. Smoot, in the *Bulletin* of the Canadian Mining Institute: Metallic scales from samples are assayed separately by the all-fire process, using 1-gram charges, and when the amount of scales is small, as many assays of each sample are made as the amount of scales will permit, but in cases where the amount of scale is large, six 1-20 assay-ton portions are used. In calculating the average assay of fines and scales, a simple method is as follows: From the assay of the scale in ounces per ton, subtract the assay of the fines in ounces per ton, and multiply the difference by the percentage of metallic scale in the sample. The result is addition of scale, that is, the amount to be added to the assay of the pulp to give the total assay of the sample. The derivation of this method is as follows:

If a = percentage of metallic scale

$100 - a$ = percentage of fines

s = assay of scale in ounces per ton

f = assay of fine in ounces per ton

x = average assay of sample in ounces per ton

$x - f$ = addition for scale.

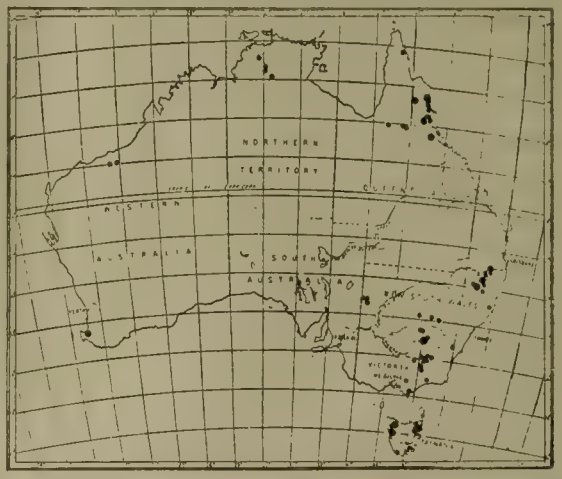
Then $\frac{as}{100} + \frac{(100 - a)\, f}{100} = x$

$as = 100f - af = 100x$

$as - af = 100x - 100f$

$a\,(s - f) = x - f =$ addition for scale.

TIN MINING AND REDUCTION has received little attention from writers. The best known works are 'Tin Deposits,' by Sidney Fawns, and 'Metallurgy of Tin,' by Henry Louis. At the May meeting of the Australasian Institute of Mining Engineers, at Melbourne, Victoria,



MAP OF AUSTRALIA, SHOWING TIN DEPOSITS. TO THE END OF 1912 THE OUTPUT WAS 374,206 TONS, VALUED AT £30,125,571.

'Australian Tin Lodes and Tin Mills' was the subject of a lengthy paper by H. Herman, government geologist for that state. Mr. Herman has personally studied all the deposits and mills in Australia, including Tasmania. The paper was published in the *Proceedings* of the Institute, occupying 125 pages, and may be had bound separately at small cost.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

NEW YORK

F. A. Heinze and Sundry Litigation.—The Pato Dredge's Troubles.—Copper Notes.—European Holdings in American Mining Companies' Shares.

It is hard for any topic to get much space in the newspapers these days in competition with the war news. Nevertheless, the suit of Edward Gould against F. A. Heinze, last week, was the source of a good deal of public interest. The suit was for the recovery of $1,264,449 claimed to be due on account of notes signed by Heinze as part payment in the purchase of 7000 shares of the Mercantile National Bank. The testimony involved various checks given by various people, concealed assets carried on the bank books, and the question of whether Gould had sold the stock to Heinze or to Charles W. Morse. The jury gave Gould a verdict for the full amount. Except through litigation, Heinze is no longer able to attract much attention in the mining field. He has lost control of nearly all his mining properties except the Stewart, and save for areas of land in British Columbia, probably has not very much in the way of assets left out of the $10,000,000 that he is reputed to have brought with him when he came in from the West to show the New York financiers super-modern ways of doing business. Everything with which Heinze is connected seems to be quickly plunged into litigation, and the Ontario Mining Co., and Jonathan Bourne, Jr., have filed suit against the Stewart Mining Co., claiming that it has trespassed on the Ontario and extracted ore to the value of $40,000. The ore-shoot is just on the boundary line between the properties, and there is likely to be more work for the consulting geologists. The earnings of the Stewart in the last half-year were $537,230.

A couple of years ago, one of the Chicago papers, in commenting on the failure of the 'White Socks' baseball team to achieve successive victories, epigrammatically remarked, "There is always some damn thing!" The same remark might be made of the Pato property of the Oroville Dredging Co. There were many difficulties before the dredge arrived on the ground, as is well known, and since that time the boat seems to be under the impression that it is a French submarine, for it has sunk twice. It is reported that it will be more than a month before it can be again raised and repaired so as to resume operation. In a general way, these troubles are rather characteristic of mining operations in distant countries. There are always a great many unexpected difficulties and drawbacks, and it takes a rather rich mine to pay good profits if it is a long distance from the main centres of trade.

The directors of the Amalgamated cut the quarterly dividend to one-third of what it has been, or to 50c. per share. More than a dozen of the big companies have decreased their dividends within the last quarter, and one of the financial journals has figured out that the decreased earnings correspond to a decrease in the book value of the stocks of over $7,000,000. It is quite likely that a further cut in production will have to be made. *The Boston News Bureau* has calculated that copper stocks, which on July 1 were about 106,000,000 lb., have increased to 220,000,000 lb., or the largest surplus on hand for many years. Exports of copper continue at about two-thirds of what they were last year, and the price seems to be barely holding its own, or slowly weakening, so that the best thing that could be done would be for some more of the companies that are not making any profit to shut down until consumption can catch up to the stocks of copper. There are a great many mines which, if working at their full capacity, would make a profit on their present prices, but which on the present basis of half capacity, must be making little or no money, and it would be better for such mines to shut down now rather than to keep going for a while, with the result that not only they, but other companies, may be eventually compelled to shut down.

One of the interesting points raised by the war is the amount of stocks that will probably be thrown back on this country when the exchanges resume regular business. After the war is over, the European countries will have large war debts; they will naturally attempt to place these with their own people, and the natural supposition is that shareholdings in American corporations will be liquidated in order to place the money in war bonds that will probably have preferential treatment. *The Wall Street Journal* has been carrying on investigation of the amounts of stock held in Europe of several American corporations. Of the mining companies reported, European holdings are surprisingly small. Of the more than 7,000,000 shares of Inspiration Consolidated Copper Co., less than 1000 shares are held in Europe, and of the Greene Cananea Copper Co., Europe holds less than $55,000 out of $48,614,700. Of the Batopilas Mining Co., less than 6000 shares out of 446,599 outstanding are held in Europe, while of the Horn Silver Mining Co., less than 70,000 out of a total of 400,000 are held there. If the same ratio holds true for most of the other mining corporations, it does not seem probable that the mining-share market will be heavily affected by European selling after the war is over.

WASHINGTON, D. C.

No More Mining Legislation this Session.—Assessment Work Bill Failed to Pass.—Mining Representative for Trades Commission.

The adjournment of Congress now seems in sight, but there is to be no further mining legislation, not even on the proposal to enact a commission to codify the mining laws, which has been asked for by mining men. This is to be held over for the next session, when action seems sure. Congress will then be more liberal on appropriations, extravagant though it has already been, as charged. Other mining legislation is also hoped for then.

An attempt was made this week to procure action on the bills in Congress giving authority temporarily to suspend the requirement of $100 labor on all mining claims, but Congress was not very enthusiastic over the proposal as a help in the emergencies occasioned by the European war. Senator Shafroth has been busiest on this score in behalf of radium mining, and he was ready to make an appeal before the Committee on Mines and Mining of the Senate, but a quorum of the committee did not develop, and so the matter was off.

Franklin K. Lane, Secretary of the Department of the Interior, has taken a positive stand against the suspension bill. He has written a letter on the question to Congressman Foster, chairman of the House mining committee, in which he says: "I have made an investigation and found strong protest against the adoption of the policy, because many miners had already done their work, and the passage of such a bill would

be in the nature of a preference to those who had waited until the last of the year to comply with the provisions of the law. I found also that many men in mining states expected during the fall and winter to do this assessment work for others, and that the postponement of it would be in effect the shutting down of an industry." The Secretary said he had been informed that none wanted suspension work in Alaska. It is thought that this opposition will suffice to kill the bill.

The President is determined to appoint the Trades Commission in December, and he is now 'weighing' names, so that if the mining world is desirous of being represented on the Commission, it behooves it to become active. However, care should be taken here, as the President is easily offended by any 'booming' for any man. Such efforts would be fatal to the chances of any such candidate. It is better to conduct a canvass in a quiet way, by indirection. Forward in the mention for a place on this most important commission is that of James F. Callbreath, secretary of the American Mining Congress. Others proposed are E. W. Parker and Hennen Jennings.

SILVER CITY, NEW MEXICO

PHELPS, DODGE & CO. PROFIT-SHARING PLAN.—CHINO PRODUCTION.—PINOS ALTOS HIGH-GRADE ORE.—OPERATIONS IN SIERRA COUNTY.—MOLYBDENITE SHIPMENTS FROM LAS VEGAS.

The Burro Mountain Copper Co., operating the 'porphyry' copper mines at Tyrone, has started a 'profit-sharing plan' among the patrons of the Phelps-Dodge store, who are also employees of the Company, that is attracting considerable attention. The system is also in vogue at the firm's Arizona properties. The Company will share with the employees who have been in continuous employ for three months or more, the net profit accruing from sale of merchandise to them.

FIFTY-TON EXPERIMENTAL MILL AT THE BURRO MOUNTAIN MINE, TYRONE.

The extent to which employees of the Burro Mountain company will participate in this net profit, will be equivalent to 5% on their purchases of merchandise, not including wines and liquors. The year will be divided into quarterly periods to expedite the disbursal of the dividends. The new arrangement went into effect on October 1. It is an endeavor to relieve present unusual conditions, owing to readjustment of wages made necessary because of the state of the copper business, and will continue in effect as long as, in the opinion of the directors of the Company, it is advisable. There is a large force of men employed at the experimental mill of the Burro Mountain mine, and a crew at work breaking down ore for experimental work and sampling the Chemung dumps. Three churn-drills are at work prospecting new ground, and the installation of Diesel engines is under way at the new power plant. Practically all the development work of the Company was stopped at the beginning of the European crisis. This leaves about 300 men at Tyrone and Leopold, at which places Phelps, Dodge & Co. has stores.

The Chino Copper Co. is operating one steam-shovel and two locomotives at its mines at Santa Rita, as a night shift, and it is believed more additions to this shift will be made soon. The day shift is employed six days out of the week. The Chino production of copper for August was 3,045,015 pounds.

The C. & O. Mining & Milling Co., at Pinos Altos, continues to mine high-grade gold ore from the Langston vein. According to the management an ore-shoot from 1 to 2 ft. wide has been opened at a depth of 200 ft., on the incline. Ore occurs as a true fissure filling, with a granite foot-wall and a diorite hanging wall. The rich ore does not occur in pockets, as many think, but is continuous. It is sent to Silver City banks and will later go to some refinery. Ore is carefully sorted and lower grade is shipped to the Douglas, Arizona, smelter, bringing returns of from $22,000 to $24,000 per car. The ore is the richest in appearance ever taken from the famous Pinos Altos district, and is attracting great attention. Several arrests have been made for alleged high-grading. Cases will go before the grand jury in Silver City next February. In the same area, but at the extreme north end, J. T. Janes and associates have opened high-grade silver and copper ore in the Hardscrabble mine, on which a lease and bond is held. Ore assays 30% copper and 56 oz. silver per ton. A large amount of development work had been performed prior to this discovery. The vein is in soft ground and considerable timbering is necessary. Ore shipments will be made soon. George Brown, lessee of the Manhattan mine, is shipping pyrite containing good gold content. Pinos Altos in general is very active.

Las Animas Peaks Gold Mines Co., with main offices in Dallas, Texas, has taken over the group of seven claims near Hillsboro, Sierra county, formerly owned by the Hillsboro Consolidated Mines Co. It is the intention of the Company to begin systematic operations as soon as the disturbed financial condition is better. The Hillsboro, Lake Valley, and Kingston areas still present many opportunities to men with the brains and means to make profitable mines.

Margarito Romero, operator of the molybdenum mines and mill near Las Vegas, San Miguel county, has received an order for one ton of molybdenite delivered in Philadelphia. There is a great demand for this mineral from New Mexico.

The Silver Queen mine at Red River, Taos county, is shipping ore to a mill. Tables for concentration are being installed. The product will be shipped to Pueblo, Colorado, smelters. Road improvement up Bitter creek is under way.

LONDON

THE DETINNING INDUSTRY OF ENGLAND, A GERMAN PLANT IN LONDON AND THE PROCESS USED.

In recent letters I have referred to the effect of the war on the lead, zinc, and tin industries of Great Britain, and told how the previously smooth metallurgical relations between this country and the Continent have been upset. An equally interesting case, though of relatively less importance, is presented by the position of the detinning industry in the east end of London, controlled by the Goldschmidts of Essen. We are fond, politically, of talking about the 'German lie factories,' but I am sorry to say that perversions of the truth are not unknown in London. A rumor was spread freely in the city to the effect that the London Electron Works Co., which is a Goldschmidt subsidiary, had been closed on the outbreak of the war, the staff returning to Germany, leaving

a truculent German of anti-English sentiments, though naturalized here, as a sort of garrison to protect the works against a supposed attack organized by rivals or others desirous of capturing the business. Some doubt being cast on this story, I determined to go down and make inquiries. In view of the statement about truculent defenders, I was not quite sure of the nature of my reception; so as I walked from Commercial road to Limehouse basin I roused my courage by singing 'It's a long way to Tipperary.' I found, however, that the works were in full blast, and that those in authority, though of foreign birth, were charming men, as scientists and metallurgists should be, whatever their nationality. I ascertained that the only grain of truth in the rumor was that on the outbreak of the war, operations had to be suspended because the product of the works could not be shipped to Essen. In a fortnight or so the managers were able to modify the process and find an outlet for the products in Great Britain, so a resumption was possible after only a short interval. As the nature of this business is little known, it will be of interest to your readers if I say something of it. The London Electron company was started a dozen years ago to work E. M. Kardos' process whereby tin cans collected by the municipal dustmen, and also accumulated by the wholesale confectioners and sweetmeat manufacturers, were submitted first to cleansing operations for the removal of the clinging animal and vegetable matter; second to a baling process, whereby they were compressed into briquettes; third, to the action of heat to remove solder, paper, varnish, paint, or rubber; and lastly, to electrolysis in a caustic-soda solution, whereby the tin was precipitated in pulverulent form. The Goldschmidts subsequently secured control, and for the last three years no stripping has been done here, but the briquettes have been sent direct to Essen, where the tin was recovered by the dry chlorine process, and the remaining iron sold to the steel makers. On the stoppage of shipments to Germany, it was decided to modify the heating furnace in such a way that the tin would be melted after the removal of the solder, and the metal thus obtained in a form suitable for sale to English tin-smelting firms. The amount of tin remaining on the briquettes is not very large, and British steel makers do not object to its presence in the briquettes. So the business of the firm continued, though naturally only in makeshift manner. It is well known that the recovery of tin from clean scrap produced during the construction of cans and other ware from tin-plates has been conducted for many years in England, on the Continent, and in America. But the recovery of tin from discarded cans presents a different problem. The removal of fat, grease, syrup, varnish, and paper involves the use of a plant of large capacity, consumption of considerable chemical solution, and a great deal of heat. The cost of collecting and transporting bulky material constitutes in itself an economic problem of importance. In a populous centre such as London, it is possible to make contracts with big hotels, and wholesale manufacturers of articles of food, but for the collection of waste tins rejected by the householder recourse must be had to the municipal dust-collector. In spite of these disadvantageous conditions, the Goldschmidts' detinning works in Germany, France, and Limehouse have been profitable. Before the war, arrangements had been made, I believe, to establish two similar enterprises in the United States, but these schemes will probably be abandoned. As far as I am aware, no one has ever used chlorine as the agent for removing the tin except the Goldschmidts. The caustic-soda process has been employed by many inventors who have obtained patents for variants of the electrolytic bath. One notable enterprise founded on this principle is the Vulcan Detinning Co., in America, which by winning a patent suit two years ago, forced the American Can Co. to close its detinning works. I ought to add that, according to the Goldschmidt process, the tin is recovered as tetrachloride, a chemical in request among silk manufacturers for giving a body or weight to the silk. In this form the tin brings a far higher price than if sold as impure metal or as oxide. The tin produced by the caustic-soda process has a property similar to that of zinc dust, of oxidizing directly it is heated, and it has to be remelted. Unfortunately, the silk industry of England is of too small proportion to be of use as an outlet for tetrachloride. No doubt a more profitable method of treating the scrap will be evolved, that will recover more tin and in a more valuable form.

JOPLIN, MISSOURI

PICHER LEAD CO.'S EXTENSIVE PROSPECTING IN THE MIAMI FIELD. —NEW ZINC AND LEAD AREAS.—NEW MILL AT ALBA.

The most extensive prospecting campaign started by any company in the Missouri-Kansas-Oklahoma district in recent years is that under way by the Picher Lead Co., which is operating several churn-drills in the north Miami, Oklahoma, district. While this work has been going on for almost a year, the Company has been reticent about giving any information regarding the nature of its ore discoveries. Recently it has been announced that extensive deposits of ore have been cut at considerable depth in many holes, and it is likely the Company will begin active mining development soon. The region in which the prospecting has been conducted is developing into the greatest lead-producing area in the entire Missouri-Kansas-Oklahoma district, other companies on nearby tracts having opened deposits of high-grade galena. The Picher Lead Co. is a heavy consumer of galena concentrate, and will doubtless utilize the greater portion, if not all, of its production of lead ore, while the zinc-blende which is associated with the galena can be sold to the various smelting concerns purchasing concentrate in this district. Recently the Picher Lead Co. has added a third sublimed white-lead unit to its plant at Joplin, and made other extensive improvements, costing, in the aggregate, more than $100,000.

A discovery of lead ore in an isolated region, northwest of Miami, is reported by Samuel Moss, owning land two miles west of the Neosho river, and 2½ miles west of the nearest producing mine, the McConnell & Barnes No. 2, which, in itself, is quite distantly removed from the other mines of the Miami field. The drill-hole on the Moss land is reported to have penetrated galena at a depth of 70 ft. and continued in ore down to 120 ft. This is the first discovery of importance made west of the river, although some 'shines' were found in previous drilling on land several miles south of the new area.——Thomas F. Coyne, considered one of the luckiest operators of the entire district, has opened a shallow bonanza of lead and zinc on a lease of the Missouri Zinc Fields land, southeast of Webb City. He cut the ore in the only strip of land in that vicinity that had not already been extensively mined. All around his new mine are old producers, the drifts of which had failed to penetrate the rich orebody just opened by Mr. Coyne. The ore occurs at a depth of 30 ft., and continues down to 75 ft. The ore yields 10% lead and zinc when treated by a nearby custom mill.——Mining activities will probably be resumed soon at the property of the Amalgamated Lead & Zinc Co., operating on the Granby Mining & Smelting Co.'s land in the northwest part of Joplin. For some time this mine, one of the former big producers of the Joplin district, has been idle while drill prospecting has been conducted some distance from the old workings and in virgin ground. An unusually good blanket formation of zinc and lead ore is reported in several holes at a depth of 114 to 120 ft.——The Granby Mining & Smelting Co., in drilling on practically virgin land in the Leadville Hollow region northwest of Joplin, has cut lead and zinc ore at a depth of 120 to 138 ft., and will sink a shaft on this prospect in the near future. It is only recently that the Granby company has essayed to mine, its previous function having been that of a leasing company only. Some

time ago this Company opened the B & H mine in northwest Joplin, constructed a large concentrating plant, and is now producing steadily from this property. The scene of the new find is in a region mined only to a very shallow depth in the past.

A new concentrating plant of 200-ton daily capacity has just been started by C. H. Britt, Charles H. La Pierre, W. T. Landrum, and J. McWilliams, on the Sunflower land at Alba. The plant was remodeled from the old Brown mill, and all equipment is new. Two trams, each 300 ft. long, connect the company's shafts with the mill, which is equipped with a large hopper capable of holding 500 cans.

DEADWOOD, SOUTH DAKOTA

WORK AT THE MONARCH, ORO HONDO, HEIDELBERG, BUNKER HILL, AND OTHER MINES.

Hanson & Sweet, who are leasing on the Monarch property, near the head of Two Bit gulch, have made their initial shipment of ore to the Omaha smelter. Its value was about $50 per ton in gold. These men were fortunate enough to secure a lease on a portion of the Monarch property which had been idle for upward of 30 years. In the old wagon road leading to the adit from which they are taking ore, were 'jack pine' trees, in the trunks of which were counted 30 rings, each of which indicated a year's growth. The shoot is holding out well, and the lessees hope to maintain regular shipments during the life of their lease, which is for two years. In the same neighborhood, R. I. Zipp has opened a shoot of similar character, which, however, is not quite rich enough to ship. It assays $15 per ton, of which $9 is free gold. None of the custom mills in the Black Hills is equipped to save this gold, so Mr. Zipp has his ore on hand and is meanwhile endeavoring to develop enough to warrant the construction of a mill.

Now that the superintendent, Mr. Talbert, at the Oro Hondo, has things in good order, continuous progress in sinking is anticipated. During September, which was the first full month under his superintendency, the shaft was deepened 75 ft. The best week's run was 19 ft., made the last week in the month. Mr. Talbert hopes to make 100 ft. per month, or better, when he gets things thoroughly organized. Hoisting from the bottom to the 1000-ft. level is done with an auxiliary engine placed on the latter level. The shaft is now 1200 ft. deep.

At the Heidelberg, the shaft following the ore from the main adit-level has reached a depth of 35 ft., giving assays from as wide an orebody as on the main level. Sinking is being done with a windlass.

The New Reliance company was unfortunate enough to lose the hoist-house at the Bunker Hill mine as the result of a forest fire, and thus an important source of ore supply was cut off. Other parts of the property are being drawn upon to keep the mill busy while the damage is being repaired.

An assessment of 2c. per share has been levied by the Custer Peak Milling & Ore Co., with the proceeds of which work will be resumed in the shaft. The shaft is now 250 ft. deep, with several hundred feet of laterals, the whole exposing a good quantity and grade of copper ore. At the Jungle property, adjoining, work on construction of a copper leaching plant has been suspended on account of the low price of copper.

Rebsamen & Burns, who are developing their Harrison property, at the head of Blacktail gulch, are developing an orebody which promises to be profitable. Assays show a gold content of $6, $8, and $10, in a body of fair size. The shoot lies nearly horizontal, and is reached through an adit, so that it can be cheaply mined.

Robert Mulford, who recently visited the Black Hills to investigate mining possibilities, and particularly the Golden West and other properties near Rochford, was highly pleased with the results he secured, and is expected to stand sponsor for large operations which will likely commence in the near future. Mr Mulford, like a number of other large operators who have visited the Hills in the past year or so, was looking for a promising orebody assaying $2 or $3 gold per ton. Since the exploitation of the big deposits at Juneau, Alaska, engineers have been searching for similar opportunities, and it is thought that they will find them in the Black Hills. The Homestake is one of the world's largest known bodies of gold ore, and it is not reasonable to presume that it is the only deposit of its kind in the Black Hills.

The Mogul company has leased the Clinton property, on lower Nevada gulch, from the owner, Charles Thompson, of Whitewood. The property is stated to contain an immense deposit of quartzite, which can readily be cyanided. An air-compressor, drills, and other equipment are being installed, and mining will be done by sub-lessees. It will be a round-about journey for the ore from this property to the mill, as it will be necessary to load it in narrow-gage cars, haul it to Englewood, transfer to standard-gage cars, and transport to the mill. The railroad has made a rate of 65c. per ton on the handling of the product.

HOUGHTON, MICHIGAN

TAMARACK REGRINDING MILL.—SUSPENSION OF WORK AT PROMISING PROPERTIES.—MINE ACCIDENTS.

In the midst of general curtailment and reduced wages, it is interesting to note that the work on the new regrinding mill for the Tamarack sand on Torch lake is still progressing. A contract to construct a spur from the Mineral Range line to the plant has been awarded to a Houghton firm. This work will be rushed, and the immediate installment of equipment will be possible.

Every now and then the suspension of mining operations at some property is announced. There are several in the copper country which have been in the exploration and development stage for so many years that they are considered mines by the people of the district. On September 1, work was stopped at the Wyandot. Reorganization of the company will be necessary before further work can be undertaken. In most cases these forced suspensions have come at times when the properties had reached the most hopeful stage of development. For that reason these shut-downs seem most unfortunate.

The report of the Houghton County mine inspector shows a total of 29 casualties for the year ended September 30, 1914. This county includes, besides numerous claims being developed, the mines of the Calumet & Hecla, Copper Range Consolidated, Quincy, Winona, Superior, Isle Royale, Hancock, Franklin, Kearsarge, and Centennial. The largest number of casualties was four at the Baltic. The reports of the inspector since 1888 to date show that the highest percentage of accidents was in 1895, when, with 7249 men employed, there were 44 fatalities. During this year, however, 30 men were suffocated at the Osceola. The percentage for 1914 is 0.0022 with 12,954 men employed. The only year which shows a better percentage is 1899, when with 13,057 men employed, 27 accidents occurred, giving a percentage of 0.0021. The report of the mine inspector of Keweenaw county shows four mine fatalities during the past year.

The entire North Webb City sheet-ground district is threatened with a shut-down on account of a misunderstanding regarding pumping expenses at the Providence mine. Heretofore this expense has been divided among the various operators of this area who have been benefited by the pumps of the Providence company. If these pumps are stopped, other companies must start individual pumps or be flooded. The latter seems to be the probable result, in view of the low prices for zinc ore that are now prevailing.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

The Iditarod-Ruby region is described by Henry M. Eakin in *Bulletin* 578 of the U. S. Geological Survey, and is replete with three large maps. Under exceptionally difficult conditions, Mr. Eakin made this investigation late in the summer of 1913. The topography of the region is diversified by broad lowlands of less than 500 ft., rolling uplands of 1000 to 2000 ft., and local mountain groups of up to 4500 ft. elevation. The area is drained by the Yukon and Kuskokwim river systems. There is not much rainfall, never above 20 in. per year. Winter lasts from October to April. Mining may be done during about 120 days. Violent storms are comparatively rare. The timber-line, the maximum elevation at which trees grow in the Iditarod-Ruby region, is about 2000 ft. above sea-level. The general distribution is shown on the cut accompanying these notes. There are plenty of fish in the rivers, and only small game is plentiful. There are about 1600 people in the Iditarod, 150 in the Innoko, and 1000 in the Ruby district. Steamboat service is maintained on the rivers in the season. Mail service continues all the year round to most of the centres, and there is wireless and telephone service available in many places. Labor is plentiful, and receives from $5 to $6 per day, with board. Fuel used is wood, costing from $6 to $15 per cord. Rough and dressed lumber at Ruby costs $50 and $80 per 1000 ft., respectively. After describing the geology of the area, Mr. Eakin discusses the veins and mineralization. Quartz veins are common in the Cretaceous sedimentary rocks of the Iditarod district, are generally gold bearing, but have not yet proved to be worth mining. Quartz veins cut the rocks in the Innoko district, and are common in acidic dikes that intrude the sedimentary rocks. They occur mostly as close stockworks. The Independence mine, on Carter creek, has a vein 2 ft. wide, which has been opened to 90 ft. In the Ruby area, quartz veins are a common feature of the metamorphic rocks. The veins in these districts probably supplied the gold for the placer accumulations. Practically all of the work done in the Iditarod-Ruby region has been in placer mining, which is fully described in the work. The Yukon Gold Co. has a large dredge working in the Iditarod district, on Flat creek. The 1913 gold output of the Iditarod, Innoko, and Ruby districts was about $1,860,000, $280,000, and $850,000, respectively.

MAP OF IDITAROD-RUBY DISTRICT. SHADED PORTIONS SHOW TIMBERED AREAS. BETHEL, FROM WHICH CORRESPONDENCE IS PRINTED ON THIS PAGE, IS IN THE EXTREME LEFT BOTTOM CORNER.

A gold nugget worth $1900 was found on Long creek by Xavier Ditz and associates about the middle of September. Two others, worth $300 and $400, were also unearthed recently.

Bethel

(Special Correspondence.)—From the recent development work on Bear creek, a tributary to Tuluksak river, and on other points on Kuskokwim, the fact seems established that this will be one of the large gold-producing rivers.

R. S. Eskridge, a prominent and enterprising mining man from Louisiana, brought in a No. 5 Keystone drill this spring for prospecting a group of claims which he bought last summer, and some which he holds under option, with the intention of putting in a dredge. It is reported that he has proved a pay-streak 300 ft. wide and is not through it yet. Part of this averages $5 per cu. yd., and $2,000,000 is in sight. Mr. Eskridge has sent out orders for a dredge to be shipped in next spring.

Brice & Hamachmen have started to work on their group of claims. They have ground that yields $1 per sq. ft., and promises even more. They are putting on all the men they can get at $10 per day with board. There are a number of others who work their claims, and some of these have ground that yields, when shoveled into boxes, $100 per man.

A report came from Candle creek that 35 men are at work and have taken out 2200 oz. This creek is a tributary to Kuskokwim river, and empties into the Kuskokwim a few miles below Takutna from the right limit.

The U. S. Geological Survey steamer *Yukon*, with Richard R. Lukens in command, called in at Bethel. Mr. Lukens said that Kuskokwim bay and river is one of the best to navigate on the Alaskan coast, and ships drawing 15 ft. of water can easily come up to Bethel, and that the main or Eek channel, through the flats, is well defined, which can be easily seen on the excellent chart made by the Survey. Mr. Lukens is a man of ability, and his quick and active work is greatly appreciated by the reputable citizens of this country. This work, in connection with A. G. Maddren's work on the Geological Survey, will undoubtedly open one of the most promising mining areas of Alaska, which can be seen from the above report of the recently developed mines on the Kuskokwim.

Bethel, August 27.

Fairbanks

Owing to cold weather in the second week of September, operators on Cleary creek were forced to shut down. An agricultural fair was held in Fairbanks during the month, and excellent vegetables of all kinds were displayed. There were also samples of quartz, some of which were high grade.

Juneau

A 12-page illustrated pamphlet has recently been issued by the Alaska Gold Mines Co., from which the following extracts are taken:

Altogether 22,137 ft. of development work was done during 1913, and about 20,000 ft. during the first eight months of 1914, or a total of over 42,000 ft. since the beginning of most active mine development, about the first of 1913. This total does not include several thousand feet of diamond-drill work, which has been done to prove the thickness and value of orebodies, which method of development, where applicable, is much cheaper than cross-cutting in the regular way.

The mill of 6000-ton daily capacity is nearing completion, and the first unit, having a daily capacity of 1500 tons, will be in regular operation by or before the end of December this year. According to present schedule, it is thought that the remaining three units of the plant will be completed at intervals of a few weeks, so that the total plant is expected to be operating at its full rated capacity of 6000 tons per day by or about the middle of 1915. It is necessary to say that as a result of improvements and simplification of the metallurgical processes to be applied to the treatment of these ores, which have been devised since the original designs of the milling plant now under construction were completed, it is estimated that this plant will have an economical capacity of about 8000 tons per day, instead of 6000 tons as originally contemplated, and that by the installation of a comparatively small amount of additional machinery, it may be brought up to a capacity of 10,000 tons per day without extension of buildings.

The construction of a water-power plant, and system of distribution to provide a minimum of 6000 hp., and a maximum of 8000 hp., is practically completed. The principal feature of this development was the construction of a concrete dam 700 ft. long on its crest and 165 ft. high, to create a reservoir. This dam has been finished, and on September 1 the water had already risen 62 feet.

Those in control of and interested in this Company may, therefore, look forward to operations within a few years' time at the rate of 7,000,000 tons per annum, at a profit, on normal grade ores, of at least 75c. per ton, yielding an annual profit of approximately $5,000,000.

Nelchina

According to L. F. Shaw, commissioner at the Nelchina camp, there are only 30 men there at present, most of the men who rushed there last winter and spring having gone to other districts. Several promising prospects have been found. A shaft on Crooked creek is down 190 ft., without reaching bedrock.

Nome

The last steamer for Nome for the season, the *Victoria*, left Seattle on October 18. On the Kougarok river, the Bering Dredge Co. has been hydraulicking, which was expensive work, so a 2½-cu. ft. Union Construction Co. dredge will be erected next spring. J. F. Mathews is general agent. Five inches of snow fell at Candle on September 29. *The Nome Weekly Nugget* is publishing a mining and dredging booklet dealing with the district.

ARIZONA

Cochise County

(Special Correspondence.)—The George H. Crosby Mining Co., of Bisbee, has applied at Phoenix for 40 claims in the California district. This was done to enable publication notices and assessment work being done by 1915.

Bisbee, October 12.

The vein in the Commonwealth mine at Pearce was cut on No. 8 level last week, picked samples assaying $11 per ton. As further driving was expected before cutting the two shoots, the development is encouraging.

Gila County

Good progress is being made with the 300-ft. stack at the International smelter at Miami. The contractors, Taft & Short Bros., of Chicago, in one day recently, drove 1,200 rivets besides putting up 22½ ft. of regular course work, with two gangs of eight men each.

Graham County

(Special Correspondence.)—In the Clark district, T. D. Morris has three shifts of miners working in the Gold Cord mine. Ore from the 200-ft. level is to be sent to the mill early in November. These claims contain gold, silver, and copper, and are said to be a valuable group.

Pima, October 12.

Greenlee County

Directors of the Arizona Copper Co. from Scotland have been visiting the mines and smelter. Some sales of copper are being made by the Company, and the directors stated that there is no intention, at present, of shutting down.

Pinal County

(Special Correspondence.)—Driving is being continued on the 500-ft. level of the Kelvin-Sultana mine, at Superior, with good results. Lessees recently sent a car of carbonate ore, assaying 15% copper, to the Hayden smelter. The new mill is nearly finished, the last load across the Gila river being a 6-ft. Hardinge mill. Rain has done a good deal of damage to dumps and old workings.

Superior, October 12.

Yavapai County

The second annual Northern Arizona Fair was held at Prescott last week. Besides the machinery display of the Arizona Mine Supply Co., and powder by the Hercules Powder Co., Mohave and Yavapai County minerals were well represented. The former is mostly a gold producer, with some lead and zinc. The latter county is mainly a copper producer, and the United Verde and Humboldt smelters sent fine exhibits of ores and products. The Crown King, War Eagle-Gladiator, Wildflower, Tiger, Lincoln, Savoy, and others showed samples of copper and silver-gold ores from the Bradshaw mountains. Many other districts displayed their ores.

The United Verde Extension company has published a circular in which it states that about 6000 ft. of underground work has been done since James S. Douglas assumed the management two years ago. Only recently was anything valuable opened. The Edith shaft is down to the 1200-ft. level. Cash and bills receivable amount to $8571.

CALIFORNIA

Amador County

The orebody recently cut at 2600 ft. in the Keystone mine is developing satisfactorily.——Two rope drums from the Zeila mine at Jackson have been purchased for the Keystone hoist.

Glenn County

It is said that New York people are expected soon to inspect the old chrome mine near Newville, which is being opened by Willows men.

Plumas County

At the Rose Quartz mine, Onion valley, near Quincy, the adit is in 225 ft., and in a 30-ft. shaft at the end of the adit 3½ ft. of rich ore has been cut.

Shasta County

The electric smelter at Heroult has been short of manganese ore, as the supply from the mine in Glenn county was exhausted. A mine in Mendocino county is being developed. The reported discovery of manganese ore across the river from the smelter was not up to expectations.——Prospecting is being done below No. 5 adit of the American mine at French Gulch. This mine adjoins the Gladstone.——The Milkmaid company is prospecting the Franklin with a diamond-drill.

H. F. Musser is manager.——The Shasta County Farmers' Protective Association has obtained an order from the United States district court for the Mammoth Copper Mining Co. to show cause on October 26 why the permission to operate its smelter at Kennett should not be revoked, and pay certain costs to the Association. The general manager, G. W. Metcalfe, stated that he was not surprised at the action. The output of copper in September was 800,000 lb.——The Coram station of the Southern Pacific has been closed.

On account of the abundance of water for development of electric power, and the large deposits of limestone in this county, Boston capitalists, represented by Charles G. Carter, have secured an area of land near Heroult containing limestone. It is proposed to manufacture calcium nitrate, the first unit of a plant to have a capacity of 100,000 tons per annum, costing about $300,000.

SIERRA COUNTY

The Bald Mountain mine is to be developed by W. Copeland, who has it under bond and lease. Buildings and plant are to be erected.——The Oxford quartz mine is being sampled by Salt Lake City people.——A Keystone drill has been working during the summer at the Lost River gravel claims. Ten holes sunk to bedrock average 155 ft. each. Gold-bearing gravel was found in four holes. An adit will be driven to open the channel.

TEHAMA COUNTY

The Ash Creek Mining Co., composed of Red Bluff people, is erecting a 5-stamp mill and other plant.

COLORADO

LAKE COUNTY (LEADVILLE)

The mining situation in this district is quite encouraging. ——The zinc smelter is again in full blast.——The Penn properties on Breece hill are to be reopened by Joseph Lanphier. ——The Big Four shaft is to be sunk 350 ft. from its present

THE SMELTERS AND MOUNT MASSIVE, LEADVILLE.

depth of 768 ft., and the Company is steadily shipping rich gold ore.——During September, the D. & R. G. railroad moved 895 cars of ore from the district, not including that to the Arkansas Valley plant.

OURAY COUNTY

A new furnace is being erected at the Wanakak smelter, while the plant is receiving a good deal of ore for treatment. Ten more stamps have been added to the existing ten. A high-tension power-line has been constructed to the mine.—— Lessees at the Pink Rose mine, near the Camp Bird, have 8 ft. of $20 ore opened.

PARK COUNTY

The Tomboy company of Telluride, San Miguel county, has started extensive work in the south Mosquito district. Sixty men are employed, and prospects are favorable.

SAN JUAN COUNTY

Shipments of crude ore and concentrate from Silverton in September were 308 and 2310 tons, respectively.

TELLER COUNTY (CRIPPLE CREEK)

During August, Stratton's Independence reports that the production was 3630 tons of ore averaging $5.32 per ton; low-grade mine and dump ore milled totaled 11,870 tons; working profit from milling department, $8940; loss on mine department, $3530; and net profit to Company, $5410.——Lessees at the Isabella Mines property have opened 7 ft. of 4-oz. ore, 12 in. of which is worth $2300 per ton.——Lessees in the Hiawatha mine, on Beacon hill, have opened about $20 ore at the 100-ft. level.——Lessees on the El Paso estate have found $74 ore in an 80-ft. winze.——Last week the El Oro mine shipped 1200 tons of $12 ore. The vein is 32 ft. wide and 110 ft. long.——The Cripple Creek Cyanide & Mining Co. has been formed, with Howard Schultz as secretary, and a custom mill is to be erected.——A vein 20 ft. wide, assaying $18 to $20 per ton, has been cut at 300 ft. in the Abe Lincoln by C. Porter, a sub-lessee. Development at 400, 500, and 800 ft. is extremely encouraging.——Water from the Roosevelt drainage tunnel amounts to 10,000 gal. per minute.——The Blue Flag shaft is now down 1100 ft.——The Miller lease at the El Paso is producing $31 to $33 ore from a 4-ft. vein.—— The Mary McKinney dividend has been passed.——On October 20 the Portland company paid its quarterly dividend.

IDAHO

BLAINE COUNTY

The new mill at the Nau Aug mine, 12 miles from Hailey, will be ready for work on November 1. It consists of a crusher, rolls, and concentrating tables for silver-lead ore. K. C. Wooley is in charge.

SHOSHONE COUNTY

The Caledonia Mining Co. has distributed 1c. per share, or $26,050, to its shareholders. This will be done each month. It is the first since the recent settlement of litigation with the Bunker Hill & Sullivan company.——The Interstate-Callahan produced 3493 tons of high-grade zinc concentrate in September. The winze from No. 4 adit is down 225 ft., in ore all the way.——Net earnings of the Stewart company were $75,000 in September, against $82,000 in August.

MICHIGAN

HOUGHTON COUNTY

(Special Correspondence.)—Why only two mines in the Michigan copper district, the Mohawk and the Wolverine, are operating full time, is explained by the fact that practically all of the normal production of these mines is sold to American consumers. The mines which produce copper for foreign markets must either reduce the scale of operations or, better, find domestic consumers: There may be relief for them in the large and growing automobile industry at Detroit. Large shipments have been made by the lake routes, and it is interesting to note that rail shipments are being called for.——At the Quincy, 'rock' is being hoisted from three shafts at full capacity.——With the men working half time, the output of the Baltic, Champion, and Tri-mountain mines is 60% of normal.

Houghton, October 15.

MONTANA

The Montana Power Co., including all subsidiary companies, reports for the quarter ended September 30, and the nine months ending that date, as follows:

	Quarter.	9 months.
Gross earnings	$908,864	$2,812,766
Operating expenses and taxes	281,525	839,667
Net earnings	627,339	1,973,099
Interest accrued	226,607	719,216
Surplus	400,732	1,253,883

FERGUS COUNTY

The Barnes-King Development Co. has issued a statement concerning its Piegan-Gloster mine, near Marysville. It says

that the original Gloster mill worked in 1880 to 1885, had 60 stamps, plates, pans, and settlers, recovery being by amalgamation only. Nearly all of this equipment was sold in the latter year. The present Company found the building in good condition, and new machinery now being installed includes a gyratory crusher, three Chilean mills, concentrating tables, classifiers, and cyanide plant. A 2500-ft. surface tram formerly brought ore to the mill from the mine, but now a 1700-ft. aerial tram will convey it from the Norman adit, which is being driven to develop the Ophir and Pegan claims. The new mill, of 100-ton capacity, should be ready early in 1915. If the Montana Power Co. cannot supply current by then, the boilers and engines left by the old company will be used for the time. The old Gloster five-compartment shaft is being overhauled.

SILVERBOW COUNTY

Owing to an accident to the Black Rock shaft of the Butte & Superior, the mine and mill are temporarily closed. This shaft has been in bad order for some time, and 300 ft. will be retimbered. Only 150 out of the 1150 men employed will be needed for mine and mill repairs. J. L. Bruce is manager of this great zinc-producing property.——The Tuolumne mine has been shut down on account of the copper market.

NEVADA

ESMERALDA COUNTY

From a rise above the 1017-ft. level of the Jumbo Extension, 58.3 tons of ore has been settled for at 13.04 oz. gold and 31.1 oz. silver per ton, and 13.1% copper, or $302.55 per ton.

HUMBOLDT COUNTY

The National Mines Co. is overhauling its mill, and will probably operate it through the winter.

LANDER COUNTY

A number of mills and treatment plants worked in the Austin district in the past, and several tailing dumps remained from these operations. Hart and Cameron are now treating one lot of 30,000 tons by cyanide, and when finished will move their plant to a 100,000-ton heap below the Austin-Manhattan mill.

LINCOLN COUNTY

Owing to the discovery of a small vein of rich gold ore, a rush has set in for an area 22 miles east of Las Vegas and one mile west of the Colorado river.

LYON COUNTY

The Pittsburgh-Dolores Mining Co. is working the Rockland mine, south of Pine Grove, in charge of E. J. Schrader. The property is an old producer, and about 15,000 ft. of work was done. About three years' ore is in sight. An 80-ton plant with rolls and cyanide plant is being erected.——The Mason Valley company has stopped work at its mines on account of the copper market. About 250 men are deprived of employment through this action. The smelter is to close down shortly.

NYE COUNTY

(Special Correspondence.)—Up to 60 days ago, mining in the Tonopah district was confined to an area of about 2 by 4 miles, with Mt. Oddie in the centre. Prospecting had been done outside of this limit, but without anything startling. Two months ago John Shipway and Tom Talty discovered what they called a contact between rhyolite and porphyry about four miles north of Mt. Oddie, resulting in the discovery of ore which panned free gold. This was interesting, as Tonopah is essentially a silver producer. Three pioneer lessees of the district, R. Dougherty, P. Mooney, and H. McNamara, leased the new find and have been sacking ore from the surface down, using a windlass in sinking. From 15 to 20 leases have since been taken up, with good surface indications. H. Campbell and R. Kelly have milled four tons of ore yielding 2 oz. per ton. About six others are sacking ore. The Tonopah Mining company's engineers examined the claims and are waiting for further development. The strike of the ore-shoots is toward the contact, and so far the wall rock on both sides is the same. A townsite has been laid out and named 'Tonogold' but it is really a suburb of Tonopah. Generally, considerable optimism is felt regarding the new gold area.

Tonopah, October 17.

Ore production from seven mines at Tonopah last week totaled 11,533 tons valued at $233,554.——Some September returns were as follows: Belmont, 14,845 tons, yielding 306,783 oz. bullion for a profit of $121,165; Tonopah Mining, 12,011 tons for 211,690 oz. and 64 tons of concentrate, and a profit of $65,350; and Jim Butler, 3417 tons for $20,842 profit.——Ore from the North Star is to be treated at the West End mill.

STOREY COUNTY

The *Virginia City Chronicle* summarizes mining operations on Comstock lode during the past week as follows: Consolidated Virginia rising on 6-ft. vein above the 2500-ft. level, 71 cars of low-grade ore being saved. Ophir makes good progress in reopening old workings of the Central tunnel to develop low-grade ore. The Mexican continues work on the 2500-ft. level winze at 2650 ft. also, sinking and timbering station. Union Consolidated west cross-cut at 2650 ft. in the Union winze is in diorite at the 236-ft. point. The C. & C. pumping plant is working smoothly and holding water at all points. The Yellow Jacket mill shipped a bar of bullion, and 648 tons of ore was placed in bins. The Crown Point suspended stoping for the present on the 1300-ft. level. The Belcher extracted 354 cars of ore from the 1600-ft. level stope. Water held 95 ft. below the 1600-ft. station of joint incline. The Overman continues reopening old workings on the 1300-ft. level. The Caledonia extended the northwest drift from the rise above the 1100-ft. level, through quartz, giving fair assays. The South drift on the 200-ft. level of the joint Confidence-Challenge-Imperial shaft is all in quartz of low assay value.

Fire broke out in an old stope on the 2500-ft. level of the Mexican mine on October 19. Bulkheads were placed on the 1600 and 2000-ft. levels to hold back the smoke. According to T. F. McCormick, of the United Comstock Pumping Association, and of the Ophir and Con. Virginia mines, there is no danger to the pumps on these properties.

WHITE PINE COUNTY

Mining claims and a mill at Seligman, near Hamilton, which have been idle for many years, have been jumped, and the ownership is to be decided in court. It is alleged that the required assessment work has not been done on the claims. The mill cost $100,000 about 25 years ago.

NEW MEXICO

SAN MIGUEL COUNTY

(Special Correspondence.)—For the treatment of molybdenite ores in the El Porvenir district, Margarito Romero has devised a successful process after a most discouraging series of tests, in which not more than 47% of the mineral was recovered. A concentrating plant has been erected, and the new process extracts from 80 to 95%. The ore is crushed in a flat mortar, after which it is roasted and run through a series of screens. The tailing is treated in a flume of running water. The interfering mineral in the ore is copper, but the final product is worth $1.50 per pound in New York.

Silver City, October 15.

NORTH CAROLINA

YADKIN COUNTY

(Special Correspondence.)—The Gross and Dixon Gold Mining Co., an Omaha, Nebraska, concern, is making extensive improvements to its mine and mill. At the former, retimbering is being done, and hoisting and compressor machinery is being installed; and in the mill, modern cyaniding apparatus is to be put in. The mine has been developed during several

years, and a large tonnage of profitable low-grade and a fair quantity of very rich ore is in sight. Gold is in an iron-copper sulphide. George E. Price is in charge of the property.

Cana, October 2.

SOUTH DAKOTA

Lawrence County

According to the monthly statement of the Homestake Mining Co.'s employees' aid fund, published in the *Lead Daily Call* 141 persons received a total of $2703 in September. Among the list is $800 for the late manager, T. J. Grier. This fund is for death, injury, sickness, suicide, and insanity. Receipts from employees totaled $2396, and the Company $1000, and including cash on hand, etc., the total available in September was $41,024. Cash at the end of the month was $38,321.

UTAH

Beaver County

Forty to fifty per cent zinc ore, with some silver, has been cut in the Leonora mine in the Star district. A good deal of development is proposed.——On October 30 and 31, all of the material and auxiliary plant of the Montreal mine of the Glasgow & Western Exploration Co. will be sold at auction. The Company has spent about $5,000,000 during the past 12 years. This mine is five miles from Milford, and is in charge of Frank Schuyler.

Juab County

The Eagle & Blue Bell shaft is being sunk four feet per day, and is now about 1700 ft. deep. A 16-ft. sump will be sunk for pumps.

Ore shipments from 20 mines in the Tintic district last week totaled 128 cars.——A mill will probably be built at the Grand Central mine at Tintic, to treat low-grade copper ore found down to 2200 ft., according to the manager, C. E. Loose.

Summit County

The new Park City Mills' 50-ton plant is in full operation, and gold-silver-copper ore from the American Flag mine is being treated. The chlorination process is being used, operating a Knight-Christensen roasting furnace. George H. Scibird is in charge.——The Michigan-Utah Mining Co., operating about four miles west of Park City, is to be reorganized. A new 1500-ft. adit has been started to cut the orebodies at 600 ft. vertical depth.

Uinta County

According to A. S. Brown, a property owner in Lucerne valley, 115 miles east of Salt Lake City, there are good chances for prospectors in the Uinta mountains.

WASHINGTON

Pend Oreille County

The Bead Lake Gold-Copper Mining Co., which has been developing a group of 20 claims near Newport for the past 10 years, has opened a vein about 12 ft. wide in the lower adit, at a depth of 300 ft. The ore assays high in lead and silver, also $2 to $6 per ton in gold. Ore is to be shipped, and for the low-grade material a mill may be erected. W. E. Allen is secretary and the largest shareholder, resident in Spokane.

Stevens County

The United Copper Co.' at Chewelah, has engaged 70 men in Spokane, making a total of 115 employed. The Company has a contract to send 125 tons of ore and some concentrate daily to the Trail smelter.——The Gwin mine at Kettle Falls is being reopened after a shut-down due to low water. A 50-ton concentrating plant is ready for work.

CANADA

Alberta

Spokane people have organized another company to exploit the oil districts of the Sweet Grass-Milk river and Flathead area. A total of 2920 acres has been secured. It is estimated that the oil strata of the Calgary field are at a depth of 3500 ft., and the Sweet Grass at 2000 ft. Drilling is under way at the latter place, and the new concern is erecting a rig for sinking a well.

Ontario

The annual report of the Hudson Bay Mines Co. shows that the output of silver was 393,360 oz., worth $196,436, from the Cobalt property. This has been worked out, and is closed. A balance of $52,561 remains after paying all expenses. Since 1907 the mine has produced 5,604,168 oz., valued at $2,965,523, from which large dividends were paid. The Company controls the Dome Lake mine at Porcupine, and spent $119,375 on it during the year. Development at this property is promising. A. H. Brown is general manager.

On October 15 the Seneca-Superior company paid a dividend of 10%, equal to $47,638, and making a total of $595,580.—— The Coniagas company has its No. 4 shaft, in the town of Cobalt, down 150 ft.——The report of the Dome Mines Co., Ltd., shows the value of gold recovered in September to be $99,301, comparing with $90,893 in August and $82,983 in July. Gold recovered for the twelve months ended September 30 totaled $1,204,263. The value recovered per ton milled in September was $4.52.——Gold production from the Tough-Oakes mine to date is $100,000. The mill has a capacity of 40 tons per day, but the new one will treat 100 tons. There are 125 men employed.——The Dome mill treated 21,940 tons in September, yielding $99,302.

KOREA

The Oriental Consolidated Mining Co.'s clean-up for September was $132,200. In August the mills treated 27,081 tons of ore yielding $119,210. The rainfall was 28 in., and 22½ in. in July, consequently the Tabowie, Taracol, Charabowie, and Candlestick mines were partly flooded. The season was not over on September 5. The war has not had any serious effect on operations, save a hold-up of dynamite and rails in neutral ports. Supplies have been ordered from America. Cyanide has risen from 15 to 50c. per pound. Labor is satisfactory. Foodstuffs have advanced, and costs will rise.

MEXICO

According to a recent *Daily Consular Report*, a decree issued under date of September 15, 1914, by Governor Eulalio Gutierrez, fixes the minimum wage in the state of San Luis Potosi at 75 *centavos* per day, to be paid in cash, which at the ruling rate of exchange is equivalent to about 21c. U. S. currency. In mines the minimum wage is fixed at $1.25, or about 35c. U. S. currency. The 9-hour day is also decreed. Employers who have been paying more than the minimum are forbidden to reduce wages to the minimum. Workers on farms must be supplied free water, wood, and shelter. By the same decree, company stores are abolished. All debts contracted by laborers to employers expire by limitation in one year. Employers are prohibited from placing any obstacle in the way of laborers who desire to change their place of employment or to accept other employment. The wages of laborers are exempted from garnishment. The decree provides that a landowner who furnishes to the tenant the land, implements, animals, and seed shall not collect more than 25% of the crop for rent and reimbursement, but in cases where he makes these advances and also furnishes water for irrigation he may collect 50% of the crop. All advances to the tenant must be in cash and must be returned in cash or in grain at the price current in the nearest market. Probably the most important article of the decree provides that in view of the exceedingly low wages heretofore prevailing, all loans and advances heretofore made and now outstanding against the laborers, must be considered as a voluntary supplement to the inadequate wages, and are therefore declared liquidated and canceled.

PERSONAL

W. J. Cox was in New York last week.

D'Arcy Weatherbe is on his way to northern Mexico.

Information is wanted concerning Lesid Rambal Mascarenas, who left Rossland, B. C., April 12, 1913.

Karl Hoffman sailed from Liverpool on October 7 on the *Baltic*, and will make a short stay in New York.

Lewis F. Johnson has returned to San Francisco from Los Angeles. He went to Sierra county at the end of the week.

Otto von Schlichten, of the Missouri Geological Survey, was married to Miss Anna Erdwein, of Cincinnati, October 21.

F. B. Weeks and G. E. Anderson are in Alaska, and recently examined some quartz properties in the Kantishna field.

Willis Lawrence returned from the Orient on the *Mongolia*, September 15, and has gone to El Dorado, California, on professional business.

A. M. Patterson, editor of *Chemical Abstracts*, has resigned from that position on account of his health. He joined the staff as associate editor in 1908. J. J. Miller will take his place, having been with the publication for five years.

The officers of the Oriental Consolidated Mining Co., operating in Korea, are as follows: Alf. Welhaven, general manager; Thomas W. Van Ess, assistant general manager; C. A. Crispin, auditor; E. S. Barstow, superintendent of transportation; J. B. Lower, superintendent of Tabowie, Taracol, Candlestick, Chintui, and prospects; F. W. Deal, superintendent of Maibong and Kuk San Dong; W. H. Aldridge, mechanical engineer; E. H. Emerson, electrical engineer; J. N. Fletcher, superintendent of fuel and timber railway; A. B. Palmer, cashier; J. A. Vernon, assistant superintendent of Candlestick, Chintui, and prospects; J. W. Nolan, physician, and W. D. Townsend, agent at Chemulpo.

Obituary

William Lofland Dudley, of Nashville, Tennessee, died September 8, 1914, after a sudden stroke of paralysis.

Albert Peterson, of Odda, Norway, lost his life during August, 1914, in a manner not clearly known, since he disappeared from a steamer leaving Odda for Bergen and his body was not recovered.

SCHOOLS AND SOCIETIES

The Cleveland Engineering Society met on October 13, when J. B. Meriam read a paper on 'The Useful Recovery of Heat Losses in Internal-Combustion Engines.'

The Salt Lake City local section of the American Institute of Mining Engineers recently elected the following officers: Robert C. Gemmell, president; Charles W. Whitley, vice-president; and E. Gayford, secretary and treasurer.

The nominating committee of the A. I. M. E. reported the following ticket at the meeting of the Board of Directors, October 23: president, W. L. Saunders; vice-presidents, Sidney J. Jennings, Philip N. Moore; directors, George C. Stone, W. H. Aldridge, Robert W. Hunt, S. A. Taylor, Hennen Jennings.

The Le Conte Geological Club will meet at the University of California, Berkeley, today. The program will include: Bogoslof Island,' A. S. Eakle. 'Prospective Oil and Gas Field in Rio Blanco County, Colorado,' J. A. Taff. 'What the Petroleum Department of the State Mining Bureau Is Doing,' C. A. Waring. 'Stratigraphy of the Tesla, Pleasanton, and San Jose Quadrangles,' E. B. Hall.

The American Electrochemical Society held a joint session at Pittsburgh with the local branch of the American Institute of Electrical Engineers on September 22. The electrical precipitation of smoke, dust, etc., was discussed by A. F. Nesbit, of the University of Pittsburgh, while A. F. Weston, of the Research Corporation of New York City, showed lantern slides illustrating applications of the precipitation process. The Niagara Falls meeting of the Society was held on the first days of October, and was an excellent one. The experimental symposium at the Fitzgerald laboratories was an interesting innovation.

The State School of Mines and Metallurgy at El Paso, Texas, announces that the first semester began on September 23 and ends on January 31, 1915. The location of this new institution is first class, being in a city of 60,000 people, an important railroad centre, with great agricultural and irrigation resources near by, and where one of the largest smelters in the world is in operation, receiving a great variety of ores from the Southern and Western states and Mexico. Students have little trouble in gaining admission to the school. Complete courses are given in mining and metallurgy. The college contains a number of fine buildings for all purposes.

In accordance with the agreements for coöperation between the Massachusetts Institute of Technology and Harvard University, fifteen of the Harvard professors are to be added to the instructing staff of the Institute this year. Their names and departments are the following: Mining department—Henry Lloyd Smyth, Edward Dyer Peters, Albert Sauveur, George Sharpe Raymer, and Charles Henry White. Metallurgy—Louis Caryl Graton. Mechanical Engineering—Lionel Simeon Marks, and Arthur Edwin Norton. Civil Engineering—George Fillmore Swain, Lewis Jerome Johnson, Hector James Hughes, and George Chandler Whipple. Electrical Engineering—Arthur Kennelly, Harry Ellsworth Clifford, and Comfort Avery Adams. Four of these gentlemen, Messrs. Swain, Whipple, Sauveur, and Clifford, are M. I. T. graduates.

The U. S. Civil Service Commission announces an open competitive examination for junior explosives engineer, for men only, on November 18. From the register of eligibles resulting from this examination, certification will be made to fill a vacancy in this position in the Bureau of Mines at Pittsburgh, or at other places in the field, at salaries ranging from $1200 to $1500 per year, and vacancies as they may occur in positions requiring similar qualifications. Competitors will be examined in the following subjects: Elementary chemistry and physics; essay relating to one or more of the following subjects: manufacture, transportation, storage, or use of blasting explosives; testing and properties of blasting explosives; precautions to be observed in the testing and use of blasting explosives; and education, training, and experience.

The U. S. Civil Service Commission announces an open competitive examination for aid in mineral technology, for men only, on November 18. From the register of eligibles resulting from this examination, certification will be made to fill a vacancy in this position in the Division of Mineral Technology in the National Museum, Washington, D. C., at a salary of $1200 per year, and vacancies as they may occur in positions requiring similar qualifications, unless service officials are appointed. Competitors will be examined in the following subjects: general geology, elements of chemistry and practical mineralogy, economic geology and mining, metallurgy and applied chemistry of the non-metals, and education and experience.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, October 22.

Antimony	12 —12¾
Electrolytic copper	13 —13¼
Pig lead	3.75— 4.70
Quicksilver (flask)	$50
Tin	36 —37½
Spelter	6 — 6¼
Zinc dust, 100-kg. zinc-lined cases	10

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, October 22.—Lead is dull at 3.50c., and spelter firmer at 4.73c. per pound. Gold output of the Rand in September was 702,170 oz. worth £2,982,630, compared with 711,917 oz. and £3,024,037 in August, a decrease due to the shorter month.

'The American Metal Market,' in discussing the effect of the war on the metal market, shows that the situation is as follows: lowest price for 17 years, lead; 10 years, copper; 5 years, tin; and 5 years, spelter.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The steady downward course of prices continues. Silver is now 50c. per oz. in New York, and 22.81d. in London. Samuel Montagu & Co., on October 8, stated that steadiness continued to characterize the market. Interest taken by India and China is light. Exports from London to the East for the year to date show a decrease of £3,256,500, or say 30,000,000 oz. An Indian currency return for the last week in September shows a decrease of 104 lacs of rupees of gold ($3,362,320), compared with the previous week. The rupees decreased $129,320. The 688 bars of silver confiscated in Mexico City by the authorities have been returned to the owners. At the end of last week 280 bars, weighing 318,985 oz., left Cobalt for England.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date		Average week ending	
Oct. 15	3.50	Sept. 2	3.90
" 16	3.50	" 9	3.85
" 17	3.50	" 16	3.85
" 18 Sunday		" 23	3.85
" 19	3.50	" 30	3.75
" 20	3.50	Oct. 14	3.75
" 21	3.50	" 21	3.50

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

The low quotations have induced purchases in the East. There is said to have been some curtailment of production, although not general. Prices in St. Louis are firm at 3.37½c. per pound.

COPPER

Prices of electrolytic in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13 60	Dec.	14.25	....

The September average, like that for August, is the settlement price of ore shipments received by the American Smelting & Refining Co. Electrolytic metal is now quoted at from 11.30 to 11.40c. per pound. Sales have been light, though there were signs of stiffening in prices, resulting from domestic and foreign enquiries. Exports to October 21 totaled 13,154 tons. War risk rates on metal consigned to Italy have advanced to 2% from ¾%. Standard copper in London is £49 per ton, against £56 on July 30.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
Sept. 24	75.00	Oct. 8	55.00
Oct. 1	55.00	" 15	55.00
		" 22	50.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mch.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

There have been small sales at $47.50 per flask, but the regular price is as above.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date		Average week ending	
Oct. 15	4.73	Sept. 2	5.75
" 16	4.73	" 9	5.50
" 17	4.73	" 16	5.25
" 18 Sunday		" 23	5.00
" 19	4.73	" 30	4.88
" 20	4.73	Oct. 14	4.55
" 21	4.73	" 21	4.73

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

St. Louis quotations are 4.70 to 4.75c. per pound, with a strong feeling. Ore producers in the Missouri-Kansas-Oklahoma district are receiving the lowest price since 1908, namely, $32 to $39 per ton for 60% grade. The Butte & Superior mine, Montana, is closed for some time, owing to repairs to the main shaft. This should relieve the supply of concentrate for a time.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

Tin has been down to 28.50c. per pound, but shows signs of an advance. There is a movement on foot to erect a smelter in the East to handle tin concentrate from Bolivia. It is thought that if the American supply of Straits metal is interrupted, the situation would be dangerous.

CYANIDE

Odd lots of a few tons are now available second-hand, and the steamer sent to Rotterdam by the Roessler & Hasslacher Chemical Co. should by now be returning. It was to have loaded October 20. The difficulties as to re-shipment to Mexico have been smoothed out, though there is still no assurance that a supply will be available for Central and South America. After the accumulated surplus in Germany has been brought over, it may be necessary to rely entirely upon domestic manufacture, as operations in Germany are much disturbed. Just how that may result cannot yet be foretold. The Perth Amboy plant can take care of all the mines in the United States. When the Cyanamid company gets into business there should be a surplus available for Latin America. Roessler & Hasslacher company quote sodium and potassium cyanide in their chemical list of October 15 at 25c. per pound.

COMPANY REPORTS

BISMARCK MINING COMPANY

During the year ended July 31, 1914, the Bismarck company, at Flatiron, South Dakota, mined and milled 79,036 tons of ore containing a gross value, by assay, of $114,831 (an average of $1.453 per ton). From January 1 to July 31 the figures were a trifle better: 42,880 tons had a gross assay value of $65,326 (an average of $1.52 per ton), and, of this, $55,113 was recovered. The recovery, made entirely by simple leaching of the dry-crushed product, was $1.285 per ton, equal to an extraction of 84.54%. During this 7-month period the property earned a slight profit; during the remainder of the year it sustained a loss. The costs for the entire year were at an average of $1.253 per ton. This remarkably low cost covers all of the expenditures for mining, including stripping of 25 to 30 ft. of overburden, tramming, milling, and general expenses, on an output of 250 tons per day, and is only comparable in its excellence to the high extraction made in the mill. It apparently indicates good management and close attention to detail. Of the costs, 69.4c. is charged to milling and 55.9c. to mining. The stripping cost 15.18c. per ton of ore mined. During only three months of the year was the mill operated at full capacity, and in that time the lowest costs were recorded, namely, $1.13, $1.125, and $1.09 per ton. In the mill, 0.349 lb. of cyanide was consumed for each ton of ore treated. Zinc consumption amounted to 0.396 lb. per ton, or $33.27 per $1000 of bullion recovered. The property has been closed, and no statement has been made as to possibility of resumption.

ORIENTAL CONSOLIDATED MINING COMPANY

Regular monthly reports of this Company, operating in Korea, are published in this journal, and the one under review covers the year ended June 30, 1914. It consists of 43 pages, replete with tables and an index. The general manager, Alf. Welhaven, reported as follows:

Development in nine mines totaled 32,379 ft., against 33,248 ft. in 1912-13, while there was also 2548 ft. done in prospecting outside of the active mines, making 34,927 ft. in all. Reserves of ore in the various claims is as follows, as at July 1, 1914:

Mine.	Tons.	Value.	Prod., tons.	Value.
Tabowie	500,000	$ 6.10	112,002	$ 7.31
Taracol	255,000	4.65	95,767	5.87
Kuk San Dong (4)	2,500	3.50	22,443	4.82
Charabowie	37,000	8.22	33,552	10.25
East Candlestick	6,000	13.34	7,778	12.70
Chintui	14,000	3.79	29,620	4.39
Total	814,500		301,162	$ 6.85

There is also 8000 tons of $10 ore in the Tongkol mine.

Mining the above tonnage last year cost $1.98 per ton, including all development. The total value of the ore hoisted was $2,062,563. The Tabowie mine is in fine condition, and promises well for the future. A new western orebody was opened on No. 8 and 10 levels. Development in the Taracol was satisfactory, although western extensions were disappointing. Ore-shoots in the Chintui are irregular, but results were fairly good. All development in the Kuk San Dong North, South, Central, and Kisen mine has been stopped, and ore left is confined to pillars. The Charabowie mine is promising. Water from the river has hindered work. Hoisting and pumping here is done by three electric hoists and seven electric pumps. Cost of mining was $3.41, compared with $1.18 to $1.94 in the others, save the Candlestick, where it was $6.69 per ton. The latter mine is opening well. A good deal of prospecting was done at the West Candlestick, Tongkol Sambong, Chosen claims, and 10 other properties. Korean tributers ran 19 water-power mills in five different places.

Metallurgical results were as follows:

Mill.	Stamps.	Ore, tons	Bullion, value.	Concentrate saved, tons
Tabowie	80	112,002	$ 344,313	13,010
Taracol	80	125,387	308,514	10,131
Kuk San Dong	40	22,443	56,734	2,940
Maibong	30	33,552	256,129	1,154
Candlestick	10	7,778	70,378	*7,778
Total	240	301,162	$1,036,068	35,013

*Mill pulp.

The assay offices conducted 39,386 assays. The Taracol tube-mill plant treated 12,856 tons of concentrate, yielding $317,827, with 80.2% recovery. Owing to high cost and low extraction, the leaching method on fresh concentrate was reverted to in February 1914. The Taracol cyanide plant treated 10,285 tons of concentrate, yielding $252,961, with 82.5% recovery. Its extraction was 2.3% higher than the tube-mill plant, and cost $1.63 per ton, against $4.58 in the tube-mill plant. The Kuk San Dong cyanide plant treated 4552 tons of concentrate, yielding $67,353, with 59.1% recovery. This was 5.9% lower than last year. The Kuk San Dong re-treatment plant dealt with 12,646 tons of dump and old untreated concentrate, yielding $59,455, with 63.8% recovery. The cost was $3.18 per ton, or 79c. over last year, due to more refractory ore using more cyanide and zinc. This plant is to be reërected at the Maibong mill. The Candlestick cyanide plant treated 7778 tons of mill pulp, yielding $14,868, with 52.4% recovery. The average gross and net saving were 90.2 and 81.8%, respectively. Mill tailing averaged 67c. per ton, or $202,356 out of a gross value of $2,062,563.

Financial results were as follows:

Total revenue	$1,731,472
Operating expenses	994,733
Operating profit	$ 736,739
Development and construction	113,959
Net profit ($51,396 over last year)	$ 622,780
Dividends paid (part from previous surplus)	644,780
Surplus on hand	645,702
Supplies on hand at June 30, 1914	356,085

Costs were as follows: mining, $1.98; transport of ore, 1c.; milling, 56c.; concentrate treatment, 32c. ($2.77 per ton treated); and general, 43c.; a total of $3.30 per ton.

Taxes paid to the government-general of Chosen were $26,489. Construction work, $104,282, included electrification of the important Nuchadagi pumping plant, mills' water supply, cottages, head-frame, saw-mills, refinery, electrification of three camps, tube-mill construction, and explosives' magazines, the last in compliance with government regulations.

The wood company supplied 18,130 cords of wood, 194,120 pieces of mining timber, lumber, and lagging, and 4110 boxes of charcoal. The cordwood line is 17 miles long. In reforesting, there were 72,000 acacia trees planted, and the nurseries contain 120,000 seedlings for next year's planting. The cost was $2755.

The hydro-electric plant worked 69½ days, averaging 506 hp. per day. Owing to lack of water, it was closed the remainder of the year. The rainfall was 41.25 in., June supplying 12 in., but at present there is plenty of water.

Bullion from the plants is sent to the Imperial Japanese mint at Osaka. The medical staff treated 26,209 cases, of which 8693 cases were from Company employees. No charge of any kind is made to anybody for service.

MINERAL STATISTICS

The following data, covering the year 1913 is from the U. S. Geological Survey:

Iron Ore in Minnesota

Iron ore mined in Minnesota last year was 34,249,813 long tons, worth $61,805,017, out of the United States total of 59,-643,098 tons, valued at $130,905,558.

White Arsenic Consumption

The consumption of white arsenic in the United States in 1913 amounted to about 7200 tons, valued at $570,000, of which 2513 tons, valued at $159,236, was produced in this country as a by-product from copper and precious-metal smelters, and the remainder was imported largely from European countries.

Mineral Production of Ohio

Mineral production of Ohio in 1913 was valued at $121,690,-661, an increase from the $111,229,656 of the previous year. Coal and clay are the leading products, the former being 36,200,527 short tons, valued at $39,948,058. The oil yield decreased from 8,969,007 to 8,781,468 bbl., and natural gas from $11,891,299 to $10,416,699. Salt amounted to 5,310,135 bbl., valued at $1,318,156, according to the U. S. Geological Survey.

Asphalt

The production of natural asphalt in 1913 amounted to 92,604 short tons, valued at $750,713, a decrease from 95,166 tons, valued at $865,225, in 1912. The output of manufactured or oil asphalt in 1913 was 436,586 tons, valued at $4,531,657, against 354,344 tons in 1912, valued at $3,755,506. The total quantity of asphalt imported into the United States for consumption in 1913 was 228,178 tons, valued at $910,611. The island of Trinidad furnished the greater part of this, namely, 125,273 short tons.

Bauxite in Arkansas

Arkansas is first among the states in the production of two minerals, bauxite and novaculite, the former being the ore of aluminum and the latter the source of the larger part of the oilstones produced in the United States. The principal mineral product of Arkansas, however, is coal, the annual value of which constituted over 50% of the state's total. The total value of all mineral products of Arkansas in 1913 was $6,780,-760, compared with $6,258,726 in 1912. The coal production was 2,234,107 short tons, valued at $3,923,701 in 1913, against 2,100,819 tons, valued at $3,582,789, in 1912.

Phosphate Rock in Florida

Florida lays claim to importance as a mineral producing state by reason of the exploitation of its phosphate resources, ranking first among all the states in the quantity and value of its production of phosphate rock, which represents 90% of the value of the state's total mineral output. In 1913 the output amounted to 2,545,276 long tons, valued at $9,563,084, against 2,406,899 tons, valued at $9,461,297, in 1912. Land pebble constitutes approximately 80% of the total quantity produced, but only about two-thirds of the total value. Hard rock is generally of higher grade than pebble and brings about twice as much per ton to the producers. This state also produces 70% of the total United States output of fuller's earth.

Mineral Production of Kentucky

The principal mineral product of Kentucky is coal, the value of which constitutes about three-fourths of the value of the state's total mineral output. In 1913, the total value of the mineral production of Kentucky was about $27,000,000, of which the coal mines contributed $20,516,749. This is an increase of about $4,500,000 in value of total mineral products over the figures for 1912. The second industry in importance, clay-working, contributed $2,914,276 in 1913, an increase of $470,536 over 1912. The quarrying industry is third, its products in 1913 being valued at $1,150,205, against $1,282,148 in 1912.

Lead and Zinc in Missouri

Missouri leads all the other states in the production of lead and zinc, and barytes and tripoli. The total value of the lead and zinc concentrates sold in 1913 was $21,109,358, against $24,937,161 in 1912. Based on the metallic content, the total production of lead and zinc in Missouri in 1913 was valued at $29,494,064, against $34,820,248 in 1912. The decrease in 1913 was almost entirely due to a smaller output of zinc ores, with a marked decline in price. Third in importance among Missouri's mineral industries is the mining of coal, the production of which decreased slightly, from 4,339,856 short tons, valued at $7,633,864, in 1912, to 4,318,125 tons, valued at $7,468,308, in 1913. The total value of the clay products increased from $6,412,861 in 1912 to $6,602,076 in 1913. In addition to the manufacture of clay products, the raw clay mined and sold in 1913 amounted to 238,032 short tons, valued at $470,277. The production of portland cement, which ranks fifth among Missouri's mining industries, decreased from 4,614,547 bbl. in 1912 to 4,485,820 bbl. in 1913, but increased in value from $3,700,766 to $4,556,822. The quarry products, principally limestone, exhibited a slight increase, showing $2,538,699 in 1913, against $2,486,505 in 1912. The sand and gravel pits yielded 4,126,126 short tons in 1913, valued at $1,109,233, against 3,687,380 tons, valued at $1,088,279, in 1912. The production of lime increased from 148,885 short tons, valued at $721,896, in 1912 to 161,770 tons, valued at $734,009, in 1913. On account of the decreased value of the zinc production in 1913, the total value of the mineral products decreased from $58,332,550 in 1912 to $54,001,008 in 1913.

Mineral Production of Pennsylvania

Pennsylvania so far exceeds all the rest of the states in the value of its mineral products as to stand almost alone. Exclusive of the value of pig iron, coke, and other derived or secondary products not included in the total, the value of Pennsylvania's mineral production is nearly one-fourth that of the entire country. Although not an iron-ore state, Pennsylvania is by far the leading producer of pig iron, which is obtained from the Lake Superior ores. The production in 1913 was 12,871,349 long tons, valued at $197,726,314. If the value of the pig iron made in Pennsylvania were added to the value of the other products of the state, the total values for 1913 would have exceeded $700,000,000, which is more than one-fourth of the value of the total mineral production of the United States. The production of coal in Pennsylvania in 1912 amounted to 246,227,086 short tons, valued at $346,993,123; in 1913 the value was $388,220,933, an increase of $41,227,810, or 12%, over 1912. Second in importance among Pennsylvania's mineral industries is the manufacture of portland cement, closely followed by the clay-working industry. The production of cement in 1913 was 28,060,495 bbl., valued at $24,268,800, against 27,625,340 bbl., valued at $18,945,835, in 1912. The value of clay products, exclusive of raw clay mined and sold, increased from $21,537,221 in 1912 to $24,231,482 in 1913. The value of the natural gas produced increased from $18,539,672 in 1912 to $21,695,845 in 1913. The output of petroleum increased slightly in quantity, from 7,837,948 bbl. in 1912 to 7,963,282 bbl. in 1913, with an increase of over 50% in value, from $12,886,-752 to $19,805,452. The production of limestone is the principal factor in placing Pennsylvania first as a producer of stone, though the state is also first in the production of slate, sand and gravel, and lime. In 1913 the total value of the stone quarried in Pennsylvania, exclusive of slate and of limestone made into lime, was $10,117,469, against $9,144,214 in 1912.

RECENT PUBLICATIONS

Ore Deposition in and Near Intrusive Rocks by Meteoric Waters. By Andrew C. Lawson. P. 23. Ill. University of California, Berkeley.

On a Probable Eighth Fragment of the Glorieta Meteorite. By Richard C. Hills. Reprint from *Proceedings* of the Colorado Scientific Society. P. 4 and 4 plates.

Relative Resistance of Various Conifers to Injection with Creosote. By C. H. Teesdale. *Professional Paper* 101. P. 43. Ill. U. S. Department of Agriculture, Washington, D. C., 1914.

The Diaphragm Method for the Measurement of Water in Open Channels of Uniform Cross-Section. By Carl Robert Weidner. *Bulletin* 672. P. 72. Ill., plans, tables. University of Wisconsin, Madison, 1914.

Labor Laws of the United States, with Decisions of Courts Relating Thereto. Part II. *Bulletin* 148. P. 1256. U. S. Department of Labor, Bureau of Labor Statistics, Washington, D. C., 1914. A comprehensive work which should be in the hands of all employers of labor.

A Geologic and Microscopic Study of a Magmatic Copper Sulphide Deposit in Plumas County, California, and Its Modification by Ascending Secondary Enrichment. By H. W. Turner and A. F. Rogers. Reprint from *Economic Geology*. P. 33. Illustrated. An abstract of this paper was printed in the *Press* of July 4, 1914.

The Deep Boring at Spur. By J. A. Udden. *Bulletin* 363 of the University of Texas. P. 105. Ill., 12 plates, plan, index. Austin, October, 1914. For the purpose of finding water for the town of Spur, a well was drilled 4489 ft. at a cost of approximately $50,000. A fine geological record was kept of the country passed through by the driller, H. P. Minihan.

Department of Mines, Ottawa, Canada, publications, 1913 and 1914:

The Copper Smelting Industries of Canada. By Alfred W. G. Wilson. P. 184. Ill, 5 plates, maps, plans, index. This is a valuable contribution to copper smelting practice, and an abstract will appear in another issue of the *Press*.

Lode Mining in Yukon. An investigation of quartz deposits in the Klondike division. By T. A. MacLean. P. 212. Ill., maps, plans, index. An abstract of this work, which should be owned by all interested in the Yukon, was published in the *Press* of October 17.

Preston County, West Virginia. By Ray V. Hennen and David B. Reger. Part IV, Paleontology, by W. Armstrong Price. P. 566. Ill., index, and case of maps. Wheeling, 1914. In addition to the detailed description of all the geologic formations exposed in Preston county, the geologic map gives the structural contours and outcrop of the Upper Freeport coal, the most important mineral horizon of the area in question. The soil and topographic maps will also prove of great value to every interest including agriculture, road improvement, water resources, etc. Price, with case of maps, delivered charges paid by the West Virginia Geological Survey, $2.

Thermal Properties of Steam. By G. A. Goodenough. *Bulletin* 75. P. 69. Ill. University of Illinois, Urbana, 1914. The bulletin presents a critical discussion of the experimental investigations of the various thermal properties of steam, an outline of the thermodynamic relations that must be satisfied, and finally, the development of a general theory of superheated and saturated steam. As a basis for such a theory the well known Munich experiments on specific volumes and specific heats are taken and properly correlated through the Clausius relation. The result of the investigation is a formulation of the properties of steam for which the following claims may be urged: (1) absolute thermodynamic consistence, (2) extreme accuracy; (3) simplicity, (4) flexibility, and (5) great range of validity.

Proceedings of the Australasian Institute of Mining Engineers. May meeting. P. 402, Ill., plans, maps. Melbourne, Victoria. Contains the presidential address of H. Herman on 'Mining, Other Industries, and Gambling;' 'The Long Tunnel Incline and Vertical Shaft, Walhalla, Victoria,' by J. Finlayson; 'Victorian State Coal mine, Wanthaggi,' notes on development, organization, etc., by George H. Broome; 'Geology of the State Coal Mine,' by Stanley Hunter and Leslie Owen; 'Core-Drills at the State Coal Mine,' by Stanley Hunter; 'Practical Underground Work at the State Coal Mine,' by John M'Leish; 'The Electrical Installation at the State Coal Mine,' by Struan S. D. Robertson; and 'Australian Tin Lodes and Tin Mills,' by H. Herman. Abstracts from these interesting papers will appear in the *Press* from time to time.

U. S. Geological Survey publications, Washington, D. C., 1914:

Abstracts from 'Mineral Resources of the United States,' 1913:

Production of Platinum and Allied Metals. By David T. Day. P. 13.

Production of Iron Ore, Pig Iron, and Steel. By Ernest F. Burchard. P. 48.

Gold, Silver, Copper, Lead, and Zinc in Utah. Mines report. By V. C. Heikes. P. 49.

Production of Asphalt, Related Bitumens, and Bituminous Rock. By David T. Day. P. 8.

Gold, Silver, Copper, Lead, and Zinc in California and Oregon. Mines report. By Charles G. Yale. P. 64.

Gold, Silver, Copper, Lead, and Zinc in New Mexico and Texas. Mines report. By Charles W. Henderson. P. 29.

Geology of the Phosphate Deposits Northeast of Georgetown, Idaho. By R. W. Richards and G. R. Mansfield. *Bulletin* 577. P. 76, ill., maps, index.

United States Bureau of Mines publications, Washington, D. C., 1914:

Supplementary List of Permissible Explosives. Leaflet showing names of 13 new brands added to the previous list.

Waste Oil and Gas in the Mid-Continent Fields. By Raymond S. Blatchley. *Technical Paper* 45. P. 54. Ill., map, index.

The Humidity of Mine Air. With especial reference to coal mines in Illinois. By R. Y. Williams. *Bulletin* 83. P. 69. Ill., index. U. S. Bureau of Mines, Washington, D. C., 1914.

Experiments with Furnaces for a Hand-Fired Return Tubular Boiler. By Samuel B. Flagg, George C. Cook, and Forrest E. Woodman. *Technical Paper* 34. P. 29. Plan.

Factors Governing the Combustion of Coal in Boiler Furnaces. A preliminary report by J. K. Clement, J. C. W. Frazer, and C. E. Augustine. *Technical Paper* 63. P. 46. Ill., index.

The Explosibility of Grain Dust. A preliminary report by David J. Price and Harold H. Brown. P. 59. Ill. Pittsburgh, 1914. As a result of a number of explosions in grain mills and industrial plants in this country and in Europe, and more especially as a result of an explosion in a feed-grinding plant at Buffalo, in June 1913, by which 33 men lost their lives and upward of 70 were injured, a coöperative movement between milling interests generally and the U. S. Bureau of Mines was arranged for the purpose of making a scientific study of the explosibility of grain dusts, and of methods pertaining to the prevention of such explosions. Since 1905 there have been 13 explosions, killing 78 and injuring 119, and damaging property amounting to $2,000,000.

New Machines and Devices

Largest Diesel Engine Built in Ame ica

The Lyons Atlas Co., of Indianapolis, Indiana, has recently completed and shipped the largest Diesel engine constructed to date in this country. This engine is composed of four cylinders, 21-in. bore by 30-in. stroke, and is of the vertical four-cycle type, rated at 600 brake horse-power, with an overload capacity of 15%, or 690 b.hp. maximum. It was sold to the Hawaiian Commercial & Sugar Co., and is intended to supersede a steam plant for irrigation purposes, to be direct connected to a two-stage turbine pump of 15,000,000 gal. capacity at 200 ft. head. The purchaser insisted that the engine should operate continuously 710 out of each 720 hours per month at rated load, using the ordinary 14 to 18° asphaltum base California fuel oil, similar to that used in the purchaser's steam plant, and which is the only grade available on the Islands. The test was conducted by the chief engineer of the sugar company, and the engine was given a preliminary continuous run of 48 hours with Eastern paraffin-base fuel, after which all parts connected with the combustion chambers were inspected in order to determine a basis for comparison between the effect of the two fuels. It was then subjected to a 144-hour continuous run at full load with fuel shipped by the purchaser from California to the manufacturer's works. At the completion of this run the combustion chambers were again examined, and as there was no evidence of deposit on the heads, valves, or pistons, the engine was accepted and is now en route to the Islands, to be erected without any assistance from the manufacturer.

A Portable Motor-Operated Compressor

The Sullivan Machinery Co. manufactures a small motor-driven air-compressor which is designed for use in mines and industrial plants, for supplying air for rock-drills, hammer drills, pneumatic tools, coal pick machines, and post punchers. The complete unit is mounted on a truck of any desired gage and comprises a 15-hp. Westinghouse motor, the air-compressor, a storage tank, and a motor-starting rheostat.

The motor is of the damp-proof type and will operate successfully in the wettest mines. It is supplied for either alternating or direct current. The receiver is made of plate steel and is tested to withstand 100 lb. air pressure. With it are furnished a pop safety valve, pressure gauge, and drain cock. The construction of the air-compressor is very substantial. The bearings are all adjustable and removable. The cylinder is lubricated by a sight feed air-cylinder lubricator, and the crank-shaft and crosshead by the splash system. An unloading device on the air-inlet valves saves energy when the demand for air is less than the output of the machine.

Commercial Paragraphs

The Charles C. Moore Co. has sold through its Seattle office to the Carbon Hill Coal Co. one 6-in. 6-stage Platt Iron Works centrifugal pump.

The B. F. Goodrich Co. recently shipped 18 tons of belting, nearly one mile, upon receipt of a cable order from abroad. The Goodrich company now manufactures about five miles of rubber belting per day and has regularly 15 miles in process and 50 miles under order.

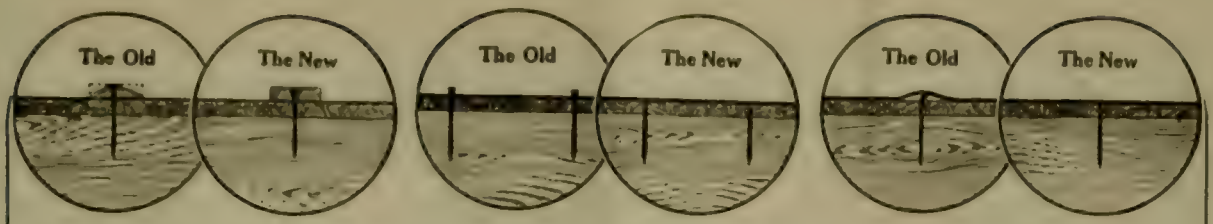
The Tropenas Converter Co. issues a little journal called *Steel Castings*, in the October number of which is reprinted an article by G. Muntz on 'Tropenas Converters *v.* Electric Furnaces for the Manufacture of Steel Castings,' from *Met. & Chem. Eng.* The Tropenas converter is one in which the air is blown between the slag and the metal. It has established an enviable reputation for reliability.

The Link-Belt Co. announces receipt of an order from the United States government for four steam-operated revolving cranes, three of which will be used at the Philadelphia Navy Yard, and the fourth at Charleston. These cranes are all of the standard eight-wheel type with slight modifications to conform to government specifications. The Link-Belt Co. has just issued a new 'Locomotive Crane Book,' No. 158 which illustrates excellently the different types of cranes made by the Company and the wide variety of uses to which they are applied.

The Sullivan Machinery Co., Chicago, *Bulletin* 66-H, describes Sullivan rock drills, especially 'Liteweight' and 'Hy-Speed' machines. Every part of these drills is illustrated and described. Both are fitted with Sullivan automatic lubricators, oiling having been a problem to all drill manufacturers. The characteristic feature of the 'Hy-Speed' is the valve-motion, a combination of the differential or pressure-thrown and piston-thrown or tappet patterns, in which the advantages of each are retained. The 'Liteweight' weighs 162 lb., and will drill nine feet. A lot of interesting data is given on drill steel suitable for these machines.

'Nascent Engineering Phases in the Iron and Steel Industries' is the title of a most attractive booklet prepared and distributed by the Wellman-Seaver-Morgan Co. It consists of a series of reprints of articles published in *Metallurgical & Chemical Engineering*. The list includes: Recovery of By-Products in the Modern By-Product Coke Oven Plant; A New Pulverized Coal Burner; Handling the Raw Materials at the Iron Blast-Furnace; The Heat Balance of the Open Hearth; A New Electric Steel Casting Plant; Essentials in the Making of the Finer Steel Sheets; the Manufacture of Chilled Iron Car Wheels; Steel for Electrical Purposes. It shows how intimately this firm is concerned with modern metallurgy that the series of articles includes repeated references to machinery made by the Wellman-Seaver-Morgan Co. Indeed, the articles could not be written without reference.

The Lane Mill & Machinery Co., Los Angeles, California, has published an attractive catalogue, which is descriptive of the many products of this well known Company. The catalogue is the seventh edition and contains many new features not to be found in the old edition of 1911. While no radical changes have been made in the construction of the mills, a few minor changes have been made in the construction of the Model 1914 mills which will undoubtedly be beneficial; the tires have been increased in thickness, some parts have been made heavier, the number of separate pieces has been reduced by combining some of them into a single casting, and a few parts are now made of cast iron, which were formerly made of channel or angle iron. The Company has stated plainly and fully the way in which the Lane mill does its work, how it is constructed, its adaptability for different kinds of treatment, and its claims for superiority. The catalogue is fully illustrated and contains a number of plans and specifications of milling plants in which the Lane mill is being used.



G-O RIFFLE
OF MONEL METAL
WITH THE INTEGRAL TACK

Here is a new thing which is very much worth your investigation.

A monel metal riffle. (Monel metal is as hard as steel, yet non-corrosive.)

Study the illustrations above. Note that a square edge is present to the traveling pulp. No nail heads—always in place. The riffle can be quickly attached to the table and more quickly removed by the simple process of ripping them off. No nail heads will remain in the table—they are a part of the riffle itself.

The G-O riffle comes in varying sizes to suit all conditions. They will save you money by giving a better extraction and concentrate. They will also save you much trouble.

Write for our literature which explains the G-O riffle in detail.
It will surely interest you.

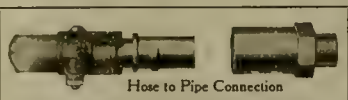
General Ore Concentrating Co., Inc.

40 Cedar St., New York

We Started Something

when we began to use **drop forged steel** wherever possible in the manufacture of

Cleveland Drills



Hose to Pipe Connection

Cleveland "Neverleak" Couplings Are Absolutely Guaranteed Against Leakage.

We started investigation on the part of the Mine Managers into the question of drilling efficiency. They began to consider that to grow accustomed to the expense of frequent repair of cast metal drills did not necessarily commit them to the **indefinite** use of inferior equipment. They began to make tests and comparisons; to compile records of results. That was just what we wanted, and, to help them to exact and profitable conclusions we offered to send a CLEVELAND on a 30-day-no-cost-to-you basis.

Why not YOU, too?

High cutting capacity, low air consumption and **low repair cost** must be as important to you as to any other mining man.

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Considerable interest has been manifested in the subject of secondary sulphide enrichment of recent years, and the study of the subject has been of both scientific and economic importance. The subject has been approached from the geological, chemical, and microscopic standpoints; the latter field has been particularly developed in recent years and has been productive of most interesting results. The present discussion is limited to copper minerals and applies especially to chalcocite enrichment. The conclusions are of interest and the results of a broad investigation of this interesting subject.

UPPER YENESEI VALLEY AND ADJACENT MONGOLIA.
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The Uriankhai region is almost entirely unknown to Western civilization, but seems likely now to attract the attention of the prospector since Mongolia has made a treaty with Russia and opened this frontier country to foreign exploration. While the production of gold from this district has not been great in the past, it is nevertheless important, and there is reason to believe that a mineral production which will be a real factor in the world's output may some day be developed. It is a country of peculiar conditions, and the present general survey is both interesting and timely.

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EDITORIAL

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IT is with profound regret that we record the recent disaster at the Mitchell coal mine near Royaltown, Illinois. The death of about fifty miners in the performance of their tasks underground is, indeed, a severe shock to the industry, and our deepest sympathy is extended to this grief stricken community.

A CORRESPONDENCE COURSE in the microscopic study of minerals and rocks is being conducted under the auspices of the extension division of the University of Wisconsin. This method of extending the usefulness of the class-room to the mineralogist in the field is most commendable, and we wish Mr. A. N. Winchell every success in this new educational experiment.

STATE MINING BUREAU during the past year has directed an exhaustive investigation of the California oil industry. The need of legislation in regard to the water trouble in the oil sands has been given particular attention and the Bureau has placed itself in the position of a clearing house for ideas as to the nature of the proposed legislation. Every effort is being made to construct a bill which will be fair to both large and small operators, and it is believed that it will have the unanimous support of the oil producers when the next legislature meets.

WESTERN AUSTRALIA'S gold production shows a decline of 44,114 ounces for the first eight months of the present year, as compared with the same period of the previous year. This shrinkage may be attributed to the stoppage of ore treatment at the Victorious, the closing of the Ivanhoe plant for several weeks because of the fire which occurred last February; suspension of operations at the Yuanmi because union labor forcibly objected to contract work; cessation of operations at the Great Fingall while the deep workings were being put in order; and the decliné in the Bullfinch output caused by a 'creep' cutting off the supply of good ore and compelling the Company to mine a lower grade of ore. It is anticipated that the production for the remaining four months of the year will be better, as the Ivanhoe, Yuanmi, and Fingall are again in normal condition. The resumption of work at the Edna May, Central, and Beira Consols, lends a feeling of optimism as to the future.

THE return of *The Mexican Mining Journal* to our exchange table after six months suspension of publication is another indication of renewed activity in Mexican mines. These have been stormy days in the Italy of the Occident, but we trust that the rattle of musketry is about to be replaced by the roar of the stamp and rumble of the tube-mill.

THAT field men of the United States Geological Survey are supplied with identification cards bearing their photographs is worth knowing at times. Recent frauds perpetrated by an individual posing as an engineer in this department of the government's service has awakened at least one community to the fact that cashing checks and giving credit on say so alone is sometimes costly.

INSTITUTO MEXICANO DE MINAS Y METALURGIA is to be congratulated upon the publication of Volume III of the *Transactions*, which is at the disposal of members and associates at the Institute's headquarters at 1*a* Calle Independencia 8, Mexico City, or will be mailed upon application to the secretary. Owing to the absence from Mexico of a large part of the members, it was not deemed advisable to hold the annual meeting of the Society in August as provided for in the constitution, and it was resolved in council to continue in office the present incumbents until a more representative attendance is possible. Owing to the death of the secretary and absence from Mexico of the treasurer, the council has appointed J. B. Empson and H. M. Dieffenbach to the offices of secretary and treasurer *pro tempore*.

OPTIMISM as to the country's business outlook is the prevailing sentiment among those in closest touch with the financial situation. It is encouraging to quote Mr. Charles S. Hamlin, the governor of the new Federal Reserve Board, that "while bankers and business men were utterly at sea for at least a month or more after the war started, there is at present a manifest disposition on the part of both banker and business man to discount the future and go ahead. This attitude represents a distinct advance and a speedy reëstablishment of full and mutually expressed confidence. Credit will then follow automatically." Mr. Arthur Reynolds, president of the American Bankers Associ-

ation, states that "the situation is getting better each week; the relief measures have been well planned and well executed, and the need now is for conservatism and careful, deliberate work in the direction of strengthening the weak spots. Never have the problems been as serious or as complex as those of the past three months, and no one knows but those who have been in touch with affairs and on the inside what the difficulties of the situation have been. I am thankful to say that the brighter days are ahead, and that before long we shall have clear sailing again." The return to normal conditions is reflected in the report of the New York clearing house, which on October 17 announced that the banks had made good their deficit in required cash reserves, which shortage had existed since August 8 last. The maximum deficit during this period was $43,389,250. During the panic of 1907 the banks reported a deficit for eleven consecutive weeks, the greatest being $54,103,000. Figures in the nation's business point to a restoration of confidence as to what the future holds in store, and pessimism is giving way to the utopist.

METALLURGY of the California Mother Lode ore mined in Amador county has, in the past, been of an extremely simple character, due to the free-milling class of ore mined. From the Hardenburg to the Fremont mine, a distance of about nine miles, there are ten mills of importance with 480 stamps, of which there are now about 360 in operation. Practice until recently has been as follows: Stamps of an average weight of about 950 pounds, with a 6-inch drop, falling 95 to 104 times per minute, crushed from 4 to 5 tons of the friable quartz ore through 20-mesh screens. Inside and outside amalgamation has recovered about 70 per cent of the gold. Then the pulp was diverted to two or three Frue vanners per battery of five stamps, without, save in one instance, any classification. Mother Lode millmen excel in the art of concentration, and from the vanners and other apparatus another 15 per cent of the metal content was saved. The concentrate was generally shipped to smelters. The extraction, therefore, has been about 85 per cent from ore which averaged $4.64 per ton in 1913. On account of graphite in the ore, cyanidation of the tailing from the mills has not been a decided success, and the process has remained one of amalgamation and concentration. The metallurgy of the district was described by Mr. M. W. von Bernewitz in the *Press* of January 3, 1914. On page 670 of this issue, we present a description and discussion of the new mill of the Plymouth Consolidated Gold Mines, Limited, at Plymouth, twelve miles from Jackson, by Mr. Gelasio Caetani, who designed and supervised its erection. A study of this article will show radical improvements in this new mill over those briefly described above, the improvements being mechanical rather than metallurgical. In short, the mill consists of a No. 5 Gates gyratory crusher, an ore-bin of large reserve capacity, thirty 1250-pound stamps with 7-inch drop and 104 drops per minute, 4-mesh screens, two Hardinge mills fed from classifiers, amalgamation, Wilfley tables, and Isbell vanners, and either the smelting or local cyanidation of the concentrate. Against the 4 to 5 tons per stamp crushed in other mills in the county, the Plymouth stamps reduce from 11 to 14 tons each per day. The total recovery has also been increased, and is approximately 90 per cent. While Amador mills have done good work in the past, results at the new Plymouth mill show that improvements are possible. That operations at the Plymouth are proving a valuable object lesson is evidenced by the fact that Hardinge mills are to be installed at the Original Amador mill.

PEACE PROSPECTS IN MEXICO

One traveling through northern and central Mexico at the present time, that country included in the states of Chihuahua, Coahuila, Durango, Nueva Leon, Guanajuato, San Luis Potosi, and Zacatecas, cannot fail but be impressed with what the *Ejercito Constitucionalista*, personified in Francisco Villa, has accomplished toward maintaining peace in this part of Mexico. Whether this influence is destined to be of a lasting nature and the present state of quiescence is the forerunner of a permanent peace or the lull between revolutions, remains to be seen; but for the present there is peace, and there is reason to believe that this part of Mexico at least will continue to be free of revolutions as long as 'Pancho' Villa is at the head of the 'Division of the North.'

When leaving Jiménez for the Aguascalientes convention in the early part of the present month, Villa stated emphatically that the miners could go back to work with the assurance that there would be no more war in Mexico, the lines of transportation would be kept open, and property rights of the foreigners would be respected in the future as in the past. As he was mobilizing the Constitutionalist army in the vicinity of Zacatecas and Aguascalientes at the time, the inference was that while he anticipated an amicable settlement of his differences with Carranza, if there was to be further trouble it would not be carried into this north and central country again.

Peace must be maintained in this country if Villa is to hold together the Constitutionalist army and preserve his present organization. His chief source of revenue being from the customs, mines, and railways, he is making every effort to stimulate a revival in business. True, he has other sources of revenue: street-car lines, hotels, foundries, machine-shops, soap and candle factories, city property, large country estates, and mines which, as prizes of war, the Constitutionalist government has confiscated from the former *scientificos* and their government; but to hold his army intact and preserve his present position, Villa must have funds, and to have adequate funds to meet the requirements of an army of 60,000 and the elaborate organization of the Constitutionalist administration, he must have peace. As a result, Villa has maintained peace in all country taken

by Constitutionalist arms, and he tells us that he will continue to do so.

Mitigating against peace is the present Villa-Carranza trouble arising out of Carranza's alleged violation of the San Luis agreement. There have been so many misstatements published regarding the present controversy, that a brief summary may be in order. At the outset of the recent revolt against Victeriano Huerta to oust the dictator, whose party was held directly responsible for the murder of Francisco Madero; Villa, Carranza, and the chiefs of the so-called Constitutionalist army met at San Luis Potosi and signed an agreement and manifesto stating their reasons for the call to arms, the purpose of the revolution, and made certain guarantees to the people as to future policy when victory came to the Constitutionalist army. This agreement included, among other things, a solution of the agrarian problem, and Carranza was agreed upon as supreme chief of the Constitutionalist cause, and as such would be chief executive until a regular election could be held. At this time it was agreed that no military chief would present himself as a candidate for the presidency, but that someone from civil life and in accord with the Constitutionalist policies would be nominated as their candidate for election. The consensus of opinion is that a member of the Madero family would be the Constitutionalist candidate. Carranza, Villa claims, since taking up the reins of office in Mexico City, has violated his agreement with the people formulated in the plan of San Luis. In addition to proposing an unsatisfactory solution of the agrarian problem, he is claimed to have announced his intention of resigning his office as chief of the Constitutionalist army in order, by this technicality, to conform with the plan of San Luis and become himself a candidate for the presidency. Realizing that Villa, and what he represented, was the chief obstruction in his path for such a political campaign, Carranza, it is claimed by the people of the north, has antagonized and discredited his former ally in every way possible. One instance of this was the appointment of a friend, who had taken no part in the driving of federal authority out of Sonora, to the post of governor, to succeed Maytoreña, the Constitutionalist chief who had been so active against the Huerta administration in that state. This was considered an insult to the Villa party, and has resulted in the resumption of arms by Maytoreña against Gen. Benjamin Hill and his Carranza followers at Naco. He has, according to Villa and his constituents, forgotten his pledges and promises to those who fought his battles, and has devoted his attention since assuming the temporary presidency of the Republic, to strengthening his personal position by attempts to weaken the prestige of the Constitutionalist chiefs. These and many other unfriendly acts to Villa and his former allies have resulted in Villa's proclamation to the Mexican people that Carranza has shown himself unfit to govern, and therefore must go. Like Huerta, having partaken of the presidential prerogatives and found them good, he is loath to pass this high office on to another, even though necessary for the national peace.

While there is a great deal of skepticism as to what will be the final outcome of the Aguascalientes meeting, there is a general and growing public sentiment among the Mexican people against a continuance of this internal strife which has kept the country in a state of turmoil for the past three years, and all classes are hopeful of a peaceful solution. This feeling will undoubtedly have an influence in the present conference and help toward the peaceful settlement of the present difficulty. The time is ripe in Mexico for casting aside selfish and personal ambitions, which have been the underlying cause of all of Mexico's troubles, and pulling together for the common good. The passing of Diaz and Huerta has demonstrated that Mexico will not submit to the administration of a political oligarchy or dictator. The government which shall be a lasting one and bring the much desired peace to Mexico must be constituted for and by the people.

THE AMERICAN COMMITTEE

A recent report of the American committee of London which has been performing such laudable service in the relief of American citizens in Europe who were in need of help due to the contingencies arising out of the European war, is evidence of the magnitude and helpfulness of the work being done in London. Many of the refugees arriving in England have been destitute even in the matter of food; and lodgings have been supplied to more than 5300 Americans. Over 9000 Americans were assisted financially between August 4 and September 26. By subscriptions, temporary loans, and Congressional appropriation, the committee has been able to help to the extent of about $400,000.

While a great good has already been accomplished, the situation has by no means been cleared, and every day brings appeals to the committee from deserving Americans who are in absolute distress. A large number of American families in Europe, which have been supported by their connection with the American export trade, are in great difficulties and dependent upon our own citizens for help, with the result that the resources of the committee are being taxed to the utmost. In addition to relieving the destitute, sub-committees have been selected from those who have volunteered their help, and an invaluable service is being rendered; more adequate shipping facilities are being provided; accommodations have been improved; speculation in tickets has been eliminated; information bureaus have been established, and the care-worn refugee has been helped in innumerable ways. This relief work must be kept up throughout the war, and further sums are needed for this purpose.

The work of the committee is well worthy of the support of those Americans who are safe at home, and those wishing to help in this Good Samaritan work may do so through the Treasurer of the American Committee in London, 123 Victoria street, London, S.W., or the New York Trust Company, 25 Broad street, New York City.

THE PLYMOUTH MILL.

The Design of the Plymouth Mill

By GELASIO CAETANI

The new 30-stamp mill of the Plymouth Consolidated Gold Mines, Ltd., in Amador county, California, was started on the first of August. The general design and flow-sheet of this mill is different from that of the standard Mother Lode mills and has therefore been much criticized and discussed: it represents an attempt to introduce more up-to-date methods in a district where for more than thirty years there has been no deviation from the traditional practice of direct stamping through fine screens, inside amalgamation, outside plates, and concentration on Frue vanners without any classification.

The flow-sheet of the Plymouth mill is given in Fig. 1, and a cross-section in Fig. 2. The ore is stamped through four-mesh screens; the coarse material is reground by Hardinge mills, and after amalgamation the coarse sand is separated by classification, concentrated on Wilfley tables, and returned to the Hardinge mill for further grinding. The fine sand and slime is concentrated on Isbell vanners.

The differences between this and the standard Mother Lode plant are more mechanical than metallurgical. Though the general aspect of the Plymouth mill is very different from that of the other mills in the district, the metallurgical treatment of the ore is substantially the same. A detailed description of the plant would not therefore be of any special interest, and I will limit myself to a few critical remarks that may be of greater advantage to the reader than a verbose description.

Crusher

The ore from the mine is fed to a No. 5 Gates gyratory crusher. The ore (a typical Mother Lode ore) is very friable, and, in stoping, a large percentage of it breaks up into 'fines.' There is a good deal of clay in the ore, and this comes from the mine in large pasty chunks. In consideration of this, it has been found advisable:

1. Not to use grizzlies ahead of the crusher, but to feed both the coarse and fine ore to the crusher.

2. To run the crusher at about half the speed specified by the manufacturers.

3. To run the crusher under choked feed.

The reasons for doing so are:

1. The use of grizzlies would give an irregular feed to the belt-conveyor which removes the ore from the crusher to the mill.

2. At times the percentage of 'fines' is so great that most of the ore would fall through the grizzlies and overload the belt.

3. The ore is so soft that the crusher does but little work even when buried under the ore. The ore will pass through the crusher about as fast as the swinging of the head allows it to fall through. It can be said, therefore, that the Gates acts as a feeder to the conveyor-belt.

4. If the crusher was run at full speed, it would not be possible to use a choked feed, as the capacity of the crusher would then be in excess of the capacity of the belt-conveyor.

Belt-Conveyor

The conveyor carries the ore for a horizontal distance of 631 ft. and elevates it about 108 ft.; the slope varies from the horizontal to a maximum of 20°30′. It is built in two parts of about equal length. On top of the mill-bins, the ore is dumped on a third conveyor, which distributes the ore by means of an automatic traveling tripper.

The data on this conveyor are:

Belt, 18-in. Manhattan, 5-7 ply, 'Lamina' construction.
Estimated life, three to four years.
Speed, 200 ft. per minute.
Capacity, 50 tons per hour at full load.
Power (approximate averages) for 1510 ft. of belt; one tripper; three head gear and three motors, no load: 16 hp. Same, with crusher loaded at full capacity, 28 horse-power.
Spacing of troughing idlers, 4 feet.

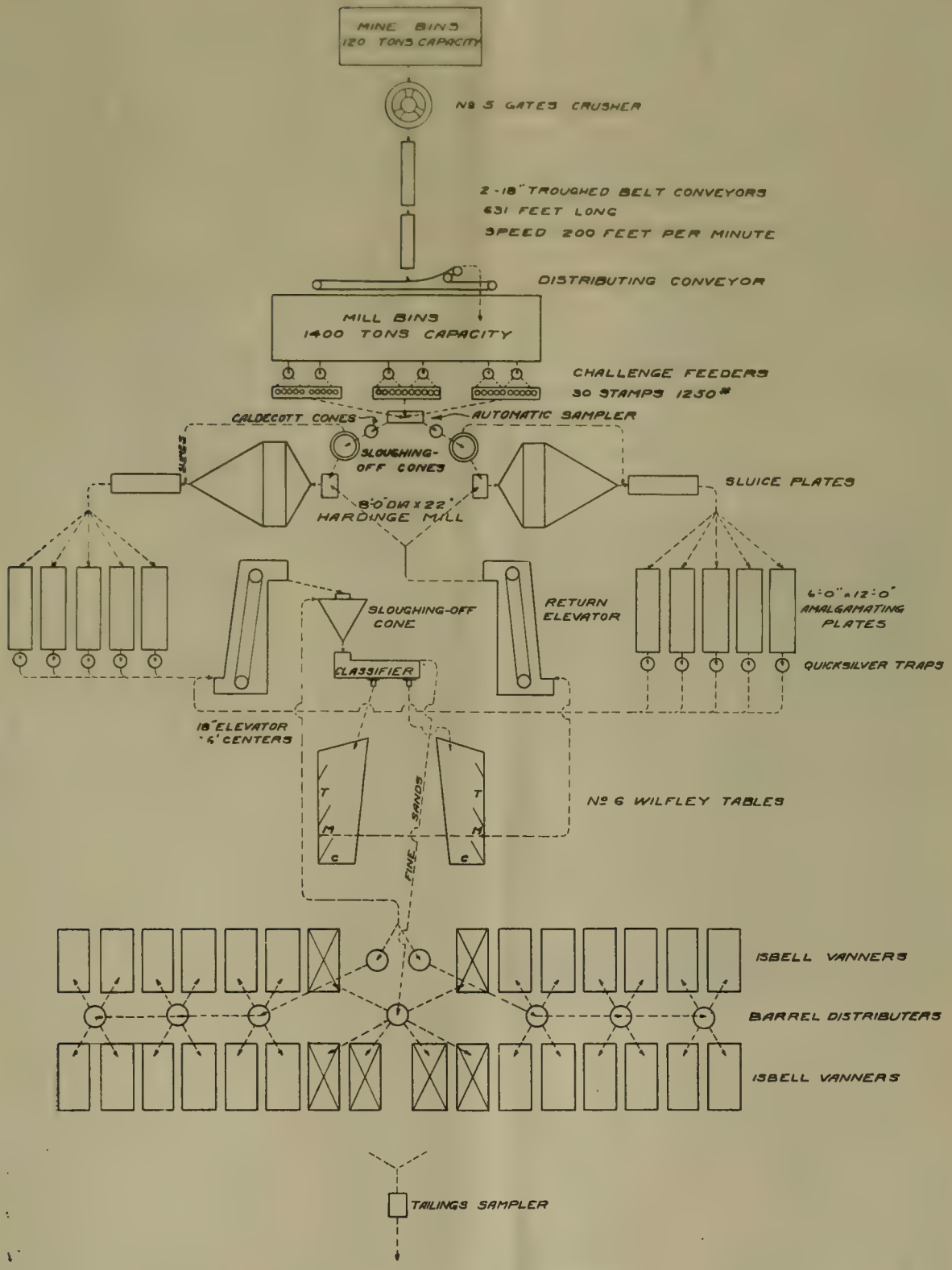
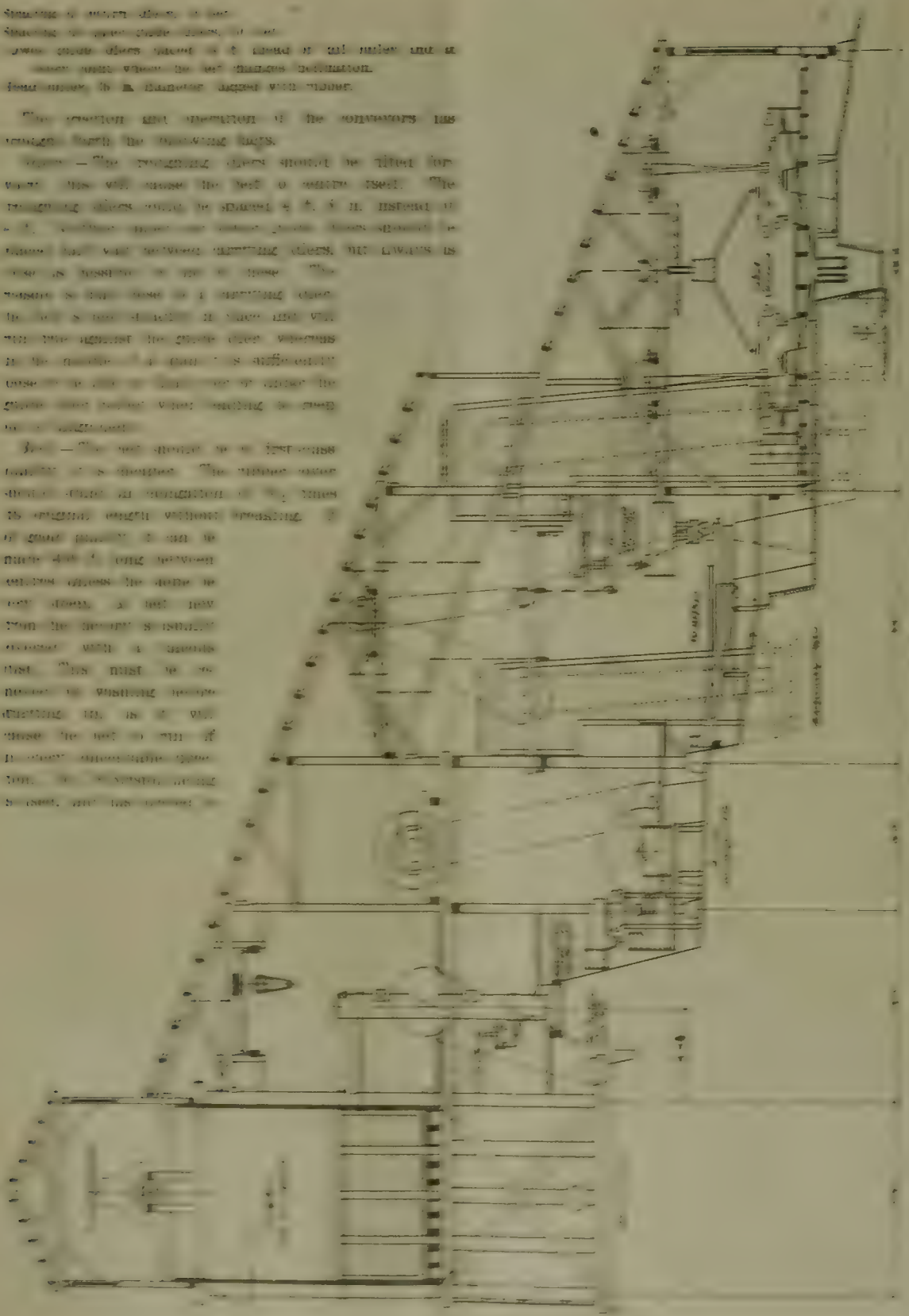


FIG. 1. FLOW-SHEET OF PLYMOUTH MILL.



be cheaper and more satisfactory than any other kind of lacing.

Slope.—On Mother Lode ore, which is damp and contains a large percentage of 'fines,' a 22° 30′ slope is quite safe when the belt is loaded. On an empty belt, isolated and rounded pieces of ore will start rolling back if the slope is greater than 20°. At the Great Fitzroy mine, in Queensland, Australia, there is a conveyor in use having a slope of 28 degrees.

Take-up and tail pulleys.—Should have a heavy crown.

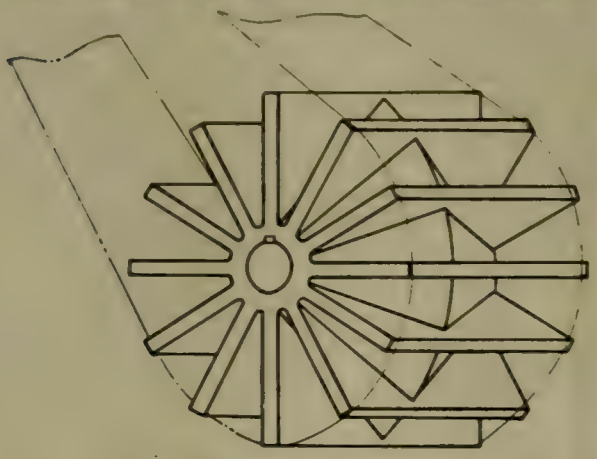


FIG. 3. BOSS ELEVATOR FOOT PULLEY.

The best type of pulley to use is the 'Boss' pulley (Fig. 3); the face consists of a series of rib-shaped spokes held by a very large double-conical hub. Coarse pieces of ore that fall on the undersize of the belt do not get pinched between the tail-pulley and the belt, but fall through the ribs on the conical hub and are thrown out sideways. A good tight floor under the upper belt will prevent rocks from falling on the lower belt. This is specially important near where the ore is fed on the belt.

Head pulley.—Long and steep belts should have head pulley of at least 42 in. diameter, lagged with rubber belting. This will prevent slipping and allow a looser belt.

Even in the best behaved mills, spouts will choke and the receiving box at the head of the conveyor will fill up in a few seconds. When this happens, the belt will scrape against the accumulated ore and is liable to be seriously damaged. It is necessary therefore to leave between the belt and the edge of the receiving box sufficient space to allow the ore to roll out on the floor.

Tripper.—Automatic trippers should not run at a speed greater than 10 ft. per minute, otherwise they will go to pieces when reversing. It is not only inconvenient but also dangerous to have a tripper start like a kangaroo when throwing-in the clutch.

ORE-BIN

The ore-bins are flat bottomed and have a capacity of 1400 tons, of which about 400 tons will run freely to the feeders. The balance forms a reserve in case of accidents to the crusher, conveyors, or to the mine. The maximum load on the posts supporting the bin is 304 lb per square inch, but the timbers do not show any weight.

STAMPS

There are 30 stamps (D. D. Demarest), 1250 lb weight, 104 drops, 7-in. drop, 5 stamps to the cam-shaft. Their capacity when crushing through 4-mesh screens (0.19-in. opening) varies from 11 to 14 tons per stamp, according to the character of the ore. The power required is 2.34 hp. per stamp, transmission and motor losses included.

The mortars are anchored by crossed bolts; this construction is good, but requires very close work in laying out the foundation pipes, and I believe the mortar foundation with a central tunnel is greatly preferable. Tests made to determine the right kind of mixture for the concrete proved that no standard rule can be followed, but that the ratio of cement, sand, and rock must be determined experimentally. The foundation of each ten stamps was poured in one continuous operation up to the top surface, the upper 2.5 in. consisting of a mixture of cement and fine sand in the ratio of $1:1\frac{1}{2}$. The top was troweled to a smooth horizontal surface

FIG. 4. CONCRETE FOUNDATION FOR STAMPS.

while setting. (See Fig. 4.) The batteries are very satisfactory and remarkably free of vibration.

Stamp v. Ball-mills.—There is no question that a stamp battery as a primary crusher is a most efficient and reliable machine; if, however, the remarkable friability of the Mother Lode ore be taken into consideration, the question comes up whether a ball-mill would not be a better suited machine for crushing the ore to 4-mesh size. If the size of the battery bins, the cost of the batteries, concrete mortar blocks, size of building required, and so forth, be taken into consideration, there

is no question that a ball-mill plant will cost not over one-third of a stamp-mill plant of equal capacity. The latest results of ball-mill operation indicate that with a proper feed load the steel consumption of a ball-mill can be kept within a half pound per ton of ore.

It is probable that a ball-mill will consume per ton of ore more steel than a coarse-mesh battery, but somewhat less power. If the line shaft, feeder, and battery repairs, screens, oil, and so forth, be also taken into consideration, it will be found that the total power and supply cost for crushing with ball-mills will be less than with stamps. There is no question that the cost of labor would be less, and so also the wear and tear on the building and the men. In the near future, reliable figures will become available on the comparative efficiency of these two types of machines, and I believe they will be in favor of the ball-mill.

Two-Stage Crushing

The advantages of two-stage crushing against stamping through a fine screen are both metallurgical and mechanical.

Metallurgical Advantages.—Sizing assay tests of the tailing of the Bunker Hill, the Amador, the South Eureka, the Argonaut, and the Plymouth plants show that the largest losses are in the coarse sizes and in the colloidal matter. The lowest grade portion of the tailing is the granular material passing a 100-mesh screen. The greatest amount of gold is in the colloids washed off by elutriation from the fine sand, and the gold content of the sand is directly proportional to the size of sand grains. When the ore is low-grade these differences are small, but on high-grade ore they become very marked. At the Plymouth a four-day composite sample of the total mill tailing gave the following screen analysis:

Mesh.	Per cent.	Value.	Per cent of total value.
On 40	2.36	$0.60	3.1
" 60	4.36	0.60	5.7
" 80	14.30	0.40	12.3
" 100	10.92	0.20	4.7
" 200	32.81	0.40	28.4
Through 200	35.25	0.60	45.8
Calculated total	100.00	$0.46	100.0

Note.—Of the minus 200-mesh material, about one-half is fine sand and one-half colloids.

From all this it appears evident that the ideal way to crush the Mother Lode ore is to crush it as fine as possible while producing the minimum amount of colloids. To crush very fine with the stamps requires a fine screen and a high discharge. This decreases the capacity of the stamps and increases the percentage of colloids. Therefore, the use of fine screens increases the slime losses, while the use of coarser screens increases the losses due to included sulphides in the coarse sand grains. The best results are obtained by two-stage crushing. At the Plymouth mill, the ore is crushed to 95% through 60-mesh and the percentage of true colloids is only 18%. This is due to the rapid discharge of the coarse battery screens and to the fact that the Hardinge mill will produce a smaller percentage of slime than any other grinding machine, the 'short tube-mill' excepted.

Mechanical Advantages.—The Plymouth mill is crushing 300 tons with 25 stamps and 2 Hardinge mills yielding a product less than 5% of which will not pass a 60-mesh screen. To approach similar results by direct stamping, it would be necessary to use approximately a 32-mesh screen, and the capacity per stamp would not be over 4 tons per day. Therefore, the two-stage crushing at Plymouth has the capacity of a 75-stamp standard Mother Lode mill. The crushing capacity of the stamps and Hardinge mills will increase proportionally to the coarseness of the product desired, and the above-given rating therefore holds true even when crushing through a 20-mesh screen.

A close estimate of the cost of grinding with the two Hardinge mills is as follows:

	Cost per day.
Danish pebbles, 400 lb. at $1.25	$5.00
Pebble lining (3 months), 6 tons	1.67
Placing lining	1.00
Power, 90 hp. at $4.50	13.50
Labor, 1.5 hr. at 35c	0.52
Oil and grease	0.04
Belts, 200 ft. in 12 months	1.07
Total cost per day	$22.80
Cost per ton milled	7.6c.

Local river pebbles, chiefly quartz, are now being used instead of Danish pebbles. They cost about $4 per ton, delivered at the mill, whereas the Danish pebbles cost approximately $27; but the consumption is about three times greater. The efficiency of the Hardinge mills does not seem to be much impaired by the softness and irregular shape of the local pebbles.

No accurate figures are yet available regarding the cost of operating the 25 stamps of the Plymouth plant, but it is reasonable to assume that the operating cost will remain the same whether crushing through 4 or through 32-mesh screen. If, therefore, the Plymouth plant be considered to correspond to an ordinary 75-stamp mill, it is evident that the Hardinge mills are doing the work of 50 ordinary stamps, crushing 4.0 tons per stamp, or a total of 200 tons per day, which corresponds to a cost of 11.4c. per ton for the share of work that the Hardinge mills are doing.

This proves that the cost of crushing with Hardinge mills compares favorably with that of stamping. The share of the work that the Hardinge mills do is done silently, without causing worries and troubles, without calling for violent physical exertion or skilled labor. It is on account of these considerations that I believe that a two-stage crushing plant consisting of ball and pebble-mills represents the simplest, cheapest, and most 'fool-proof' management for reducing a comparatively soft concentrating ore.

Whether a short tube-mill is more or less efficient

than a Hardinge mill is still a debated question. The tests being run at Miami and elsewhere will soon settle this question. I believe that if there is a difference it will be a small one; personally, I prefer a Hardinge mill, because I find that it gives a smaller percentage of oversize particles than a tube-mill.

Classifiers for the Hardinge Mills

The system of classifiers used is to place a small box acting as a Caldecott cone ahead of a sloughing-off cone, as shown in Fig. 5. This device works very satisfactorily. The Caldecott cone removes a large percentage of the coarse sand at about 30% moisture, thereby diminishing the amount of sand to be discharged by the sloughing-off cone and allowing the use of smaller spigots. It is easy to regulate the spigots of the two cones so as to have the desired dilution of the pulp fed to the Hardinge mills.

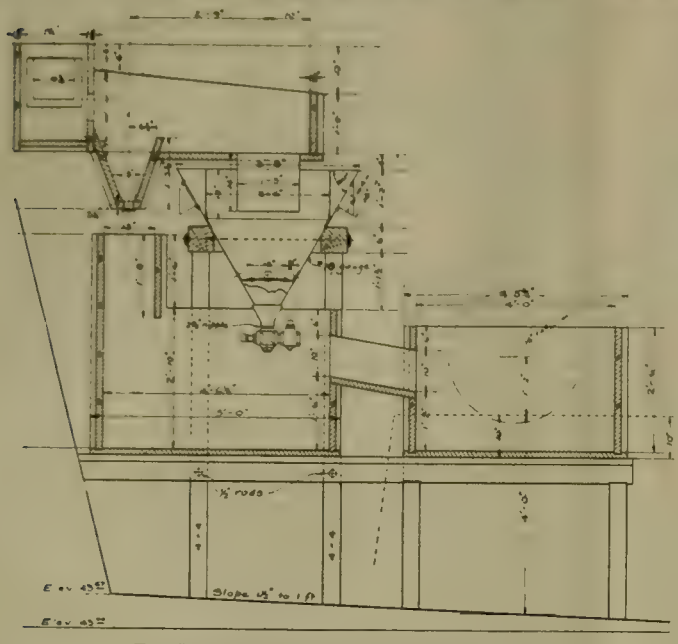


Fig. 5. Sand classifier for Hardinge mill.

Amalgamation

The problem of amalgamating is the only one that has not yet been worked out to complete satisfaction. The original plan was to amalgamate outside only, but after a few days it was found that part of the coarse gold would not catch on the plate. This coarse gold, if placed on quicksilver, will float without amalgamating, and to get it coated it is necessary to grind or rub it for some time in the presence of amalgam.

The next step was to feed quicksilver in the Hardinge mills and the amalgamation became complete. The plant was operated in this way for a month. It was found that if the amalgam was kept sufficiently soft it would build up on the pebble lining, filling up the depressions of the mortar between the pebbles. It was hopefully expected to find large amalgam balls rolling around with the pebbles, but this was not found to be the case; at the bottom of the mill there was a slough of amalgam, sand, and metallic iron which, in rolling, caused the coarse gold to amalgamate and, as the amalgam was formed, it became plastered upon the lining.

Whenever the feeding of quicksilver was stopped, the amalgam would dry up, crumble, and be thrown out of the discharge opening of the Hardinge, where it would build up in thick layers. This is a quick way for cleaning up the mills, though that of opening the mills and cleaning them up inside was not found any more laborious than that of cleaning up a battery of 30 stamps.

An unexpected result was that the amalgam, by remaining in the mill exposed to the continuous kneading action of the pebbles, became a very fine-grained pasty mass, all the coarse gold being ground or dissolved in the quicksilver. This amalgam therefore contained only 22% bullion, whereas it usually retorts close to 40% bullion. Inside amalgamation has now been discontinued, solely for the reason that the quicksilver losses were enormous, due to the flouring inside the mill. At present an amalgamating device is being attached to the mill, and this should effect the coating of the coarse gold, which will then catch on the plates.

From the results so far available, I judge that outside amalgamation will catch over 90% of the gold caught when using both inside and outside amalgamation. Each ounce of free gold that is caught in the concentrate instead of in the amalgam, represents a loss of $1.10 per ounce. The maximum recovery by amalgamation is approximately 65%, so that the net loss between inside and outside amalgamation on 300 tons of $5 ore is about $5.36.

Elevators

Two elevators are used, one for elevating the plate-tailing to the classifiers and one for returning the Wilfley tailing to the Hardinge mills. The general arrangement is shown in Fig. 6. Elevators are a bugbear to many millmen; if properly constructed, they do not give any trouble whatsoever. For the guidance of those who have not had experience with bucket-elevators, I will give a memorandum of the troubles and remedies.

1. *Elevator head pulley gets loose.*—Remedy, use heavy pulley with split hub and feather key resting in a short keyway. Use two set-screws on key and two set-screws on shaft. Use extra heavy shaft. For 16-in. belts over 30 ft. centre to centre, use not less than a $4\frac{7}{16}$-in. shaft. A bucket belt is a heavy affair, and will spring a light shaft; the revolving of the buckets will cause a rhythmical jarring of the pulleys, and these two actions combined will eventually loosen any pulley, however tightly fitted.

2. *Belt slips on head pulley.*—Remedy, lag the head pulley with 4-ply rubber belting. Use two belts touch-

ing each other along the crown-line, as thereby the crown of the pulley will remain true.

3. *Gear troubles and noise.*—Remedy, drive directly or by means of a counter-shaft. If an elevator sticks, something has to give way. If the elevator is geared, the bucket belt will give way, but if it is belt driven by a loose belt, it will throw the drive belt off and no damage is done.

4. *Spilling at receiver.*—Remedy, build the receiver

6. *Splice breaking.*—Remedy, use Holtite or Jackson lacing. They will outlive any belt.

7. *Belt wears due to strain.*—Use light buckets, so as not to overload the belt. No. 10 gauge Salem buckets are strong enough for material finer than 5 mm. When elevating fine sand, it is immaterial whether the pulp be fed through the front or the back end of the elevator boot, because the fine sand is kept in suspension by the violent agitation caused by the splashing of buckets.

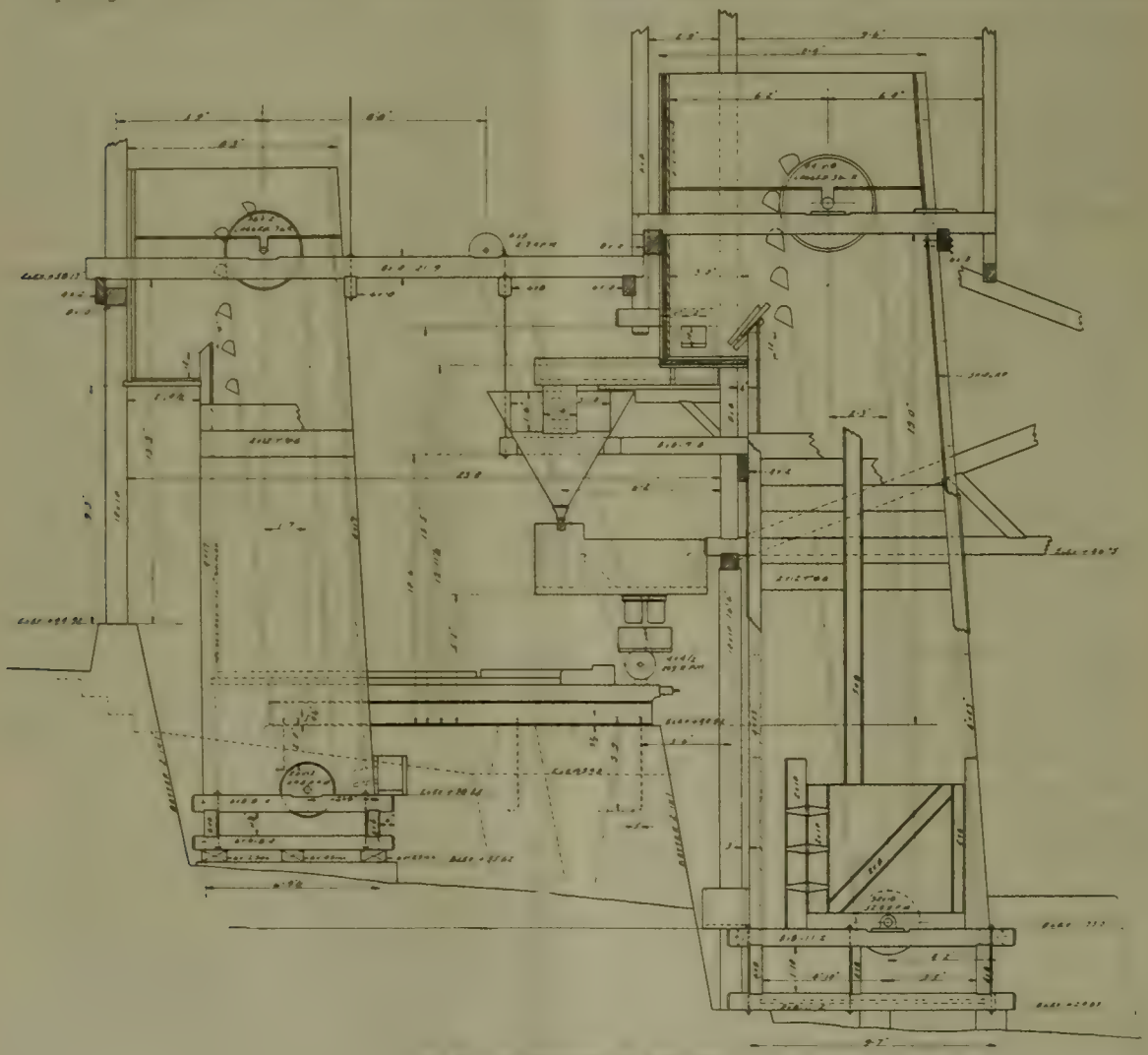


FIG. 6. ARRANGEMENT OF ELEVATORS.

so that the edge of the splitter is on a line drawn from the centre of the head pulley at an angle of 55° from the horizontal.

5. *Sand sticks in buckets.*—Remedy, drill three holes, $\frac{3}{16}$-in. diameter, through the bottom of the buckets; this will cause one bucket to leak into the following one, and prevents the sand from packing. When the bucket dumps, air is admitted through these holes to the back of the cake that has settled, and the pulp will dump freely.

Coarse material must always be fed directly into the bucket, care being taken to land it in the buckets as gently as possible.

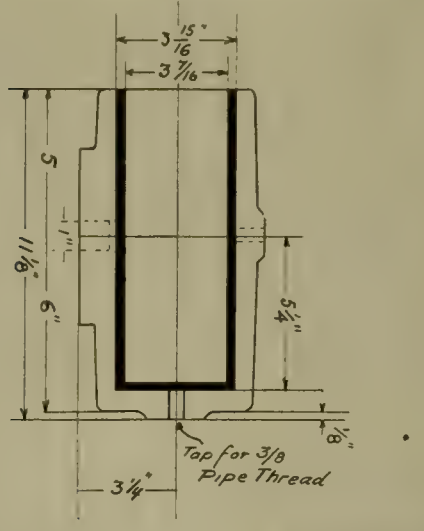
Running off.—A heavy crown is necessary to keep the belt well centred. The use of the rubber washers mentioned later will assist the belt in feeling the crown of the pulley, whereas when the buckets are rigidly attached the belt becomes rigid and cannot hug the pulleys in a uniform way. The belt should always be at least one inch wider than the buckets, as this will pre-

vent the buckets from scraping against the elevator housing.

Wear under buckets.—Usually the buckets are either rigidly attached to the belt or a piece of rubber belting is inserted between belt and buckets. In both cases sand and small rocks will gradually get wedged between the buckets and the belt, and the repeated bending of the belt will gradually drive this sand in the rubber and wear it out. A radical remedy for this is the use of pure rubber washers, ¼-in. thick, of 1½-in. diameter, with a ¼-in. hole in the centre. These are inserted on each bolt between the belt and the bucket; when the bolts are tightened, the rubber washers are compressed and, owing to their softness, will keep in close contact with the belt even when bending over the pulleys, thereby preventing any sand from getting wedged between the buckets and the belt. These washers cause a clearance of $\frac{1}{16}$ in. between buckets and belt, and there is no chance for the sand to wedge anywhere. These washers will **greatly lengthen the life of a belt.**

Rocks wedging between pulley and belt.—'Boss' pulleys should always be used as boot pulleys when elevating material coarser than 3 mm. These have already been described when discussing the belt-conveyors. The use of 'Boss' pulleys will double the life of the belt.

Bearings for elevator boot shaft.—These should always be of the solid closed pattern shown in Fig. 7. Every time an elevator stops, the pulp will overflow over the bottom bearings, which are exposed to this and other hardships. In many mills, they are buried out of sight, the shaft usually revolving in grit instead of babbitt.



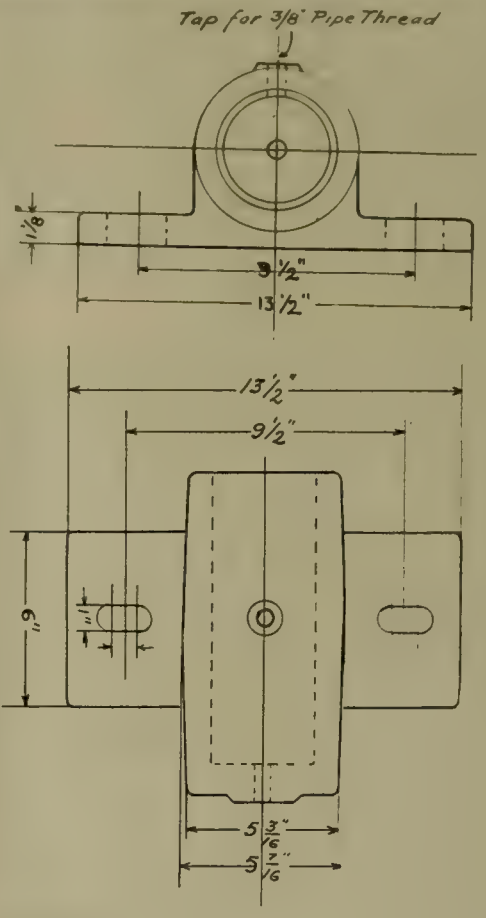


FIG. 7. SOLID BEARING FOR BUCKET ELEVATOR.

Elevator buckets.—Large buckets should always have two rows of bolts, for the reason that when the bucket line arrives at or leaves the pulley the buckets are violently jerked forward or backward, and the bolts, if in a single row, will snap off within a short time. On large buckets not less than seven $\frac{5}{16}$-in. bolts should be used.

CONCENTRATING TABLES

Two No. 6 Wilfley tables and 30 Isbell vanners are used for concentration. My long personal experience with vanners had convinced me that of all tables the vanner is the most costly and troublesome one to operate, and at one time I was convinced that never again would I place vanners in a new plant. Upon closely investigating the Mother Lode ore, I came to the conclusion that vanners were the most suitable machine, and I will explain why.

The characteristics of the Mother Lode ore are: (1) the waste contained in the ore is chiefly slate, which will break up into flakes that are easily washed off into the tailing; (2) the quartz is very light; (3) there is a large percentage of colloidal slime in the ore, and this, by increasing the viscosity of the pulp, tends to keep the sand in suspension—therefore the pulps will flow freely on the plates and tables and in the launders at much less grade than is usual in other districts; (4) the pyrite occurs in well formed crystals and in bunches—it is therefore easily freed by crushing, and the percentage of middling having a specific gravity intermediate between that of the pyrite and of the quartz is comparatively small; (5) the middling of a Wilfley

table consists chiefly of small particles of free pyrite washed over into the tailing; (6) the Plymouth ore contains a large percentage of arsenopyrite occurring in small crystallized grains; owing to its high specific gravity it will separate above the pyrite, giving the appearance of being a streak of galena.

The vanners are well suited to handle this kind of ore. The gangue is very light, and when kept in agitation it will flow so easily off the vanner belt that the sulphides can be drawn up through the wash water without being much disturbed. Comparatively large grains of gangue, that usually would be dragged over into the vanner concentrate, are instead, on account of their lightness, washed off into the tailing. This explains why Frue vanners are capable of handling efficiently such large tonnages of Mother Lode ore; in most mills of the district the 6-ft. vanners have a load of 11 tons, though better work is obtained by reducing the load to 8 tons. At Plymouth, the average load per vanner is about 8.3 tons. Panning of the vanner tailing proves that a very small percentage of the free sulphides is lost, and therefore no other machine could do much better work than the vanner. This is explained by the very small percentage of middling contained in the pulp.

Ratio of Concentration

The ratio of concentration of the Plymouth ore (when producing concentrates of shipping grade) is approximately 100 into 1.8. With this very high ratio of concentration, a Wilfley or a Deister table would have thrown out a very thin streak of concentrate which would be hard to separate accurately. To use these tables, it would be necessary to separate also a streak of middling that would have to be returned to the classifier. A vanner instead is able to separate any small percentages of sulphide as free of silica as desired. Even on vanners a certain amount of gangue has to be drawn over with the concentrate so as to reduce the tailing loss, but this percentage is more easily regulated and is less than would be the case when using Wilfley or Deister tables.

Freight and haulage charges on concentrate are heavy, especially at Plymouth; the smelters place a heavy penalty on silica, and their schedule on gold payments calls for high-grade products. It is therefore essential to produce a clean concentrate, and to obtain this a vanner is better suited than any other table unless both middling and concentrate of these tables be re-treated on secondary machines.

Tests are being run now to determine the relative economical efficiency of vanners when making high-grade and low-grade concentrates; accurate results are not yet available, but the indications are that the difference will be small. I expect it to be of the same order as the recovery obtained in other mills of the district by the use of canvas plants. The increase in economic recovery, however, may even be negative, as the increased gold saving may be more than offset by the increased haulage, freight, and treatment charges.

Cyaniding of Concentrates

Laboratory tests give very encouraging results. A weak cyanide solution will in a short period of time extract over 91% of the gold, the cyanide consumption being low. The tests do not show any fouling of the solutions, notwithstanding the large arsenic content of the concentrate; this will have to be verified by running long-time tests.

There appears to be a considerable margin of profit in cyaniding the concentrate; when doing this, it will be profitable to lower the grade of the concentrate to about $20 per ton, as the metallurgical recovery will then be higher, not only on account of the larger percentage of sulphides saved, but also on account of the gold contained in the sand dragged over into the concentrate. Recapitulating, I will say that, whereas in concentrating for smelter shipments it does not pay to attempt to increase the gold recovery by lowering the grade of the concentrate, the contrary is true when producing a concentrate that is to be cyanided. The sand dragged over into the concentrate is mostly clean quartz, free of that carbonaceous matter that causes the reprecipitation of the gold usually noticed when attempting to cyanide the Mother Lode tailings. The presence of some sand in the concentrate will assist grinding, settling, and, in a general way, the handling of the pulp.

Returning now to the subject of tables *versus* vanners, I will say that if the concentrate is to be cyanided it will be best to use Wilfley and Deister tables, the reason being that these machines are much cheaper to operate than vanners.

The question of whether to melt or cyanide the concentrate has not yet been decided at the Plymouth plant, and for this reason preference was given to the vanners. The Isbell vanners were chosen in place of Frue vanners for the reason that most reliable information received from various quarters indicated that the Isbell vanner is more easily and more cheaply operated than the Frue, and the first two months of operation at Plymouth amply confirm this.

Classification

The classification system of the Plymouth plant consists of a sloughing-off cone followed by a two-spigot Richard hindered-settling classifier, as shown in Fig. 6. The sloughing-off cone has an inside cylinder, which causes it to work like a spitzlutte. The area of the classifying column is so calculated that the flow of the pulp will carry over only material finer than 40-mesh. All the coarser material discharges through the bottom spigot together with a certain amount of slime, and this discharge, suitably diluted, flows to the two-pocket Richards hindered-settling classifier, where the coarse sand is separated from the fine sand and slime. The classifier discharges are fed to two No. 6 Wilfley tables and the fine-sand overflow of the classifier goes to six Isbell vanners which are especially adjusted for handling this comparatively coarse material. This two-

step classification gives very satisfactory results, as the bulk of pulp to be separated by hydraulic classification is greatly reduced. The overflow of both the cones and the classifier is sent to distributing barrels (see Fig. 8), and is distributed automatically by these to the vanners.

The Mother Lode ore is so easily concentrated that

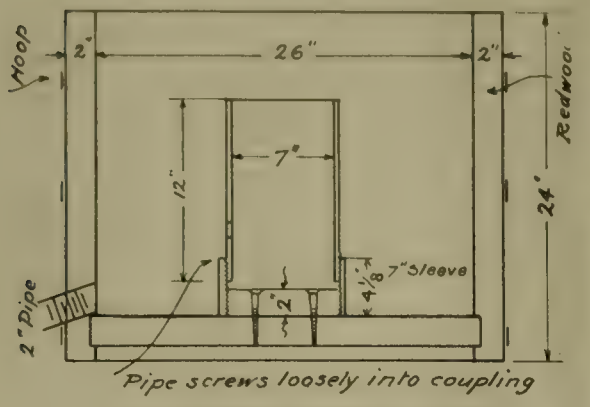


FIG. 8. DISTRIBUTING BARREL FOR VANNERS.

it does not require close classification. Tests made in various plants of the district have proved that there is no decided advantage in hydraulic classification, which usually dilutes the pulp to such an extent that it does more harm than good.

The object of the classification at Plymouth is twofold: The first object is to separate all the coarse material which requires further grinding; the second object is to remove the coarse sand from the vanners, which thereby are relieved of a large portion of the material most difficult for them to handle; the classifiers also protect the vanners from oversize material that occasionally gets into circulation owing to accidents of some kind or other.

Most of the hydraulic water used in the classifier goes to the Wilfley table, and here it is separated and sent to waste, so that the Plymouth system of classification does not cause any appreciable dilution of the pulp.

Sectional samples taken along the discharge edge of the Wilfley tables show that the highest losses are contained in that portion of the tailing which is nearest to the concentrate, and in the very coarse grains which are discharged close to the head-motion end of the table. When the ore is low-grade, only the first half of the Wilfley tailing is returned to the Hardinge mills; but when the ore is high-grade, that is, when it will assay over $6 per ton, then the total Wilfley tailing is returned for regrinding.

The six Isbell vanners working on the overflow of the hydraulic classifier handle a pulp consisting chiefly of 60 to 100-mesh sand almost free of colloidal matter, and on these vanners the tailing losses due to slimed sulphides are therefore comparatively small.

The largest percentage of the total tailing loss is due to the gold contained in the colloids. What the cause of this loss is, has not yet been thoroughly investigated, but probably it must be debited to the arsenopyrite, which has a tendency to float. With the two-stage crushing system in use at the Plymouth plant, this loss has probably been reduced to less than that in most plants of the district.

METALLURGICAL AND ECONOMIC RECOVERIES

The metallurgical and economic recovery of the new plant has not yet been determined accurately, for the reason that the automatic samplers have been installed only lately, and also because no accurate tonnage figures will be available until the automatic weigher is installed on the belt-conveyor. Judging from the comparative assay of the ore, concentrates, and tailing, it appears that the recovery must be very close to 90%. The average assay of all samples so far taken since the starting up of the plant:

	Number of samples.	Avg. gold assay, oz.
Heads	45	0.2430
Plate tailing	25	0.1070
Total tailing	49	0.0288
Wilfley tailing	9	0.0395
Vanner concentrate	45	3.0600
Wilfley concentrate	45	6.7500

Explosives Manufactured in the United States in 1913

The production of explosives in the year 1913 has just been published by the U. S. Bureau of Mines. The total output, according to the figures received from manufacturers, was 463,514,881 lb. (231,757 short tons), as compared with 489,393,131 lb. (244,696) short tons, in 1912. This production is segregated as follows: black powder, 194,146,747 lb.; 'high' explosives, other than permissible explosives, 241,682,364 lb.; and permissible explosives, 27,685,770 lb. These figures represent a decrease of 36,146,622 lb. of black powder, and an increase of 7,212,872 lb. of high explosives, and 3,055,500 lb. of permissible explosives. The figures show that in 1902 only 11,300 lb. of permissible explosives was used in coal mining, whereas in 1913 the quantity so used was 21,804,285 lb. The quantity of permissible explosives used in the United States is larger than in a number of foreign countries. In 1912 it represented about 5% of the total quantity of explosives produced, and in 1913 6%. The total amount of explosives used for the production of coal in 1913 was 209,352,938 lb., of which about 10% was of the permissible class, compared with 8% in 1912. The use of permissible explosives in coal mining has had gratifying results, and few, if any, serious accidents can be attributed directly to their use.

THE New Zealand Sulphur Co. has spent about $100,000 in preparations for mining sulphur on White island, a volcanic area in the Bay of Plenty of the North Island, but during September it was found that the camp had been demolished and 10 men killed by the collapse of a high cliff; probably by some volcanic disturbance.

Secondary Sulphide Enrichment of Copper Ores With Special Reference to Microscopic Study

By AUSTIN F. ROGERS

It is now a well established fact that many workable copper deposits, especially of the disseminated type, owe their value to the process known as secondary sulphide enrichment. Considerable interest attaches to secondary enrichment from both a scientific and economic standpoint. The theory of secondary sulphide enrichment was first clearly announced in 1900 by W. H. Weed,[1] by S. F. Emmons,[2] and by C. R. Van Hise,[3] independently, though both James Douglas[4] and J. F. Kemp[5] had recognized a zone of enrichment at Butte, Montana. F. De Launay,[6] the leading French authority on ore-deposits, had imperfectly outlined the process of sulphide enrichment in 1897, but it was first hinted at by Gonzalo y Tarin[7] in his monograph on Huelva (Spain) in 1888. In Huelva are situated the famous pyritic deposits of Rio Tinto, in which not only Gonzalo y Tarin, but also F. Klockmann[8] and J. H. L. Vogt[9] found evidences of enrichment. In spite of the preliminary work of these European geologists, the principle of secondary sulphide enrichment was first clearly established by American geologists and Americans have also made the principal contributions to the subject since that time. Though the German writers on ore deposits recognize secondary enrichment under the name *die zone der reichen sulphide* or *zementationszone*, they lay little stress upon it.

Geological Study of Secondary Enrichment

The study of secondary sulphide enrichment may be approached from the geological, chemical, or microscopic standpoints. A fairly detailed geological study of secondary enrichment has been made at a number of American mining districts. An excellent summary of sulphide enrichment has recently been given by W. H. Emmons,[10] and the influence of topography, altitude, climate, glaciation, structure, etc., upon secondary enrichment is known in a general way at least.

Chemical Study of Secondary Enrichment

While much remains to be done upon the experimental side, our knowledge of the chemical processes involved in sulphide enrichment is fairly complete in its broad outlines. The first experimental work in sulphide enrichment was probably done by C. F. Tolman, who, working under the direction of H. V. Winchell[11] in 1899-1900, produced cuprous sulphide films on pyrite. This experiment was an attempt to explain the occurrence of the Butte chalcocite.

In attempting to explain covellite pseudomorphs after sphalerite found at Galena, Kansas,[12] in 1900 I produced cupric sulphide by heating zinc sulphide and copper sulphate together in a sealed tube. Covellite as a replacement of sphalerite has since been observed by Lindgren, Irving, Butler, and others. The experimental work of H. N. Stokes,[13] R. C. Wells,[14] and E. C. Sullivan[15] has furnished valuable clues to the possible chemical changes involved in secondary enrichment. The best discussion of the chemistry of sulphide enrichment in electrolytic solutions is that by A. C. Spencer,[16] while the recent work of J. D. Clark[17] at Stanford University throws much light upon the rôle of colloidal solutions in sulphide enrichment.

Microscopic Study of Secondary Enrichment

Advances in the study of secondary enrichment in the near future are likely to be largely on the microscopic side. It is with this phase of the subject that the present paper is concerned. Discussion is limited to copper minerals and applies especially to chalcocite enrichment.

The use of the metallographic or reflecting microscope in the study of opaque ores and minerals was first pointed out by Wm. Campbell.[18] Since the application of the metallographic microscope to the study of the Cobalt (Ontario) ores,[19] brief scattering papers have appeared from time to time, but the recent paper of L. C. Graton and J. Murdoch,[20] on 'The Sulphide Ores of Copper—Some Results of Microscopic Study,' constitutes an important contribution of some length. With this paper the microscopic study of secondary sulphide enrichment may be said to have fairly begun. In a recent microscopic study of a magmatic copper sulphide ore from the Engels mine in Plumas county, Cali-

[1] *Bull.* Geol. Soc. Am., 11, 179-206.
[2] *Trans.* Am. Inst. Min. Eng., 30, 177-217.
[3] *Trans.* Am. Inst. Min. Eng., 30, 27-177.
[4] *Trans.* Am. Inst. Min. Eng., 19, 693 (1891).
[5] 'Ore Deposits of the United States' (2nd Ed.), New York, 1896, p. 163.
[6] Ann. de Mines, 12, 119 (1897).
[7] Reference cited by G. F. Becker. [8] *Trans.* Am. Inst. Min. Eng., 43, 653 (1911).
[8] Sitzber. d. Konigl. preuss. Akad. d. Wiss. Berlin, 46, 1173 (1894).
[9] Zeit. für Prakt. Geol. Jahrgang, 1899, p. 241-254.
[10] U. S. Geol. Surv. *Bull.* 529 (1913).
[11] *Bull.* Geol. Soc. Am., 14, 269-276 (1903).
[12] Kans. Univ. *Quar.*, 9, 164 (1900).
[13] U. S. Geol. Surv., *Bull.* 186 (1901); *Econ. Geol.* 2, 14-23 (1907).
[14] *Econ. Geol.*, 5, 1-19 (1910).
[15] U. S. Geol. Surv. *Bull.* 312 (1907). *Trans.* Am. Inst. Min. Eng., 143-5 (1907).
[16] *Econ. Geol.*, 8, 621 (1913).
[17] *Bull.* Univ. New Mexico, Chem. Series, 1, 79 (June 1914).
[18] *Econ. Geol.*, 1, 747 (1906).
[19] Campbell and Knight, *Econ. Geol.*, 1, 767 (1906).
[20] *Trans.* Am. Inst. Min. Eng., 45, 26 (1913).

fornia, I[21] came to the conclusion that the chalcocite and the covellite had been formed at the expense of the bornite by ascending solutions. To express this idea the term 'upward secondary sulphide enrichment' was coined. But before upward enrichment is discussed it is necessary to review our conception of downward enrichment.

Downward Sulphide Enrichment

The theory of downward sulphide enrichment may be briefly summarized in the words of W. H. Emmons.[22] "Many deposits, especially of ores of copper, are leached near the surface and are richer below the leached zones. The ore at still greater depths is of lower grade. According to the theory the copper leached from the upper zone has been carried downward and re-deposited, forming an enriched zone, and the deeper, lower grade sulphide ores are assumed to be like the original or primary mineralization of the whole deposit." The review of secondary enrichment by W. H. Emmons, from which the above paragraph is taken, is the most complete one that has yet appeared. C. F. Tolman[23] also has published an excellent short summary. But practically all that has been written on sulphide enrichment applies only to downward enrichment. The possibility of enrichment by ascending solutions is ignored and it is assumed that sulphide enrichment is always produced by descending solutions. It is significant, however, that the title of an important paper by F. L. Ransome,[24] is 'Criteria of Downward Sulphide Enrichment.'

Upward Sulphide Enrichment

A brief microscopic examination of some of the rich chalcocite-bearing ores from Butte furnished me evidence that the massive chalcocite had been formed at the expense of bornite. Taking this together with geological evidence given by Reno Sales,[25] that chalcocite was formed by ascending solutions, there was practically proof of the formation of the Butte chalcocite by upward secondary sulphide enrichment. This was announced in a paper[26] published in December 1913. The microscopic work of the writer has been checked by the detailed work of J. C. Ray,[27] who proves that the chalcocite is a metasomatic replacement of other minerals, including bornite as well as enargite and covellite. The geological evidence brought forward by Mr. Sales is incontrovertible, and the same may be said of the microscopic work of Mr. Ray.

As was the case in downward enrichment, it also is found that there are hints of the idea of upward enrichment in the literature. Mr. Weed,[28] for example, attributes the bonanza silver ores of Neihart, Montana, and the enargite of Butte, Montana, to secondary enrichment by ascending solutions. Mr. Kemp,[29] in discussing deep-seated chalcocite at Butte, says: "Most reasonable of all would appear to be W. H. Weed's suggestion of secondary enrichment by uprising solutions of copper set in action perhaps by the late rhyolite. * * * Mr. Weed applies his conclusions to the enargite at Butte, but as the glance is being found deeper and deeper we may at least raise the question whether the lower deposits may not also have been introduced from the depths."

In the Engels mine, Plumas county, California, recently described by H. W. Turner and A. F. Rogers,[30] there is evidence of the formation of chalcocite and covellite by ascending hydrothermal solutions which replaced bornite. The bornite in this case is of magmatic origin and there is no evidence of two generations of bornite. The occurrence of chalcocite in hard, dense norite-diorite and in tight pegmatites, both of which are slightly sericitized, but with no evidence of silicification, kaolinization, or oxidation, is an argument in favor of enrichment by ascending solutions. In the Engels mine there seems to have been continuity in ore-deposition beginning with the early magmatic stage (magnetite), progressing through the late magmatic stage (chalcopyrite and bornite) and ending with the hydrothermal stage (chalcocite). The apparent relation of the chalcocite-bearing ores to present surface topography may be explained by the experimental work of J. D. Clark,[31] who found that colloidal copper sulphides may be precipitated by the loss of a dispersing agent (hydrogen sulphide) without the intervention of electrolytic solutions. Tolman and Clark[32] have recently advanced the thesis "that the zones of ore deposition correspond to the zones of escape of volatile dispersing agents." There is no evidence of a definite zone of secondary enrichment in the Engels mine, and the absence of pyrite probably accounts for the absence of downward enrichment, for as far as known, downward sulphide enrichment is dependent upon pyrite, marcasite, or pyrrhotite.

With definite proof, at least for the Butte ores, of the formation of chalcocite at the expense of bornite by ascending solutions, checked as it is by the work of J. D. Clark, there can be but little doubt as to the fact, but there is room for differences of opinion as to the terms to be used. Some will object to the term 'upward secondary enrichment' and will use the term 'primary enrichment' for the process outlined in the preceding paragraphs, but as Mr. Ransome[33] has pointed out: "The term *primary* * * * denotes merely a sequential relation * * *" Much confusion has resulted from the use of terms 'primary' and 'secondary' in the double sense of sequence and genesis. Graton and Murdoch[34] use the

[21] *Econ. Geol.*, 8, 781 (December 1913).
[22] U. S. Geol. Surv. *Bull.* 529, p. 9, 1913.
[23] *Mining and Scientific Press*, 106; 38, 141, 178 (1913).
[24] *Econ. Geol.*, 5, 205 (1910).
[25] *Bull.* Am. Inst. Min. Eng., 80, 1523 (August 1913).
[26] *Econ. Geol.*, 8, 781 (1913).
[27] *Econ. Geol.*, 9, 463 (July 1914).
[28] *Trans.* Am. Inst. Min. Eng., 33, 747 (1902).
[29] *Mining and Scientific Press*, 94, 402 (1907).
[30] *Econ. Geol.*, 9, 359 (June 1914).
[31] *Loc. cit.*, p. 132.
[32] *Econ Geol.*, 9, p. 591 (September 1914).
[33] U. S. Geol. Surv. *Bull.* 540, p. 152 (1914).
[34] *Loc. cit.*

term 'primary' for minerals produced by hot ascending solutions and 'secondary' for minerals produced by cold descending solutions and have apparently overlooked the fact that some of the copper sulphides have resulted from the replacement of earlier formed sulphides by means of ascending solutions. Yet in this same paper they often use these terms in a mineralogical sense.

In my opinion, it is preferable to use the terms 'primary' and 'secondary' in the mineralogical sense. By a secondary mineral the mineralogist means one that is formed at the expense of, or by the replacement of an earlier formed mineral. 'Upward' and 'downward' (or Mr. Ransome's equivalent terms, 'hypogene' and 'supergene'[35]) may then be used to indicate the source of the solutions. The logical term for the process by which the Butte chalcocite was produced is 'upward secondary sulphide enrichment,' for enrichment involves any natural process of increasing the value of an ore, sulphides or sulpho-salts are involved, the chalcocite is secondary in a mineralogical sense, and the solutions were ascending. The only objection is that 'enrichment' is a geological, rather than a mineralogical term, in that the orebody or zone as a whole, not a polished section or single hand specimen, is considered. In view of this, it is doubtful whether the term 'secondary enrichment' itself may be consistently used. C. F. Tolman, writing in the *Mining and Scientific Press*, January 24, 1914 (Vol. 108, p. 172), has remarked: "It would be difficult to invent a more inappropriate and inaccurate name for the process than 'secondary sulphide enrichment'."

Another point to be considered is that chalcopyrite and bornite are often formed by the replacement of pyrite, usually by ascending solutions, and, as pointed out by Tolman and Clark, many so-called primary (hypogene) ores are the product of successive stages of mineralization by replacement. In a mineralogical sense these are also secondary. There should be some agreement as to the use of these terms. I do not insist upon the term 'upward enrichment,' but simply use it for the sake of argument until the whole matter is threshed out.

Microscopic Characters of the Copper Sulphide Ores

The microscopic study of polished sections of the copper sulphide ores reveals many interesting relations. Minerals that are apparently pure and homogeneous often prove to be mixtures. Metasomatic alteration of one mineral by another is common, and the various changes brought about by ore-forming solutions seem to have been faithfully recorded. Some of the transformations are so sluggish that remnants of the early stages are often preserved through the later stages.

On the accompanying plates, I and II, I have assembled a picked lot of microphotographs of polished sections of enriched copper sulphides from nine different localities. These photographs were taken with the large Leitz microscope. Colored screens were used to bring out contrasts in the minerals. The irregular dark areas are cavities gouged out during the grinding of the section, and the fine sharp lines are scratches produced during the final polishing.

Discussion of copper sulphide deposits usually involves a discussion of pyrite, chalcopyrite, bornite, chalcocite, and covellite. Of these sulphides, pyrite is the earliest formed mineral and is often present as residual grains (Fig. 4 and Fig. 6), persistent in the very late stages. Pyrite is nearly always an original mineral. Chalcopyrite and bornite are often formed at the expense of pyrite, usually by ascending solutions. For the most part they are practically contemporaneous (Fig. 1), though bornite is a little later, that is, the periods of formation overlap. Either chalcopyrite or bornite (not often both, as Spencer has emphasized) is usually an intermediate step in the transformation of pyrite to chalcocite.

Chalcocite is practically always a metasomatic mineral except locally. Chalcocite crystals have been found in cavities in the Edith May vein of the Speculator mine (2400-ft. level) at Butte, by J. C. Ray, and minute chalcocite crystals in cavities were found by C. F. Tolman at the Gray mine, Globe, Arizona. Distinct chalcocite crystals are also known from Cornwall, from Montecatini, Italy, from Bristol, Connecticut, and from several other localities. Chalcocite is formed at the expense of both chalcopyrite (figures 1 and 3) and bornite (figures 1, 2, 4, and 6 to 12), but seems not to form from pyrite while either chalcopyrite or bornite is present. Fig. 4 furnishes evidence of this fact. The bornite is a replacement of pyrite and the chalcocite of bornite, but the cessation of pyrite replacement during the chalcocite stage is evident. Veinlets of chalcocite in pyrite from the Ludwig mine, Lyon county, Nevada, and from Bingham, Utah, contain residual specks of chalcopyrite, showing clearly that the chalcocite is a replacement of chalcopyrite, but not of pyrite. Mr. Lindgren[36] states that "pyrite apparently does not precipitate Cu_2S or CuS while zinc-blende is present." Mr. Spencer[37] comments on the scanty replacement of pyrite by chalcocite in the porphyry ores of Ely. In view of these facts, the statement[38] that chalcocite is the usual derivative of pyrite is questioned. The presence of residual grains of pyrite in a matrix of chalcocite is no proof that the chalcocite replaced pyrite. Figures 5 and 6 of Graton and Murdoch's paper[39] prove that the chalcocite is a metasomatic alteration of bornite, but not of pyrite. But undoubtedly under certain conditions pyrite changes directly to chalcocite. The chalcocitization of pyrite has been proved by Mr. Lindgren at Morenci, Arizona, and by Mr. Tolman at Ray, Arizona. The condition favoring chalcocitization of pyrite is probably either acidity of the solutions (indicated by the Winchell-Tolman synthesis of chalcocite) or long-continued action of the solutions.

Covellite is formed at the expense of both chalcopyrite (Fig. 5) and bornite (Fig. 9), usually in lath-shaped

[35]U. S. Geol. Surv. *Bull.* 540, 152-3 (1914).

[36]U. S. Geol. Surv. *Prof. Paper* 43, p. 183 (1905).

[37]*Econ. Geol.*, 8, 643 (1913).

[38]Graton and Murdoch, *loc. cit.*, p. 39.

[39]*Loc. cit.*, p. 71.

PLATE I. MICROPHOTOGRAPHS OF POLISHED SECTIONS ILLUSTRATING DOWNWARD SULPHIDE ENRICHMENT

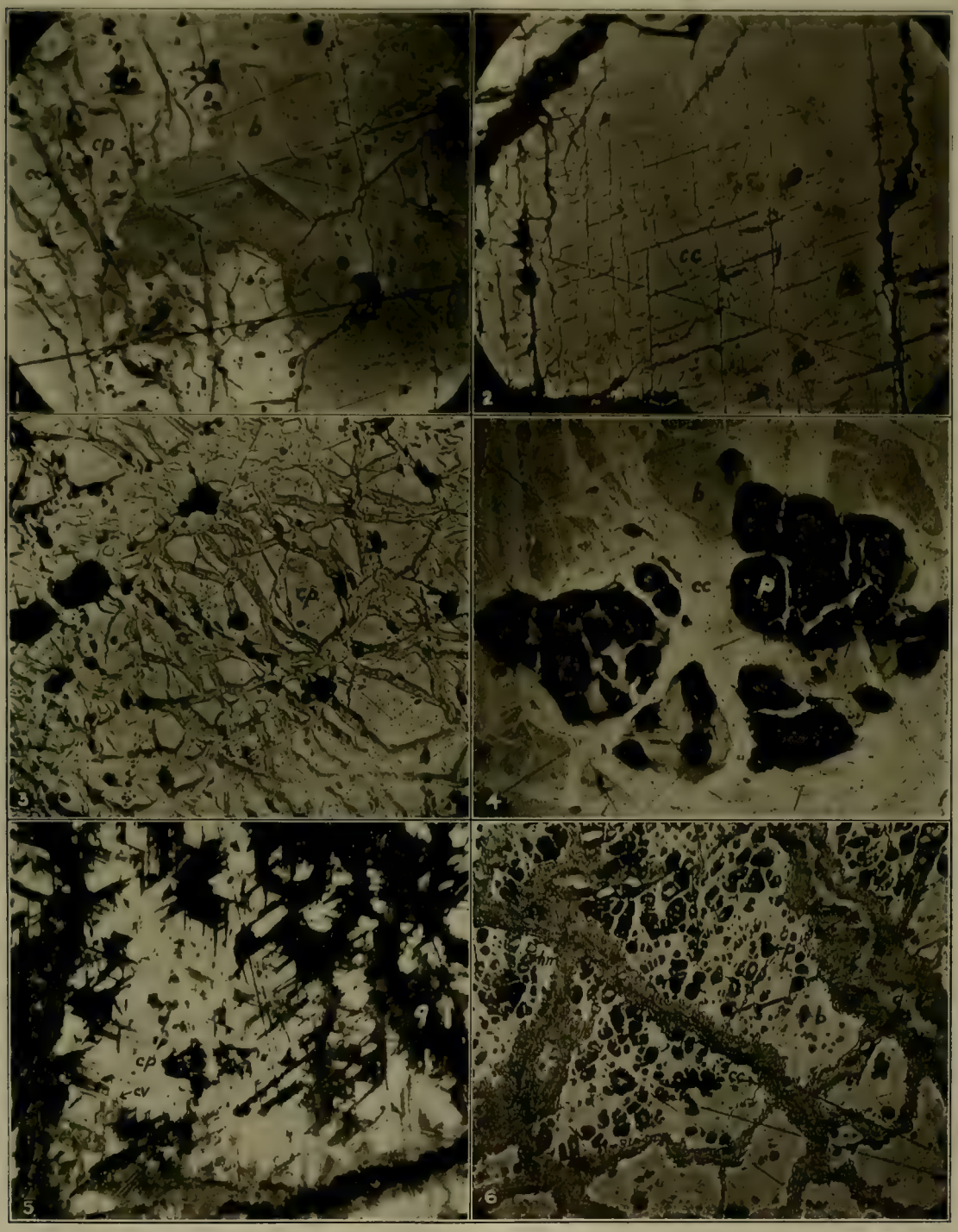


FIG. 1. (× 48) CHALCOPYRITE (cp) AND BORNITE (b) CUT BY VEINLETS OF CHALCOCITE (cc). BINGHAM, UTAH.

FIG. 2. (× 15) CHALCOCITE (cc) WITH REMNANTS OF BORNITE (b), ETCHED WITH NITRIC ACID. BINGHAM, UTAH.

FIG. 3. (× 45) CHALCOPYRITE (cp) ALTERING TO CHALCOCITE (cc). LUDWIG MINE, LYON COUNTY, NEVADA.

FIG. 4. (× 65) BORNITE (b) ALTERING TO CHALCOCITE (cc) WITH REMNANTS OF PYRITE (p). PODEROSA MINE, COLLAHUASI, CHILE.

FIG. 5. (× 220) CHALCOPYRITE (cp) ALTERING TO COVELLITE (cv) ALONG QUARTZ (q) VEINLETS. RAMBLER MINE, WYOMING.

FIG. 6. (× 59) BORNITE (b) ALTERING TO CHALCOCITE (cc) AND THE LATTER TO MELACONITE (m) ALONG QUARTZ (q) VEINLETS WITH REMNANTS OF HEMATITE (hm) AND PYRITE (p). SIERRA OSCURA MOUNTAINS, NEW MEXICO.

or acicular crystals. It is formed both by ascending (Fig. 5) and by descending (Fig. 9) solutions and often accompanies chalcocite.

Chalcopyrite of the second generation is fairly common in small amounts, as has been pointed out by Graton and Murdoch. It usually occurs as narrow gashes in bornite and can easily be distinguished from chalcopyrite of the first generation by structural relations. As it is produced by both upward and downward enrichment, it is probably formed under alkaline conditions. The neutralization, at depth, of the acid solutions which produce downward sulphide enrichment was first emphasized by Mr. Tolman.[40]

The general order of succession of the usual minerals involved in secondary enrichment is: (1) pyrite; (2) chalcopyrite; (3) bornite; (4) covellite; (5) chalcocite. Chalcocite may be followed by melaconite (Fig. 6) or cuprite, and these in turn by malachite, azurite, or chrysocolla. The only important reversal of this order is the formation of a second generation of chalcopyrite after the bornite. The formation of chalcocite does not necessarily involve the intermediate steps of chalcopyrite, bornite, and covellite, for it may form directly from bornite (figures 1, 2, 4, and 6 to 12) from chalcopyrite (Fig. 3), and even from pyrite. The tarnishes observed on chalcopyrite by Mr. Spencer[41] are simply interference colors due to thin films and there is no proof that these films are covellite and chalcocite.

This paper is an attempt at the standardization of the two contrasted types of secondary sulphide enrichment, one brought about by descending solutions, the other by ascending solutions. Graton and Murdoch attempted to distinguish primary (hypogene) structures and secondary (supergene) structures, but they do not clearly differentiate the two types. They have paved the way for future work, and without their valuable paper the present paper would not have been possible. These types are based upon the study of a number of specimens of known geologic occurrence. It may seem premature to attempt this standardization from a study of a limited number of specimens, but if the microscopic work is to be of much value, generalizations of this nature are necessary.

Microscopic Criteria of Downward Sulphide Enrichment

Figures 1 to 6 are believed to represent types of alteration brought about by descending solutions. The solutions have penetrated the earlier sulphides along anastomosing channels and have produced a structure which is regular compared with that due to ascending solutions (compare figures 7 to 11).

Narrow veinlets of quartz related to the introduction of chalcocite (figures 1 and 6) or covellite (Fig. 5) are characteristic of downward enrichment. The occurrence of melaconite as an alteration of chalcocite (Fig. 6) is also characteristic of this type. Remnants of bornite (figures 4 and 6) and chalcopyrite (Fig. 5) resulting from replacement by chalcocite are sub-angular.

Figures 1 and 2 are microphotographs of specimens from the mineralized quartz-monzonite of Bingham, Utah, extensively mined by the Utah Copper Co. These are both from narrow solid veins of sulphides cutting the monzonite. In Fig. 1 chalcopyrite and bornite are both altered to chalcocite along narrow veinlets. Some of the Bingham polished sections also show melaconite as an alteration product of chalcocite. According to J. M. Boutwell[42] the disseminated chalcocite of the quartz-monzonite is the result of downward enrichment. A specimen of massive chalcocite with a few remnants of bornite (Fig. 2) on being etched with nitric acid develops structure which proves that the individual chalcocite crystals must be at least 1 cm. in size. This shows that Graton and Murdoch's[43] criterion of supergene chalcocite based upon the well developed cleavage cannot be relied upon.

Fig. 3 represents the change of chalcopyrite to chalcocite in a specimen from the sulphide enrichment zone at the Ludwig mine, Lyon county, Nevada. There is a rather indefinite zone of rich chalcocite-bearing ore just below the oxidized zone and above the low-grade chalcopyrite-bearing pyrite. The presence of selenite in the chalcocite-bearing ore is proof of downward enrichment. Fig. 4 is a microphotograph of a specimen from 3S level of the Poderosa mine at Collahuasi, Chile, collected by B. Bryan and C. L. Severy. Not very much is known about the geology of the Poderosa mine, but the chalcocite is undoubtedly formed by descending solutions. In Fig. 5 (Rambler mine, Wyoming) is represented the replacement of chalcopyrite by acicular crystals of covellite along definite crystallographic directions. The ingress of the covellite-forming solutions along narrow quartz veinlets is indicative of supergene origin. Fig. 6 is a microphotograph of a lignite replacement from the Sierra Oscura mountains, New Mexico, collected by H. W. Turner. The so-called chalcocitized lignite of this ore deposit consists of hematite, pyrite, bornite, chalcocite, and melaconite, formed in succession in the order named. Narrow rims of chalcocite are formed around, and at the expense of the bornite. The occurrence of melaconite surrounding the chalcocite is considered proof of the action of descending solutions at a late stage at least. From the geological evidence brought forward by Mr. Lindgren[44] in a discussion of the 'Red Beds' type of ore deposit, to which the Sierra Oscura deposit belongs, it is probable that all the minerals mentioned were deposited by descending solutions. This question will be discussed in a forthcoming paper.

Microscopic Criteria of Upward Sulphide Enrichment

Butte is taken as the type of upward enrichment deposit, for the geological work of Sales combined with the

[40] *Mining and Scientific Press*, 99, 360 (1907).
[41] *Loc. cit.*, p. 625-6.
[42] U. S. Geol. Surv. *Prof. Paper* 38, p. 172 (1905).
[43] *Loc. cit.*, p. 769.
[44] *Econ. Geol.*, 6, 568 (1911).

PLATE II. MICROPHOTOGRAPHS OF POLISHED SECTIONS ILLUSTRATING UPWARD SULPHIDE ENRICHMENT.

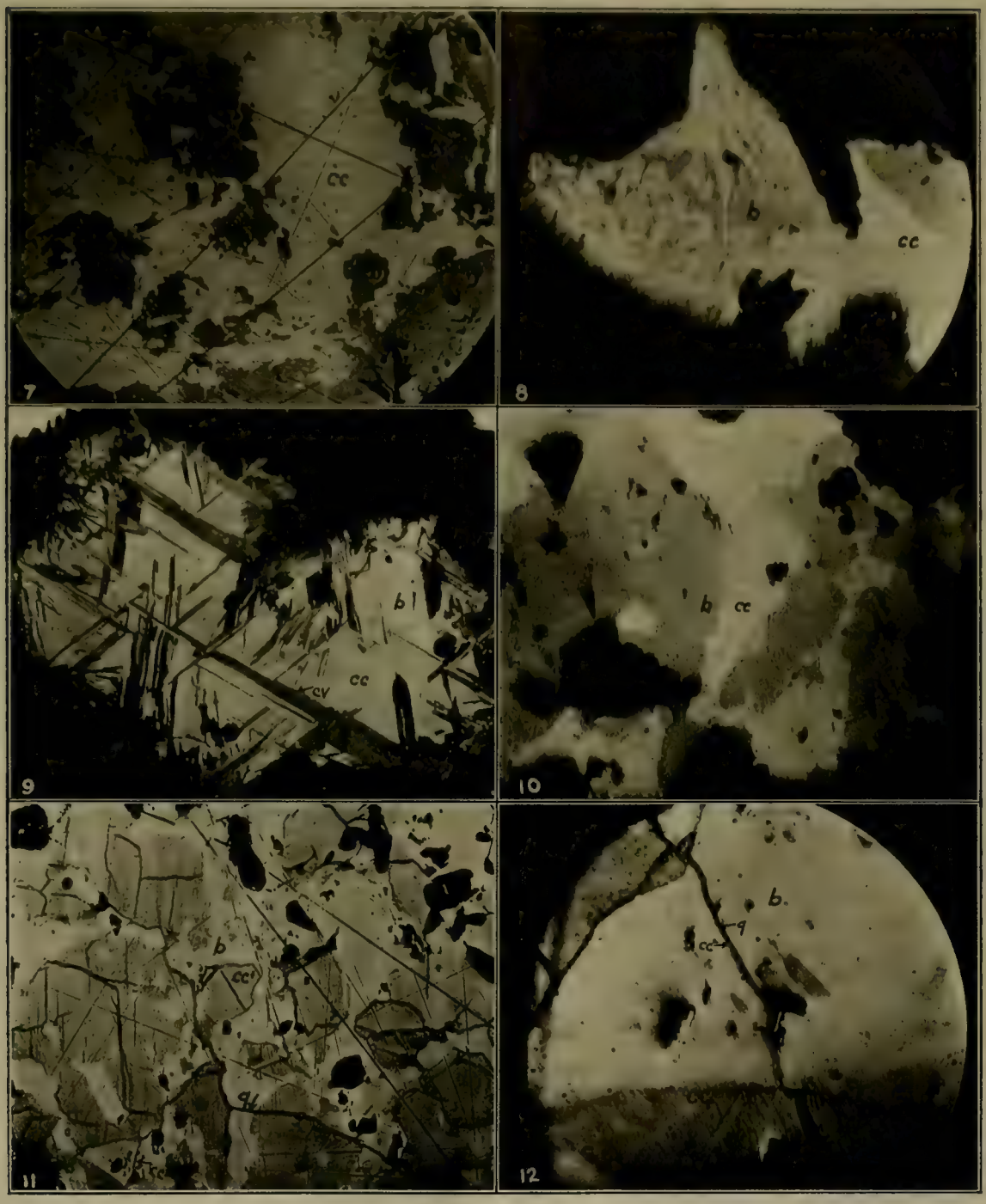


FIG. 7. (× 48) BORNITE (b) ALTERING TO CHALCOCITE (cc). ELM ORLU MINE, BUTTE, MONTANA.

FIG. 8. (× 80) SO-CALLED GRAPHIC INTERGROWTH OF BORNITE (b) AND CHALCOCITE (cc). ENGELS MINE, PLUMAS COUNTY, CALIFORNIA.

FIG. 9. (× 220) COVELLITE (cv) AND CHALCOCITE (cc) FORMED AT THE EXPENSE OF BORNITE (b). ONLY A LITTLE BORNITE REMAINS. ENGELS MINE, PLUMAS COUNTY, CALIFORNIA.

FIG. 10. (× 240) BORNITE (b) ALTERING TO CHALCOCITE (cc). THE BORNITE IS A MAGMATIC MINERAL. EVERGREEN MINE, APEX, GILPIN COUNTY, COLORADO.

FIG. 11. (× 66) SO-CALLED INTERGROWTH OF BORNITE (b) AND CHALCOCITE (cc^1) WITH QUARTZ (q) VEINLETS BORDERED BY CHALCOCITE OF THE SECOND GENERATION (cc^2). SNAKE RIVER, FOUR MILES NORTH OF HOMESTAKE, SEVEN DEVILS DISTRICT, IDAHO.

FIG. 12. (× 465) A SMALL PORTION OF LOWER LEFT-HAND CORNER OF FIG. 11 GREATLY MAGNIFIED TO SHOW SECOND GENERATION OF CHALCOCITE (cc^2) BORDERING THE QUARTZ VEINLETS (q).

[1] and [2] (In figures 11 and 12 the chalcocite appears darker than bornite, on account of the screens used in photography.)

microscopic work of Ray proves conclusively that chalcocite is the result of the metasomatic replacement of other minerals by ascending solutions. A specimen from the 1300-ft. level of the Elm Orlu mine collected by Mr. Ray is illustrated in Fig. 7. This is typical of the high-grade chalcocite ores of this part of the Butte district. The replacement of bornite by chalcocite is very irregular. No anastomosing channels are apparent. The bornite remnants in the chalcocite are irregular and often hook-shaped. The bornite seems to go to pieces almost all at once, for it apparently presents a solid front to the attack of the solutions. Fig. 7 approaches in spots the so-called graphic intergrowth of bornite and chalcocite. This is, in my opinion, not an intergrowth, but a very irregular replacement of bornite by chalcocite. On etching the Butte bornite-chalcocite intergrowth with nitric acid the chalcocite shows uniform orientation over a portion only of the intergrowth. This explains the results that F. B. Laney[45] obtained with the Virgilina specimens. The microphotographs showing the uniform orientation are highly magnified and are only portions of the whole intergrowth. The chalcocite areas with uniform orientation are doubtless skeleton crystals, but there is no reason why skeleton crystals cannot be formed by replacement of another mineral. (Note that in Fig. 9 skeleton crystals of covellite are forming at the expense of bornite which was later changed to chalcocite.) Bornite is probably a solid solution of Cu_2S in Cu_3FeS_3, and this may possibly explain the readiness with which it alters to chalcocite.

In the Engels mine, Plumas county, California, chalcocite occurs with bornite in the so-called intergrowth (Fig. 8). In the specimen from which this photograph was taken there are all gradations from the apparent intergrowths to narrow rims of chalcocite around the bornite. The right side of this figure shows the irregular nature of the replacement of bornite by chalcocite. Above is a very narrow rim of chalcocite, and below is a large area of chalcocite with no residual bornite. It should be emphasized that the bornite in the Engels mine is a magmatic mineral and the probability of the chalcocite also being a magmatic mineral is very slight indeed, for in several specimens it is definitely connected with the introduction of sericite,[46] one of the characteristic hydrothermal minerals. As there is but one generation of bornite, there is practically proof that the so-called intergrowth of bornite and chalcocite is simply an intricate replacement of bornite by chalcocite. But this intricate replacement is one of the criteria of upward secondary sulphide enrichment for at Butte, Plumas county, and Virgilina there is evidence of the formation of chalcocite by ascending solutions.

Figure 9, also from the Engels mine, is a type of replacement of bornite by covellite and chalcocite. Only a little residual bornite remains. The covellite forms along crystallographic directions of the bornite. The variation in the intensity of the covellite is due to a kind of pleochroism, as polarized light is produced by reflection. Fig. 10, representing a bornite and chalcocite mixture at the Evergreen mine, Apex, Gilpin county, Colorado, suggests upward enrichment. This seems probable from the fact that these minerals occur in an igneous dike, though the ores may be due either to magmatic segregation[47] or to an endomorphic contact effect.[48] In Fig. 11, from a mine on the Snake river, four miles north of Homestead, Seven Devils district, Idaho (collected by E. Call Brown), bornite and chalcocite occur in a relation which approaches the so-called graphic intergrowth. This chalcocite is probably formed by ascending solutions at the expense of bornite. The figure shows many quartz veinlets, and while these veinlets undoubtedly indicate descending solutions, they bear no relation to the chalcocite. On high magnification (Fig. 12, × 465 diameters) the quartz veinlets that cut the bornite are bordered by very narrow rims of chalcocite of a second generation. Here, then, is the superposed effect of downward enrichment upon upward enrichment in the same specimen.

Summary

1. The field study of secondary sulphide enrichment should be supplemented by microscopic study. The microscopic study is valuable, for the field study of an ore deposit is usually limited.

2. Secondary enrichment, especially chalcocite enrichment, is brought about not only by descending solutions, but also by ascending solutions. Upward chalcocite enrichment is probably due to the precipitation of dispersed colloidal copper sulphides brought about by the release of hydrogen sulphide.

3. Though downward enrichment and upward enrichment have certain features in common, such as the occurrence of chalcocite or covellite and often chalcopyrite of the second generation, they may usually be distinguished by careful microscopic study.

4. Criteria of *downward* chalcocite enrichment may be summarized as: (*a*) comparatively regular replacement along anastomosing channels; (*b*) the presence of quartz veinlets related to chalcocite deposition; (*c*) the association of melaconite with chalcocite along veinlets.

5. Criteria of *upward* chalcocite enrichment may be summarized as follows: (*a*) irregular, intricate replacements; (*b*) the presence of so-called graphic intergrowths of bornite and chalcocite; (*c*) presence of sericite related to chalcocite deposition.

Two dredges of the Orsk Goldfields company, Siberia, handled 178,000 cu. yd. in July, yielding $43,000. Tributers recovered $17,300 also. The war has not affected operations.

Oil output of Japan for the first half of 1914 was 992,962 *koku* (945,680 bbl.), against 798,589 *koku* (760,560 bbl.) in the corresponding period of last year.

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[45] *Econ. Geol.*, 6, 399 (1911).

[46] *Econ. Geol.*, 9, 386 (June 1914).

[47] E. Ritter, *Trans.* Am. Inst. Min. Eng., 38, 751 (1907).

[48] E. S. Bastin and B. S. Hill, *Econ. Geol.*, 6, 465 (1911).

Upper Yenesei Valley and Adjacent Mongolia

By AN OCCASIONAL CONTRIBUTOR

The Uriankhai region, between approximately 91 and 98° east longitude and 50 to 53° north latitude, is almost entirely unknown to Western civilization, but is likely to attract attention now that Mongolia has made a treaty with Russia and opened her land to foreigners.

The Upper Yenesei basin, or Uriankhai, was visited by Douglas Carruthers in 1910, and his 'Unknown Mongolia' gives a full account of the topography and forest, but, in common with nearly all travelers, he has only a few words about mines; but enough to show that gold and other metals have been mined for many years. Perhaps the most startling features of the country are the dense forests, the *taiga*, almost impassable in the northern portion, and the Uriankhai natives with their herds of reindeer in the higher lands to the south.

ASIATIC SIBERIA AND MONGOLIA, SHOWING URIANKHAI DISTRICT.

The basin of the upper Yenesei, or Uriankhai, comprises an area of about 64,000 square miles, and is watered by the two main heads of the great Yenesei, namely, the Kemchik and the Ulu-Kem, with its two sources, the Kua-Kem and the Bei-Kem. The entire basin drains through a narrow defile toward the Siberian plains. On the north is the Sayansk range, 400 miles long, which merges into the Altai system on the west and is lost in nameless ranges that form the divide between Lake Baikal and Lake Kosogoa on the east. The southern boundary of the basin is Tanna-ola, extending nearly east and west for 350 miles, with flat-topped summits rising to 8000 feet on an average. To the south of the Tanna-ola lie the vast plains of Mongolia, hitherto closed to the miner by the religious scruples of the Mongols, but probably to be opened in the near future.

A report on the mineral wealth of the Uriankhai region has recently been prepared by B. M. Porvatoff, and while the production of this region to date is not significant, the future is promising, and an increased activity is anticipated. It is hardly known whether this land belongs to Russia or China. Very little is known of the mineral wealth of the Uriankhai district, but it is scarcely possible that a territory occupying an area of 64,000 square miles, intersected by the Sayansk range and the Tanna-ola, could be void of mineral resources. The Sayansk mountains, though important, are poorer than the Urals and many other Siberian mining districts.

In Uriankhai only alluvial gold has been exploited. The discovery of gold was made in the year 1839, and until the year 1913 about 379,184 oz., say $6,825,312, of placer gold had been produced. If it be assumed that the Chinese companies and 'poachers' have produced the same amount, it can be estimated that during the past 74 years there has been produced 758,369 oz. of gold, valued at $13,650,624, in the Uriankhai.

The following are the most important mining districts along the Serlich and Siotikem-Algiaki rivers: (1) On the Tapsi river, the Karachem river, and the Baisyuti river, gold is being exploited. On the Karachem river a dredge is now being built. (2) On the Elegest river, at the Chernevitch gold mine, lessees will begin to work this year. (3) On the Teploi river, at Guhanoff and Kazantzieff, placer gold is being produced with hand labor, the sand being washed in buddles and pans. (4) On the Chaidynsik Korallych-Kem-Temerchi river, lessees are at work. Besides this, gold sands have been found on the southern slopes of the Tanna-ola range and other parts of Uriankhai.

The characteristic of the Uriankhai alluvial gold deposits is the narrowness of the gold-bearing areas in the valleys and the lack of water in the rivers. During heavy rains and prolonged wet weather the Uriankhai

rivers rise rapidly and become threatening torrents, frequently destroying the surface works on the mines. The rivers at times become dangerous, not only for pack-animals, but also for men on horseback.

Generally the Uriankhai sands are poor in gold. Even such a rich system as the Iliken (Serlich) contains on an average only 50 to 60c. per cubic yard. The gold sands of the Uriankhai district are usually covered with a shallow alluvial turf. The depth of this varies from 6 to 9 ft., with an average pay-streak of 3½ to 6 ft. Where the flood washes away the soil, only a small part of the gold remains in the fissures of the river bed and in the rocks, the greater part being carried away by the floods.

Another peculiarity of the Uriankhai gold sands is that many of the deposits contain platinum with gold as an associated metal. Iridium is found more frequently with gold than with platinum; but, judging from the quantity of platinum produced with gold, it has rather a scientific interest than an industrial one. The question of the possibility of finding industrial platinum in Uriankhai must be proved by further exploration. The absence of any considerable quantity of olivine in the gold sands of the neighboring districts causes one to doubt whether there are platinum deposits of commercial importance.

Uriankhai Gold Sands

Most of the Uriankhai gold sands are capable of being worked by simple methods. Tributers produce a large part of the gold, but until the present this method of working the deposits has not been practised much, because of the distance of the gold-bearing areas from the homes of the workers and the difficult conditions under which the work has to be done. In Uriankhai, where the miners themselves do not work but simply own the ground, the tributers are able to work the gold with profit. With an improvement in transportation to Uriankhai and a larger population, it is certain that gold mining will become an important industry. The hydraulic method is impracticable in the district for lack of water, the absence of suitable places for installing a system of hydraulic washing, and other mechanical difficulties.

The gold veins of Uriankhai were first found in the Amuibsky mountains in 1904. This mine belongs to the Yushkoff company and was called the 'Gift of God.' The production of this mine in three years was 282 oz. of gold, worth about $5000. It proved to be low-grade, and its exploitation soon ceased. There was then discovered a mine on the Quisuik-Chadru river. The owners endeavored to sell it for a fabulously high price, but when examined by a Belgian company it was shown that the deposit was overestimated, and the company declined to buy it. At present it is idle. About the same time, a gold deposit was found near the watershed between the Serlich and the Pokanash rivers. This vein was found to be poor in gold and was subsequently abandoned. The lode deposit of gold on the Talovka with an average gold content of about $10 per ton, is interesting, and if the investigation at depth should yield satisfactory results, this mine promises to be one of the best gold mines in Siberia.

Mention must be made of the asbestos deposits in the basin of the Kemgik river. The asbestos is found in a large serpentine mass constituting a range of hills. This deposit was carefully investigated in the year 1912, when the high quality of the asbestos and the presence of important reserves were established. Besides gold and asbestos, coal, iron, copper, mica, agalmatolite (Chinese figure stone), rock salt, and other minerals, are known to exist in Uriankhai.

Mr. Porvatoff was also able to observe that the region is fairly rich in semi-precious stones. It must be remembered that the district has been very imperfectly surveyed, as Uriankhai is far from any of the known railways or useful waterways, and also far from the principal towns of Siberia. The roads to the nearest town of Minusinsk are poor, so that it is only possible to work the best gold deposits at present.

If one takes into consideration the small Russian and native population of Uriankhai, the low degree of civilization obtaining there, and the low efficiency of Siberian workmen, and other factors on which the success of the mining industry of the country exists, it must be concluded that many of the minerals of Uriankhai must remain unexploited for a long period. The uncertainty of Russia's political relations with Uriankhai and the nebulous state of the frontier question constitute the principal reasons for the absence of a well thought out plan for the exploitation of the whole area. Permission to exploit the mines of Uriankhai down to the present rested on a very uncertain and, in fact, incomprehensible basis. First of all, Russian mining interests could only work the Uriankhai ground for gold, and were not allowed to look for any other mineral. In some parts of Uriankhai, as in Kemchiksky, although claims for gold were admitted, the Russian government had to delay giving the right of exploitation until the frontier question with China had been settled. Further, although the Uriankhai gold miners had complied with all the requirements of the Empire in respect to taxes, they were required to sign an agreement abandoning all claims against the Russian government and to immediately stop work in case the Uriankhai should be declared Chinese territory.

Such a state is abnormal and hampers the development of mining in the country. In view of the frontier question and difficulties in prospecting the district, the Uriankhai officials carefully saw to it that the Russians made no progress.

Labor Question

Another serious difficulty that will be encountered in Uriankhai is the labor question. Workmen will have to be brought from the nearest Siberian villages or districts, and from the interior governments of Russia, which will constitute of itself a cost of about $25 per

head. The local workmen are cattle drivers or nomads. The cost of bringing supplies into the district is also great. The delivery of a dredge at the Saphyanoff property, which cost $52,500 in Petrograd, cost $38,750 to bring it to the ground where it will operate.

It is concluded that the conditions of Uriankhai are at the present unfavorable to mining. No doubt with an improvement in the ways of communication and by colonizing the territory with Russian peasants, the position would be greatly improved. A great expansion in the development of the mining industry in Uriankhai may be expected when the waterway of the upper Yenesei has been carried through and when the Achinsk-Minusinsk branch railway, that has already been authorized by the government, is built and connects Uriankhai with the Siberian trunk line.

For the successful exploitation of the district, it is requisite that the political question respecting the frontier should be clearly established; that the waterway referred to should be promptly made, and steamer traffic on the upper Yenesei established; and last, if the territory should be recognized as Russian, that Russian subjects be allowed to undertake mining operations in the district on the conditions that obtain in other parts of Russian territory.

Uriankhai being a great distance from the Siberian railway and the seaports, low tariffs should be established in order to facilitate the development of the district, particularly on minerals not much used in Russia, but for which a good export market might be established, such as asbestos, mica, vanadium ore, wolfram ore, manganese, and graphite.

Milling at the Camp Bird Mine, Colorado

From the annual report of the general manager, William J. Cox, for the year ended June 30, 1914, the following data are obtained: An average of 25 stamps worked 347.93 days and crushed 30,595 tons of dry ore. The ore yielded as follows:

Metal.	Content.	Value, per ton.	Value, per cent.	Value of output.
Gold, ounces	1.135	$22.91	87.49	$700,880
Silver, ounces	4.270	2.36	9.01	72,206
Lead, per cent	1.324	0.44	1.67	13,378
Copper, per cent	0.260	0.48	1.83	14,615
Total		$26.19		$801,079

The value in the previous year was $22.51 per ton, and the total recovery was valued at $675,630.

The cyanide plant treated 19,344 tons of tailing from the mill, and extracted $39,748. Of the recovery in the mill and plant, the processes were as follows: amalgamation, 52.97%; concentration, 42.07%; and cyanidation, 4.96%; the saving of the gold and silver in the crude ore being 94%. Costs were $1.64 in the stamp-mill, 88c. in the cyanide plant, and $3.10 per ton for bullion and concentrate charges.

Copper Smelting in Canada

Copper production of Canada in 1913 was 41,000 long tons, from over 2,500,000 tons of ore. There are six mining companies operating seven different smelting plants, two in Ontario and five in British Columbia. According to 'The Copper Smelting Industries of Canada,' by Alfred W. G. Wilson, issued by the Department of Mines, there are 29 rectangular water-jacketed copper blast-furnaces in Canada at the present time, the majority of which were in operation when the work was published; some have been blown out since the war started. The total of the hearth areas of these furnaces is 2580 sq. ft., and the rated capacity is 15,600 tons of charge per 24 hours, varying at the plants given, on account of the difference in the ores treated. Details of the furnaces are as follows:

Operating company.	No. of furnaces.	Tuyere dimensions, inches.	Hearth area, square feet.	Ore column, feet.	Capacity, short tons.
Canadian Copper Co.	5	50 by 204	70.83	14	400
" " "	1	50 by 240	83.33	14	550
Mond Nickel Co.	2	50 by 240	83.33	12	550
Consolidated M. & S. Co.	1	42 by 210	61.25	8	350
" " " "	1	42 by 360	105.00	8	650
" " " "	1	42 by 264	77.00	8	460
" " " "	1	42 by 420	122.50	8	700
" " " "	1	50 by 420	145.80	8	875
Granby Con. M. & S. Co.	6	44 by 266.5	81.41	12	500
" " " "	2	48 by 260	86.67	12	550
" " " "	3	50 by 360	125.00	12	750
B. C. Copper Co.	2	51 by 360	127.50	12	800
" " "	1	51 by 240	85.00	12	500
Tyee Copper Co.	1	42 by 120	35.00	6	200
" " "	1	48 by 160	53.33	6	300

There are also several small oval or circular water-jacketed furnaces available, but not in blast on copper ores at present. The Canadian Copper Co. has two Steptoe type reverberatory furnaces with a total hearth area of 4256 sq. ft. The situation of the furnaces tabulated is as follows: Copper Cliff and Coniston, Ontario; and Trail, Grand Forks, Anyox, Greenwood, and Ladysmith, British Columbia. Five of the plants have copper converters. These are as follows:

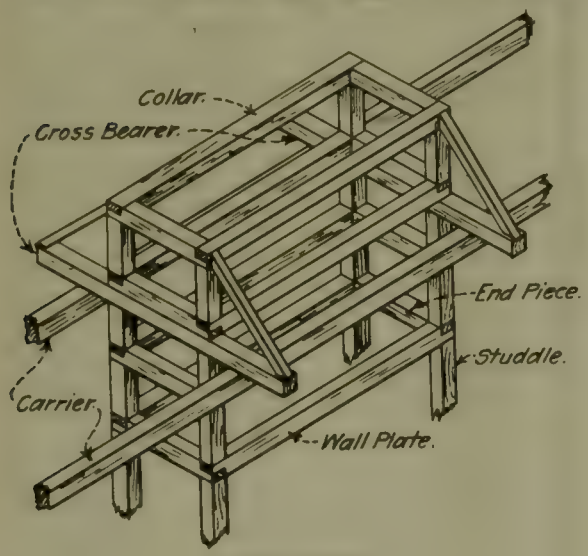
Plant.	Type of converter.	Stands.	Shells.	Dimensions, feet.
Copper Cliff.	Basic—Pierce-Smith, special	5	5	10 by 37.16
Coniston	Basic—Pierce-Smith, special	2	2	10 by 25.83
Grand Forks.	Basic—Acid shells	3	10	7 by 10.5
Anyox	Basic—Great Falls	3	3	12 by 5.75
Greenwood	Acid—Allis-Chalmers	2	5	7 by 10.5

The work from which these data were abstracted is accompanied by 43 halftones, 39 drawings, and 4 maps.

Shaft Timbering, Mesabi Range, Minnesota

By P. B. McDONALD

The accompanying sketches show timbering in an iron-mine shaft of the Mesabi range in Minnesota, and are typical of practice in that district in cases where no special difficulties are encountered, such as quicksand, but only ordinary comparatively dry overburden. The two bearing pieces or carriers, 40 or 50 ft. long, of 24 or 30-in. timber, were placed in trenches about 10 ft. apart, so that they were parallel with the long dimension of the shaft. They were leveled, and two cross-bearers, 12 by 12 in. by 20 ft., were placed perpendicularly across them 18 ft. apart. The first set was then put in place below the carriers, and the studdles of this set fitted into 1½-in. joggles cut in the cross-



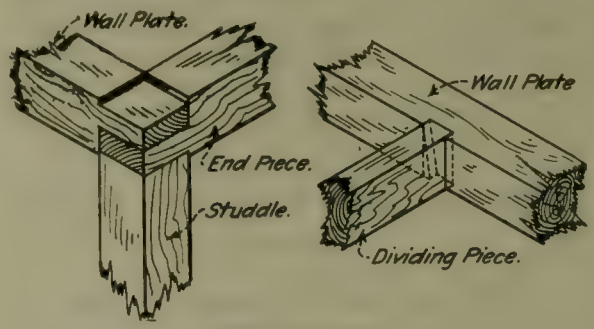
SHAFT TIMBER.

carriers. These studdles were cut so that the distance between the sets was 3 ft. 11 in. The first set below the carrier is, like the other sets, held by four hanging bolts of 1¼-in. round iron. The set which forms the collar was placed above, and was diagonally braced to both sets of bearers; four straight hanging bolts were used here instead of the jointed bolts used in the other sets; and were one foot longer than the regular 6-ft. 8-in. bolts on account of passing through the cross-carriers.

Dirt was hoisted and banked around the shaft collar, where it steadied the timber and kept out surface drainage. The middle compartment of the three into which the space was divided, was used for hoisting during sinking, and was boarded up as fast as the dividers were put in, so that the bucket would not catch. The dividers were put in as the shaft was sunk, but the last two sets were always left open to allow the wall-plates of the next set to be handled. When the end pieces and wall-plates were framed, a strip 2 by 2 in. was spiked on the outside of each piece in the centre to make a bearing for the laths, which are 2-in. plank about 4 ft. 9 in. long, and were put in at the corner studdles first, and wedged, then working toward the middle of the end pieces and wall-plates until there was space for only one lath left.

Four hanging bolts to each set are usually enough, but in heavy ground one or two more is sometimes used in the wall-plates. Divided studdles or centre studdles are put in after the dividers are put in, and since these studdles are not 'gained in' to the wall-plates, small cleats are used to hold them in place.

The second set of carriers are 12 by 12-in. timber, 16 ft. long, and to put them in place, small drifts (about 3 by 4 ft.) are run in about 8 ft. at the ends of the end pieces at two diagonally opposite corners of the shaft. Smaller drifts are run in about 4 ft. at the other two corners of the shaft. The inside corners of these 8-ft. drifts are rounded off and the bottom trued up, and short pieces of plank laid crosswise in them. A bearer is then brought down and one end is run into the 8-ft. drift; next, it is swung parallel to the end piece and the other end is run back into the 4-ft. drift. The same thing is done with the other bearer, and the two rest on the bottom boards of the drift, directly under the corresponding end pieces.



DETAIL OF JOINTS.

Long flat wedges are then driven under the bearers, on top of the boards, and as they are raised against the end pieces the hanging bolts are tightened to take up the weight.

Only light blasting is resorted to in sinking through the overburden, pick and bar work generally sufficing. The weight of the suspended sets of timber becomes an important factor as the shaft gets deeper, requiring other bearers or carriers at intervals, as described above, in addition to the collar set. The intervals between bearing sets or carriers is 25 to 60 ft. The first overburden necessary to sink through to reach bedrock may be as deep as 250 ft. Shaft-sinking on the Mesabi is an expensive operation at best, and usually costs over $50 per foot. If there is much water, this figure will be increased considerably. The shafts are 200 to 500 ft. deep and are vertical. The rock encountered under the overburden may be soft iron ore or broken, silicious, sedimentary formations.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Accident Prevention v. Compensation

The Editor:

Sir—I have been much interested in an article which appeared in your paper of July 11 and which is headed 'Workmen's Compensation Insurance in California.'

During the year 1913 there were killed in the metal mines of this country (and by metal mines, I mean those of precious metals, iron, zinc, lead, and copper) 661 employees. There were serious injuries in the metal mining industries to practically 8000 men; making no mention of minor accidents. Upon a basis of statistics, which I have compiled from many different sources, these deaths and injuries cost the metal mining industries of this country as a whole about $11,560,000 or on the basis of 170,000 men working in this industry in the United States, a tax of $71.35 for each employee. This is considerably higher than even the coal industries or railroads have to bear, so that, dealing with the question of the metal miner, it would look as though the really ultimate solution of this problem is not a question of whether or not a proper basis of taxation to take care of compensation can be found, but of one being forced to reduce the number of accidents. On a basis of 300 working days in the year at $3 per day, the miner would earn $900, and if it cost $71.35 to maintain that miner for the same period, it is going to take about 8% of the payroll to make this compensation.

It is impossible to arrive at any honest basis of computation where only one or two mines are used as an illustration, for the reason that the mines which are advertising their figures are the ones which have phenomenally low death and accident rates. That mine manager who is having bad luck along these lines is not giving out any figures for publication. Everyone knows that as long as there is a mining industry, there is going to be a certain percentage of unfortunate instances which will take the lives of men or maim them.

There is no question but that in mining exactly the same condition prevails as in all other classes of work, namely, that probably 70% of these accidents are due to carelessness, and that carelessness may possibly be on the part of the mine manager, superintendent, or foreman as well as the employee. It seems to be a peculiar condition that all branches of mining work are covered by thoroughly trained technical and practical men except this one of accident prevention. The laws of our different mining states have provided inspectors whose duty it is to go around and offer suggestions, but how frequently does it happen that even when his suggestion is made, it is pigeonholed as being impractical or too costly. I remember a number of years ago, when holding a position as timekeeper for a certain large mine, a serious accident happened in which 15 men lost their lives. This particular accident was in a shaft, and a great deal of secrecy was maintained after the investigations were made. Somewhere along the line, recommendations by the state inspector had been absolutely disregarded. I do not attempt to say that if these recommendations had been followed the accident would not have happened, but it did develop that somebody had overlooked or absolutely ignored these recommendations.

After the accident, which shut this mine down for many days, cost thousands of dollars to settle, and in a measure disorganized a working force of nearly 500 men, and had its effect on the entire mining community, it was found that an expenditure of possibly not to exceed $1500 to $2000 in proper appliances between the collar of that shaft and the sheave wheels, would have prevented the accident. In this case, the door was locked after the horse was stolen. Those safety appliances are now, and have been for several years, kept in excellent shape. This, I will admit, is an extreme case, but, unfortunately, in the large majority of cases where men are killed and injured it is only the very extreme cases that come to anybody's attention.

How many men are killed in the mining industry in a year's time from disregarding the proper use of tamping bars? How many men are killed and injured from the improper use of cages, of disregarding instructions regarding the handling of bell cords and signals underground, the improper care of electricity, and many other cases which can be enumerated?

This is, to a certain extent, the fault of the management, not because it does not suggest and as far as possible protect, but because shift-bosses and superintendents are prone to overlook a man's carelessness because of the breadth of his shoulders. They gamble the lives of the men under them against a man's ability to do a little more work than the careful man because the monthly report fails to show the cost per ton under the head of accidents and legal service. The mining industries of this country have had an enormous amount of teaching along the line of 'first aid to the injured.' What we need now is a department of 'first aid to the uninjured.'

For some reason or other, it has been felt that as long as the mine paid its premium to the liability insurance company, its duty was fulfilled and if an accident happened the company was amply protected and the widows

and orphans would be taken care of, but everyone knows that no amount of money will ever compensate for the misery and the degradation that is caused when the wage earner of the family is gone.

There was recently formed in the city of New York, to deal with this subject, the American Mine Safety Association. The probabilities are that this Association will have a hard time to get the different mining companies in this country to join, and yet there is not the least doubt that if this Association were given the undivided support of the mining industries, in ten years time the progress made and the lives saved would be simply astounding. Here, without any doubt, is a great deal of the solution of this question of workmen's compensation. What is needed in the mining industry is more prevention and less attempt at financial cure.

FRANK H. TREGO.

Denver, Colorado, August 15.

Valuation of Dredging Ground

The Editor:

Sir—Mr. Hohl, in his letter on the valuation of dredging ground, in your issue of September 26, solves a different problem from that proposed by Mr. Decoto, since he has substituted a value of $1.60 per yard for hole No. 7 in place of 60c. as stated in Mr. Decoto's original diagram.

The solution suggested by E. B. Thornhill (July 18)

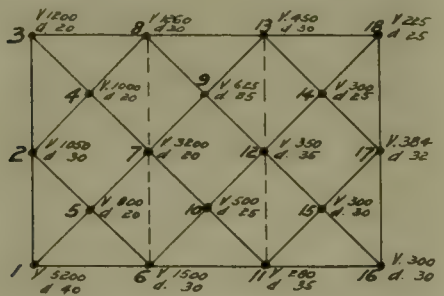


FIG. 5. FROM MR. HOHL'S DISCUSSION.

and by myself (June 27), is based on the diagram, assuming that Mr. Decoto's use of the value $1.60 in his calculation was a clerical error, so that it would be unfair to compare results on this basis with those of Mr. Hohl. Assuming the value of hole No. 7 as $1.60, as in Mr. Hohl's Fig. 5, in order to compare results on the same basis, and calculating by the method outlined in the letters last referred to, gives for the area 1-3-8-6 an average value of 65.42c., and for the whole area a value of 34.97c. per yard, against Mr. Hohl's values 69.6, 67.9, 70.8, and 35.8c., and Mr. Decoto's values, 72.42 and 37.64 cents.

The point raised with respect to the method used by Mr. Decoto is that it takes no account of the relative volume of the deposit represented by each drill hole as do both the other solutions. Mr. Hohl's method of getting the average value of part volumes evidently makes his result the most reliable of the three, but it seems that his method as outlined in his letter applies only to the usual case of holes spaced at uniform intervals, so that it should not be applied to irregularly spaced holes without due consideration. A discussion by Mr. Hohl of conditions in an area having holes spaced closer in one part than elsewhere would be of interest.

H. N. HERRICK.

Berkeley, California, September 28.

The Hall Process

The Editor:

Sir—I would like to say one word concerning your editorial appearing in the issue in which my article on the experimental development of the Hall process was published. I was extremely frank in what I said, and I believe in being so, nevertheless some of the suppositions which you make concerning the patent situation should, I feel, be answered. Our people have, naturally, delved deep into this question, and the best patent opinion which we have been able to secure on both sides of the water makes us feel very comfortable, whether the reduction of the SO_2 is accomplished by H_2S or by hydrocarbon compounds admitted as fuel into the furnace. The essential points as developed and lucidly portrayed in our patent specifications are so fundamentally different from the Thiogen process, for instance, that no interference between the two is possible. I am writing you thus, simply to correct any impression that might be given by your editorial that our patent situation is weak. It is distinctly strong, and besides this, I trust that the policy which we hope to pursue in gradually getting the process adopted and perfected will be sufficiently broad that the metallurgical fraternity will find no reason or temptation to attack the patents.

HOWARD F. WIERUM.

New York, October 19.

Economical Sliming in Grinding Pans

The Editor:

Sir—In my article published in the *Press* of May 23, a word has been omitted on page 847, which makes one sentence quite unintelligible. Instead of "* * * and after being treated on these tables the pulp overflow from classifiers and cones was made to pass an automatic sampler * * *," the sentence should be read: "* * * the pulp, *inclusive* overflows from classifiers and cones," etc. I made special reference to this, because I wanted it to be understood that all the material treated went through the samples, and that no fine material could escape from the mill unnoticed in overflows.

M. G. F. SÖHNLEIN.

Ingenio de Machacamarca, Bolivia, S. A., June 27.

SILICA OUTPUT of the United States in 1913 was 232,192 tons, valued at $953,832.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

REVENUE of the Panama canal in August was $91,664, most of which was collected after the 15th. To September 1 the earnings totaled $118,129.

SMITHSONITE, OR CARBONATE OF ZINC ORE, used almost exclusively in the manufacture of white oxide, occurs in extensive deposits in the northern parts of the Platteville, Wisconsin, zinc district.

'ALBOLINE' AND 'PETROLATUM OIL' are petroleum distillates imported from Baku, Russia, but oil from United States wells will yield these same medicinal articles, and have, in fact, been produced in this country in small quantities for many years.

NINETY-TWO dredging plants in Victoria, Australia, handled 16,706,023 cu. yd. of gravel averaging 7.2c. per yard in 1913. The Briseis company of Tasmania was the largest operator, with four boats, treating 1,461,200 cu. yd., yielding 8.2c. per yard.

PARAFFIN WAX, a petroleum product, was exported from the United States to the value of $9,000,000 to $10,000,000 during the past three years. Natural mineral wax, ozocerite, with a high melting point, is imported from Galicia, Austria; but it occurs and is produced in Utah. Reduction of the mineral is expensive.

SPARES used at the five stamp-mills (240 stamps) of the Oriental Consolidated in 1913 were as follows: shoes, 655; dies, 451; bosses, 10; tappets, 31; cams, 6; stems, 7; cam-shafts, 7; and quicksilver, 24,000 oz. Chemicals used at the five cyanide plants were as follows: cyanide, 185,395 lb.; zinc and zinc dust, 541,168 lb.; borax, 37,408 lb.; lime, 986,942 lb.; and soda, 4608 lb. A total of 301,162 tons of ore was crushed, and 48,117 tons of concentrate cyanided.

ELECTRIC INCANDESCENT LAMPS are a possible source of danger in gaseous mines or around natural gas wells. Filaments of the lamps glow at very high temperatures, and the breaking of the bulb of a lamp while surrounded with explosive gas instantly brings the gas into violent contact with the filament. The inrush of gas destroys the filament almost invariably, but while it is being destroyed, the gas may become ignited. According to H. H. Clark, of the Bureau of Mines, many tests have been made showing the danger from incandescent lamps. It was observed that the tendency to cause ignition decreased as the lamps decreased in candle-power and increased in voltage. Tungsten-filament lamps are more dangerous than carbon lamps of the same rating. Therefore it is suggested that a reasonably safe lamp is an 8-candle, 220-volt, carbon-filament lamp, with an outer globe of heavy glass, making air-tight inclosures around bulbs, and heavy metal guards, securely fastened to the support of the outer globe. The transmission line and wiring should be carefully attended to.

COAL GAS is usually made from a high volatile coal containing from 35 to 38% of volatile combustible matter. This would analyze as follows: moisture, 2.2%; volatile combustible, 38.1%; fixed carbon, 53.2%; and ash, 6.5%, according to C. C. Tutwiler in the *Journal* of the Franklin Institute. By-products from coal used in gas making in the United States in 1912 amounted to the following:

	Quantity.	Value.
Gas sold, cubic feet	89,693,372,000	$36,681,884
Coke, short tons	12,490,757	48,380,009
Tar, gallons	134,796,438	3,802,047
Ammonia (reduced to NH_3), pounds.	51,527,074	4,776,386
Ammonia sulphate, pounds	99,070,777	3,740,075
Ammoniacal liquor, gallons	35,242,549	1,002,807

THE SO-CALLED SOCIALISTIC POLICIES of Australian and New Zealand governments have resulted in the development and operation of coal mines, among many other industries. The New Zealand authorities work two mines in the South Island, and in Victoria a large producer is in full swing, in spite of the many stupid labor troubles, political opposition, and newspaper criticism. In the *Proceedings* of the Australasian Institute of Mining Engineers, containing notes and papers on the May meeting, are five papers on the Victorian coal mine, covering a total of 125 pages. These are as follows: 'Victorian State Coal Mine, Wonthaggi,' notes on development, organization, etc., by the general manager, George H. Broome; 'Geology of the State Coal Mine,' by Stanley Hunter and Leslie Owen; 'Core Drills at the State Coal Mine,' by Stanley Hunter; 'Practical Underground Work at the State Coal Mine,' by John M'Leish; and 'The Electrical Installation at the State Coal Mine,' by Struan S. D. Robertson. The mine is in the Powlett River district, about 60 miles southeast of Melbourne. Six months after it was opened the output was 1000 tons per day, and it now averages about 2000 tons per day, supplying the state railways and other industries. All equipment and working systems are thoroughly modern. To the end of June 1914, a total of £227,142 had been spent on the property; 1,797,708 tons of coal hoisted, worth £809,000; £663,300 paid in wages; and other working expenses, £82,930. There are 508 miners employed, 293 others underground, and 307 on the surface, 1108 in all. Miners average 13s. 9.59d., or $3.29, per shift.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

NEW YORK

DELAY IN SHIPPING CYANIDE FROM EUROPE.—THE LEAD MARKET AND CURTAILMENTS OF PRODUCTION.—COPPER EXPORTS AND OUTPUTS.—TIN.—RICHARD C. FLOWER'S ACTIVITIES.—ALASKA GOLD MINES.

An unfavorable turn in the cyanide situation developed on October 24 when the cables brought news that the tank steamer *Sun* had been taken into Falmouth, England. It will be remembered that after the conference in Washington it was arranged that certain needed goods, among them cyanide, should be brought out of Germany in American vessels. It was at first proposed that the 1000 tons or more of cyanide that was awaiting shipment to this country from Rotterdam, should be brought over on the boat which was sent to bring back dyestuffs. It was impossible to secure cargo space on this, however, and Roessler & Hasslacher attempted to persuade the Holland-American Line to charter an American-owned vessel on which to make the shipment. The Company was afraid to do this, however, fearing interference, and so return cargo space was finally secured on the tank steamer *Sun*, owned by the Sun Oil Co. of Philadelphia, and bound out of that port with a cargo of oil for Amsterdam. The diverting of the steamer, which is American owned, by the British authorities, indicates that they are pursuing their policy of interfering with American shipping whenever there is the slightest ground for the belief that the goods on board may reach Germany. The matter is a serious one to the cyanide operators throughout the country, as the Roessler & Hasslacher plant at Perth Amboy can barely meet the demands of the operators in the United States, and cannot supply any of the Mexican consumption. If it is impossible to bring this shipment through, as planned, the shortage will be seriously felt, and mine-owners ought to make their influence at Washington promptly and vigorously felt, so that they may secure the needed supply of cyanide.

The demand for lead has been slack for a long while, and the low price has caused many of the producers to cut their output to three-fourths of normal. The St. Joseph Lead Co., the largest independent producer, has made such a cut, and, in announcing this, Clinton H. Crane, president of the Company, says that during the past six weeks it has been impossible for the St. Joseph company to sell its lead, even at the low prices prevailing, and that therefore the plant will hereafter be run only five days a week instead of six, and two of the mines will be entirely closed down. The St. Joseph company has also announced that it is going to sever its connection with the American Metal Co., which has heretofore sold the St. Joe lead in New York. Hereafter the St. Joseph company will market its own lead, as the Granby and several other of the producers do. In the Coeur d'Alene district, the Morning mine of the Federal has shut down, and the Stewart Mining Co. has also lowered its output, though the Bunker Hill is still operating at full capacity.

During October, copper exports were surprisingly good, considering all the unfavorable things which developed to affect shipments. Between October 1 and 22, nearly 41,000,000 lb. of copper was exported, and if this rate is maintained for the rest of the month the total exports will be nearly 56,000,000 lb., or approximately two-thirds of the monthly exports just before the war started. So far as is known, none of this copper is reaching Germany, most of the consignments being to England and France, though some still gets through to Holland. Production in this country continues to be curtailed by the closing down of additional properties. The Mason Valley has sent out a notice to its stockholders advising them that the statement of earnings for the quarter ended June 30 will have to be delayed until the present difficulty in marketing copper clears up. Some of the Lake Superior mines continue to operate at full capacity, and the Isle Royale, a subsidiary of the Calumet & Hecla, produced some 600,000 lb. of copper in September, or at the rate of 14 lb. per ton of ore crushed. The output is therefore larger than it was in August, and is still being increased. The Shattuck-Arizona Copper Co. produced 646,713 lb. in September; Utah Copper Co., 6,672,194 lb.; Ray, 3,180,100 lb.; Chino, 2,959,734 lb.; and Nevada Consolidated, 2,718,471 pounds.

The National Conduit & Cable Co. states that at present prices copper should be used more for domestic purposes.

The price of tin has again taken an upward turn on account of the news that a German cruiser had sunk a ship loaded with 850 tons of tin in the Indian Ocean. American producers are giving serious thought to the possibility of tin smelting in the United States, and it is quite possible that some of the many schemes proposed may eventually be carried out. There seems to be every reason to believe that Bolivian tin could be successfully smelted on the Atlantic seaboard at a good profit, and such a venture deserves general support, because if the Bolivian people sold their tin in this country they would be inclined to buy goods from us to take out the credit established.

The Toronto police last week captured Richard C. Flower (who has also gone under the names of Oxford and Montgomery), who many years ago started an interesting career in the way of mine promotion. Before that, he had had varied experiences as a medical practitioner, with a faith cure as a side line. Having benefited Giddeon F. T. Reed, of New York, by some medical treatment, Mr. Reed was persuaded to back Flower in promoting the Illinois Coal & Coke Co., which had a brief existence. About 1900 he floated the Security Milling & Mining Co., with elaborate offices in Wall street and equally fine quarters at the Waldorf. The following year he put out the Arizona Mining Co. and the Lone Pine Co. About the same time he was maintaining the Flower Medical Co., in 34th street, where anybody was treated for anything, and then the grateful patients directed to the offices of the mining companies. In 1903, Theodore Hagerman's wife invested $200,000 in the Eastern Mining & Smelting Co., one of Flower's enterprises, and it was soon rumored that Flower was responsible for Hagerman's death by poisoning. The investigation disclosed his peculiar activities, and though no proof of the poisoning charge could be brought against him, he was indicted for grand larceny. He was placed under $20,000 bail, which he promptly jumped, and has since been a fugitive from justice.

At the Alaska Gold Mines property, the Sheep Creek tunnel is being leveled, and the permanent track laid to the mill. No. 6, 7, 8, and 9 levels have been driven west to the surface, giving an entrance to the mine from the surface of six levels, from No. 5 to 10 inclusive. Recent development has revealed unexpectedly good ore. Construction at the coarse-crushing plant and mill is progressing satisfactorily. The Salmon Creek reservoir has over 110 ft. of water in it, or 40% capacity. By winter it will be 80 per cent.

BOSTON

THE CURB REOPENS FOR BUSINESS.—RESERVE BANKS INFLUENCE.—THOMAS W. LAWSON.—ELKHORN MINE, MONTANA.—THE FIELDS PROCESS.—GOOD STOCKS TRADED.—UNITED VERDE EXTENSION.

The Boston Curb reopened for daily sessions on October 14, after having remained closed since July 30. About 20 members appeared on the floor and have been in regular attendance since. There was no excitement, but much interest was manifested in resumption of trading. But little liquidation was in evidence, and there was a noticeable supply of odd-lot buying orders on hand at the opening. Price changes were in the main unimportant as compared with the close on July 30. Lawson specialties, Bay State Gas, and First National were active and fairly strong in price. United Verde Extension and Mexican Metals were freely traded in. The greatest loss sustained by any Curb issue since resumption was that of Nevada-Douglas, which had been selling above $1 previous to July 30, but slumped to 46c., the lowest price in its history. The heavy decline was reported to be due to forced selling by a Boston trader with about 18,000 shares, who was hard hit in the big market. The Curb will not issue the daily 'blue sheets' containing records of sales and quotations until the Stock Exchange opens again.

Considerable interest is attached here to the opening of the federal reserve banks, which will probably be about the middle of November. It is thought that this move will hasten the reopening of the Stock Exchange, and will greatly assist in broadening the loan market on the better class of mining stocks.

Thomas W. Lawson is still absent at the ranch of his son-in-law, Mr. McCall, in Crook county, Oregon, but is expected home before the November election, to take part in the campaign of his friend and connection by marriage, Samuel W. McCall, who is the Republican candidate for governor.

W. R. Allen, former lieutenant governor of Montana, is still in Boston in the interest of the Boston & Montana Development Co., of which he is president. He says the adit at the Elkhorn property in Beaverhead county is being driven at a good rate, and that it is in over 900 ft. Walter Harvey Weed made an examination of the Elkhorn property sometime ago, and submitted a favorable report. Notwithstanding the stringency of the money market, arrangements have been made to continue driving for months ahead. London interests, headed by Sir Robert W. Perks and the London & Midland bank, are stated as still ready to go ahead with the flotation of the issue of $3,000,000 bonds to cover the building of the Southern Montana railroad by McArthur Bros. & Perks interests, railroad contractors.

Makeever Bros., mine operators, express great satisfaction at the progress made with the Fields' process at their Royal Basin property in Granite county, Montana, both on the ores of that mine, and of their El Favor property in Mexico. The reopening of El Favor awaits the settlement of the controversy between the Carranza and Villa factions, this mine having been interfered with in its operations probably more than any other in Mexico, despite its strong fortifications. When El Favor is again active, the Makeevers expect to install the Fields' process there. It now appears likely that these interests will exploit the Fields' process on the market.

More than one Boston house has had salesmen on the road since the Stock Exchange closed, specializing in gold mining stocks. Timely arguments are used about the stability of gold mine earnings as compared with those of copper and silver mines, the present and future need of the world for gold as the result of the European war, etc. The times change and the market changes with them.

The Douglas and Tener interests have formed an underwriting syndicate which has guaranteed the sale of 50,000 shares of United Verde Extension Co. stock at $1 per share. Stockholders are now being circularized to this effect. The prospects of making a mine of this property, which adjoins the famous United Verde owned by W. A. Clark, are now considered brighter than ever. No talk is heard now of litigation with the Clark interests, as was the case about two years ago. The Douglas people have always proved to be such peaceable and friendly neighbors in Bisbee and Cananea, that it is felt that there is not likely to be any trouble in Jerome, notwithstanding the feeling which has existed there so long to the effect that Clark had preempted everything of value in that district.

EL FAVOR PROPERTY OF MAKEEVER BROS., SHOWING WALL TO KEEP OUT BANDITS.

HOUGHTON, MICHIGAN

SKILL OF IRON MINERS RECOGNIZED.—MINING TAXES.—THE LATE HARRY ROBERTS OF DULUTH.

That the ability of the Lake Superior iron miners is recognized throughout the country, is shown by the visit to Negaunee of an Eastern contractor seeking mining men. Fifteen experienced miners have left Negaunee, with free transportation and good wages, for Lyon Mountain, New York, where they will be employed at shaft-sinking for the Chateaugey company.

It is probable that the State Tax Commission will be requested to review the 1914 assessments in Houghton county. It is reported that several mining companies are prepared to present complaints to the Commission.

The funeral services of Harry Roberts, of Duluth, former mining expert and operator, were held in Houghton, October 22. Mr. Roberts was a man with wide experience in mining on the Michigan and Minnesota iron ranges. Coming from the tin mines of Cornwall when a youth, he engaged in mining in the East and then entered the employ of the late Joseph Sellwood, then opening the iron mines of Michigan. After working in the Jackson mines at Negaunee, he later aided in the opening of the Colby mine on the Gogebic range, opened the Chandler mine at Ely on the Vermilion range, and the McKinley mine at Biwabik on the Mesabi. With Mr. Sellwood, he opened and operated several other mining properties on the Gogebic and Minnesota ranges. During the past few years he was associated with the Roberts-Kingston Contracting Co. of Virginia, Minnesota.

A general impression prevails here that several mines will have to suspend operations soon or make a further cut in wages. Some managers contemplate getting their men together and talking over the situation and asking them for their opinion as to further action.

DEADWOOD, SOUTH DAKOTA

Details of the Will of the Late T. J. Grier, and the Homestake's New Manager.

That T. J. Grier, the late superintendent of the Homestake, was a provident man, is disclosed by his will, which has been filed for probate in the courts of Lawrence county. The testament bequeaths an estate valued at $243,623. The figures are based on an appraisal by Mr. Grier on May 19, 1913. The values may be somewhat different at this time. The widow is given the residence on Buckingham road, Los Angeles, and one-third of the residuary estate. Bequests of $1000 each are made to eight brothers and sisters, of whom three have died since the will was drawn. The remaining two-thirds is given to the widow, in trust, for six children, to be divided equally among them when the youngest shall be 25 years of age. The children include two sons and two daughters of Mr. and Mrs. Grier, and a son and daughter of Mrs. Grier by a former marriage. Among the most valuable of the items listed in the will are 50,000 shares in the Wasp No. 2 Mining Co., and shares in the First National Bank of Chicago, First National Bank of Lead, First National Bank of Deadwood, National Park Bank of New York, Bank of Montreal, First National Bank of Boston, $6800 in life insurance, property in Los Angeles, and $12,508 in cash. The schedule does not show ownership of any stock in the Homestake company. It is reported that Mr. Grier never at any time owned any, and he made it a policy to refuse to own any, and thereby to escape any censure regarding possible fluctuations in its value.

R. Blackstone, who, since the death of T. J. Grier, has been in charge of the Homestake properties, is an old and valued employee of the Company. His first engagement with the Homestake began in 1878, when, in the capacity of surveyor, he, as a young man, promptly earned recognition for his ability. Later, as the enterprise expanded, his duties became of greater importance, and he was designated chief engineer. Among the earlier tasks that he completed to entire satisfaction was the construction of the Black Hills & Fort Pierre railroad, a Homestake subsidiary, which connected Lead with the timbered tracts to the south and southeast, from which wood and mining timbers were drawn to supply the rapidly growing mine. Upon the completion of the road, he was placed in charge of it as superintendent. Later he directed the construction of many miles of extensions made necessary in order to reach the virgin timber. He held his position at the head of this road until it was finally sold to the C., B. & Q. railway, which now operates it. Mr. Blackstone was also superintendent, for many years, of the 'north end' properties, which included the Father De Smet, Deadwood-Terra, and Caledonia properties, after they were purchased by the Homestake, and later was appointed assistant superintendent of the great Company. This position he has ably filled for a number of years, and during the past two years has for much of the time acted as superintendent during the absence of Mr. Grier. For years past, an important part of Mr. Blackstone's duties has been the supervising of construction of important improvements. Under his direction the water system, hydro-electric plants, and Recreation hall were built.

TORONTO, ONTARIO

Situation at Cobalt.—Dome, Schumacher, Long Lake, Tough Oakes, Burnside, and Teck-Hughes Mines.

The lower prices now obtaining for silver, compared with the previous prices of the present year, and the average for 1913, are sure to result in decreased profits for Cobalt companies. Another unfavorable factor is the decision of the insurance companies to raise the rates for shipments across the Atlantic. The old contract expired September 30, and while the new rates have not been made public, it is understood that they will be about double the old. Although there are about 900 less men employed in the district than at the beginning of the war, conditions are back to normal. The Drummond Fraction, Beaver, and Temiskaming have resumed operations, and the Cobalt Lake company has decided to commence lowering the level of the lake.

The Dome production for August was $90,893 from 20,170 tons of ore. This is an average recovery of $4.50 per ton, and the total operating costs, including development, are said to be well under $3 per ton.

At the Schumacher mine some of the underground workers and practically all of the surface men have been discharged. The owner states, however, that it is his intention to erect a mill in the near future.

The Long Lake gold mine, near Sudbury, which has recently come under new management, is obtaining satisfactory results. The property, which had consistently lost money, is now making a fair profit. Production is being maintained at about $23,000 per month.

At Kirkland Lake, the financial pressure following the war has had the effect of stopping a number of operations.——At the Tough Oakes, the most important property in the camp, all underground work has been suspended, and only the 5-stamp mill is running on dump ore. It is the Company's intention, however, to proceed with the construction of the new mill, which will have a capacity of 100 tons per day. It is stated that the Company has a large amount of money out on call in London, but it is impossible to get any of it.——The Burnside is still tied up in litigation, and no work is being done.——A few months ago a new English company was formed to develop a number of properties, but it has also been forced to stop all work. The Teck-Hughes, which is under option to the Nipissing, is showing up well and is being vigorously developed.

LUNING, NEVADA

Work at the Vemilla, New York Canyon, Wagner-Azurite, Alameda, and Shipper, Luning Gold, Luning Idaho, Red Butte, Esmeralda, and Copper Queen Properties.

The Vemilla property is starting to ship ore this month, a good road having been built to the property, which lies about 1¼ miles northeast of the old Garfield mine, which was a large producer in the early eighties. This property consists of nine claims, on which a 140-ft. adit has been driven on the ore, which averages 55 oz. silver and $9 gold per ton. This ground lies seven miles southeast of Luning.

New York canyon is still being actively developed. Two leases have been let on the Mayflower, owned by T. L. Patrick of Goldfield, and on the West End, controlled by H. B. Lind of Goldfield. This part of the district has the largest developed tonnage of low-grade copper ore, and is anxiously awaiting the opening of the leaching plant to custom ores.

The Wagner-Azurite Copper Co. has closed the leaching plant temporarily, on account of the uncertain conditions of copper at the present time. A meeting of the larger stockholders is to determine on the future policy. It is possible that it will be found necessary to roast the ores, on account of the excess of lime, but this will not increase the expense of making metal very much, on account of the cheap fuel that can be procured from Coaldale, and salt from Sodaville, only 10 miles away. The development in the mine is satisfactory, and the Company has sufficient ore blocked out for many years' run.

The leaching test so far conducted on ores from the Alameda and Shipper properties, has proved that these properties can be worked by this process in a manner that will insure the early erection of a plant on the ground.

An important sale was closed here on October 5, when

Sacramento and Nebraska mining men, represented by M. T. Rowland formerly a Tonopah operator, secured the property of the Luning Gold Mines Co. under a lease and sale agreement. This property consists of 12 claims about four miles north of Luning, and adjoining the Luning Idaho company's property, which has lately been the scene of much activity. These people will immediately commence operations, and have ample resources for carrying on the work. They propose to treat the ore themselves, and thus save the expense of shipping and smelting.

On the Luning Idaho work has been progressing continuously in the adit, and on October 13 the Company cut the casing of the vein on which the shaft was sunk, and before the end of the month should crosscut another large body of ore. This will be at a depth of over 150 ft. and near the

PART OF WESTERN NEVADA.

hanging wall of the mineralized zone. This vein is about 70 ft. beyond the 18-ft. vein cut a month or so ago, and if it improves in width and value as did the first vein, it will place the mine in condition for extremely large production. It is reported that the people having made a success of the leaching process, have offered to take an interest in the mine for the erection of a large leaching plant to handle these ores.

The Red Butte Mining Co. of Spokane has financed its Company, and Chris. Smith has just returned from headquarters with the necessary money. This mine is about 12 miles northwest of Luning. The mine yields high-grade lead and silver, and indications are good for a large production.

The Esmeralda Copper Co. is about to resume operations, and the manager, Mr. Jacobs, is now on his way from the East for that purpose. There has been considerable development done on the property.

At the Copper Queen Mining Co.'s claims it is understood that arrangements have just been completed whereby there will be an increased activity in connection with this property.

Robert B. Todd of Los Angeles visited the district last week, and was greatly pleased with the progress made, and the development at the Luning Idaho property. Mr. Todd consummated the sale of the Luning Gold Mines Co. He is interested in claims adjoining this property, which have developed several promising gold and silver veins.

Closing of the Mason Valley company's smelter at Thompson will affect this district somewhat, as it was comparatively near, and ore transport to California or Utah is high.

KALGOORLIE, WESTERN AUSTRALIA

EXPLOSIVES AND CYANIDE SUPPLIES FOR THE MINES—CONTRACT WORK—WHIM WELL COPPER MINE—CORINTHIAN NORTH AND VICTORIOUS MINES.

Owing to the war, there has been some anxiety regarding mine supplies, especially explosives and cyanide, but unless something happens, there will be no serious restriction in output of gold. Explosives on the spot are estimated to be sufficient for six months, and Nobel's Explosives Co., Ltd., Glasgow, has cabled its local agents stating that it will have no difficulty in maintaining full supplies. In an emergency, the De Beers factory at Kimberley, South Africa, can supplement supplies. Regarding cyanide, Bewick, Moreing & Co. have just landed from Singapore a full four months supply for all their mines, and other shipments are en route from England. To conserve explosives, all mines, with three and four years of ore reserves, are temporarily curtailing development work. The regularity of the mail steamers may be upset at any time by the commandeering of the boats by the government for the transport of troops to the seat of war. All the Austrian reservists employed in the mines and on the wood-lines have been escorted to Rottnest island for internment during the war.

After being idle for 68 days, the men have resumed work at the Yuanmi mine, in the Murchison district, on practically the same terms as before, except that the work formerly called 'contract work' is now termed the 'bonus system.' In other words, competent men can increase their wages by extra footage. We are not likely to hear any more regarding the abolition of contract work for some time, as no objection was made at Lancefield, on resumption of work there, and, at the Great Fingall mine, the men themselves voted in favor of the continuation of contract work by a considerable majority.

Owing to Germany being practically the only buyer of copper ore and matte, the Whim Well mine in the northwest, like other copper mines in Australia, has been forced to close down. This mine employed over 300 men, and exported about 10,000 tons of ore per year. The Company has been operating a Murex magnetic plant of an estimated capacity of 200 tons per day. The mine was in bad order and all the old workings had been condemned and forbidden to be operated by the inspector of mines, and only new shallow ground has been worked for some months. Two years ago, H. R. Sleeman, the manager, estimated the ore reserves at 1,000,000 tons of 5% copper, and estimated that, with copper at £70 per ton, a profit of £60,000 per year would be made. Later events reduced this considerably.

Since the mill on the Corinthian North at Southern Cross started crushing, in April, 51,278 tons has been treated, returning £46,875, and, as the oxidized reserves are being rapidly expanded, a No. 8 Krupp ball mill and an Edwards' duplex roaster have been ordered to treat the sulphides. The mine has not fulfilled expectations, and it is doubtful if shareholders will get much benefit from it.

The Associated Northern company's Victorious mine at Ora Banda may have to be closed down, as the shipment of the new suction gas engine, ordered in England, has been delayed by the war. During the past six months the Company has expended £15,479 on development and equipment, of which £6472 has been spent during the past two months. Developments at No. 7 level have proved disappointing, as the oreshoots are short and patchy, and G. M. Roberts, the manager, is beginning to be rather doubtful of the success of the venture.

During August, the Horse-Shoe mill treated 22,884 tons of ore yielding £34,216, with a profit of £4014. The north drift at 2900 ft. shows ore worth £12 15s. per ton.——In September the Ivanhoe mill treated 19,094 tons for £30,700, with £10,790 profit. The main shaft is down 3154 feet.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

Chisana

According to an estimate of G. R. Goshaw, the district's gold yield for the season was as follows:

Bonanza creek	$140,000
Little Eldorado	79,000
Big Eldorado	6,000
Skookum	24,000
Gold Run	1,500
Coarse Money	1,000
All others	1,500
Total	$253,000

The sluicing season was less than 90 days. About 125 people will winter there.

Cordova

At the Mother Lode copper mine, the Pittsburg cross-cut has cut the main vein, giving 380 ft. of vertical depth. According to the president, James L. Godfrey, this development proves the extension of the rich chalcocite ore from the surface. Work will be continued during the winter with 40 men, and 1000 tons of ore will be mined and shipped for smelting.

MAIN STREET OF CHISANA IN WINTER GARB.

Fairbanks

Record hoisting was recently done at the claim of C. Watson on the Chatanika flats, when 582 buckets of material was hauled from a depth of 147 ft. in one shift. He employs 19 men, of whom three are Bulgarians, four Swedes, four Russians, three Austrians, two Norwegians, one German, one Californian, and one Scotchman, who are working amicably in spite of the war in Europe.

Juneau

During September the Alaska Treadwell output was as follows: 540 stamps crushed 78,015 tons of ore, yielding $93,196 by amalgamation and $88,444 from cyanidation of 1731 tons of concentrate. The total realizable value was $179,823, and the yield per ton $2.33. Operating expenses totaled $78,778, and construction $19,995, leaving a profit of $81,050. Development in the mine amounted to 618 ft., and the stock of broken ore decreased 48,079 tons.

The Alaska Mexican mill crushed 19,173 tons of ore in September, yielding a total of $14,641 by amalgamation and treatment of 360 tons of concentrate. Net profit was $14,279. Development amounted to 55 ft., and the stock of broken ore decreased 6736 tons.

The Alaska United Ready Bullion and 700-Ft. Claim mills crushed a total of 38,157 tons of ore, yielding $78,314 by amalgamation and treatment of 894 tons of concentrate. There was a profit of $11,024 from the former mill and a loss of $753 from the latter. Development totaled 1283 ft., and the stock of broken ore increased 1288 tons, and decreased 9418 tons in the respective mines.

Ketchikan

The Gold Banner claims, stated in a recent issue of the *Press* as belonging to E. Steers, are owned by Joseph Hamblet.

ARIZONA

At the state fair at Phoenix there will be contests in first-aid and mine-rescue work. There are three entries in each of the contests so far, namely, the Old Dominion of Globe, Detroit of Morenci, and Copper Queen of Bisbee.

Cochise County

At the Shattuck-Arizona mine in September, a good tonnage of high-grade ore was mined in several stopes, but no ore was shipped. There is stored about 150 tons of 40% copper and 30-oz silver ore. Development during the month totaled 998 ft. At 800 ft. there has been opened 121 ft. of ore assaying 4% copper, $2 gold, and 2 oz. silver per ton. The rise above the 900-ft. level is up 96 ft. and shows 9% ore at the top.

Mohave County

The old Tennessee mine at Chloride is shipping about 150 tons of zinc-silver ore per day to the Needles smelter.——The Golconda, at Todd basin, is sending 40 tons of zinc concentrate daily to the same smelter. About 10,000 ft. of work has been done in this mine, in charge of John Boyle. The vein worked averages 4 ft. wide, and 20% zinc, with some gold and silver.——A wide gold-bearing lode is being developed at the Cyclopic.——At the Gold Reed, two miles from the Tom Reed, there is 5½ ft. of ore on the 200-ft. level. The incline shaft is down 220 ft. following a 4-ft. vein. C. R. Walters is manager.

Yavapai County

(Special Correspondence.)—At a depth of 250 ft. in the Humboldt Consolidated mine at McCabe, 12 in. of 400-oz. silver ore has been opened for some distance.——In spite of many difficulties, the new mill of the Dolphin mine on Turkey creek has been finished. W. H. Temme is in charge.——The

first carload of ore from the Poverty mine on Slate creek to the Hayden smelter returned 61 oz. silver, $11 gold, and 10% copper.

Hayden, October 17.

The smelter at Humboldt is employing 145 men, and there are 75 miners at the Pine Bell, according to G. M. Calvocoress, general manager for the Consolidated Arizona Smelting Co. Unless the price of copper falls too low, present conditions will be maintained. The Arizona Power Co. has closed another contract for 2000 hp. for the United Verde Copper Co.'s new plant at Clarkdale.

YUMA COUNTY

(Special Correspondence.) Frank B. Keever, of San Francisco, general manager for the Fortuna Mines Corporation, with properties in the Fortuna district, is in Boston in the interest of the old Fortuna mine, formerly owned by the estate of Charles D. Lane. The Fortuna produced nearly $3,000,000 in gold up to about 12 years ago, and paid over $1,000,000 in dividends. Its production was cut short by the intrusion of a fault at the 800-ft. level, and the previous management spent over $400,000 in futile efforts to relocate the Fortuna vein, sinking a winze from the 800 to the 2000-ft. level. The new management has spent about $100,000 more, working along directly opposite lines, after a thorough geological mapping of the property, and has found the vein again. Eugene R. Foss is heavily interested with Mr. Keever in reviving this old property.

Boston, Massachusetts, October 19.

CALIFORNIA

The oil output of the state in September was 289,979 bbl. per day, a decrease of 4000 bbl. compared with August. Shipments from the 11 fields totaled 6,860,910 bbl., and stocks are now 55,027,328 barrels.

AMADOR COUNTY

A dam is being constructed on Amador creek, three miles west from Amador City, to impound tailing from the Original Amador mill. It will be constructed 30 ft. high, and will hold about 1,000,000 tons. T. S. O'Brien, mine superintendent, and Louis S. Cain, engineer, are supervising the work.

During September the Plymouth mill worked 650 hours, crushing 7474 tons of ore, yielding gold worth $33,600, including that in concentrate.

BUTTE COUNTY

The old Coal mine, near Magalia, is being reopened by Portland people, under the management of C. Cramer.——A $140 gold nugget was found recently in the west branch of the Feather river, near Magalia, by E. Burt.——Cleaning out the old Indian Spring adit is being conducted under the direction of E. T. Barnett. Out of over one mile in length, 3000 ft. has been completed.

CALAVERAS COUNTY

(Special Correspondence.)—Fordyce & Co., of Boston, announce the receipt of a telegram from the manager of the Royal Gold Mines property, at Angels, stating that the mine is unwatered down to the 200-ft. level, and that a 4-ft. vein has been cut, from which assays were made of $46 per ton in gold. A claim of 5,000,000 tons of $3 ore which can be mined and treated at $1 per ton has been made for this mine, which has been examined by several American and foreign mining engineers, but it is now claimed, further, that high-grade ground such as the recent development will raise this estimated average. The management expects to begin hoisting ore and operating the first unit of the mill by January 1, 1915.

Boston, Massachusetts, October 19.

ELDORADO COUNTY

A 5-stamp mill is being erected on the old Pacific mine near Placerville by J. H. Santo and P. D. Burtt. Ore will be mined from the 500-ft. level.

INYO COUNTY

Grading for the Bishop Creek 50-ton cyanide plant was finished last week, and the building is now being constructed. It is hoped to have the 10-stamp mill and treatment plant working by the end of the year. To prevent tailing getting into the creek, it will be discharged as dry as possible, and two restraining dams built.

KERN COUNTY

Rich ore has been opened in the Aunt Rosa mine in the Amalie district. This property is owned by W. P. O'Meara and associates. West of this claim, and also in the Phillips and Crane claim, Hart Bros. has opened good ore. J. Ferris' 70-ton mill should soon be in operation. The camp is eight miles east of Caliente. The formation is schist, lime, and granite.

NEVADA COUNTY

At a depth of 80 ft., there is 24 in. of rich ore in the Dunmaine claim, in the Rough and Ready district. Some good specimens have been found, and the property is likely to be a fair producer.

Good progress is being shown in the additions to the Empire stamp-mill. Rich ore is being mined from the Pennsylvania mine, owned by the Empire company.

PLACER COUNTY

The magnesite deposit being developed five miles from Alta by J. D. Sullivan is said to look promising.

San Francisco men have purchased the Rough and Ready gravel mine, on Dutch Flat, from W. Gray. The concern is known as the Naomi Mining Company.

PLUMAS COUNTY

Improvements are being made to the mill of the Seneca Consolidated company's White Lily mine. J. J. Reilley is superintendent of this and other claims.——A large vein of $20 ore is being opened in the Plumas Bonanza mine, on Winter's creek. M. M. Page is manager.

SHASTA COUNTY

(Special Correspondence.)—There has been a marked revival in gold mining throughout Shasta county since the decrease in copper mining, and several important deals are reported by owners to be under negotiation.——Engineers, said to be representing John Hays Hammond and associates, are examining placer ground in the vicinity of Igo. The properties have been worked in a small way for years, and are considered highly promising. The same people are examining ground along Clear creek, below Redding.——Shipments of high-grade ore from the Uncle Sam mine, eight miles from Kennett, are being made to the Selby smelter. The 10-stamp mill is being overhauled for operation. A strong vein of good ore was recently opened in the property after a long search. Fred Dakin, Jr., is superintendent.——Arthur Rule and associates of Redding are developing a group of promising gold claims near the Uncle Sam, and recently uncovered some good quartz.——Van Ness Bros. are developing their Five Pines group and opening good ore.——James Hulme has a small force at work in the Gold Leaf mine, near Redding, in the interest of Seattle people who are considering the acquisition of the property.

Redding, October 26.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—There have been some good developments made in the mines here lately. The Ruth lease in the Golden Edge mine, which adjoins the Sun and Moon, is in good ore. They have one streak of pure argentite liberally sprinkled with coarse gold.——There has been a good find made in the Big Five tunnel at the intersection of the Lake and Belman veins. There is said to be 3 to 5 ft. of ore which averages about $100 per ton in carload lots. It is one of the

best discoveries made in this district for a long time.——The old Gunnell mine, which is near the terminus of the tunnel, is shipping a considerable quantity of good grade ore.——Central City and Black Hawk are quiet, as practically all of the business for this district is now done through the tunnel.——The Newton mill, which jigs ahead of the stamps, is running almost continuously, and the Roberts or Jackson mill is running spasmodically. Except for these two, and the Argo mill, there is no other work in the custom business.——The Little Mattie mine, on Chicago creek, is operating continuously on low-grade ore, the plant being of the usual type for this district. There is talk of installing cyanide equipment. There is a new cyanide plant on the Oneida, near Freeland, but it has not yet started. Its capacity is 50 tons per day.

Idaho Springs, October 19.

A molybdenite claim of Lively Bros. and W. Young, near Georgetown, has been optioned to the Primos Chemical Co. for $75,000.——The Bard Creek Mining Co. has acquired machinery in the Pay Rock mill, and will move it to Bard creek, where the Company has a large tonnage of ore ready for mining.

LAKE COUNTY (LEADVILLE)

The Down Town Pumping Co. has let contracts for its pumps to the Providence Engineering Works of Rhode Island, and motors to the General Electric Co. There will be four motor-driven centrifugal pumps of 1500-gal. per minute capacity each, against 450-ft. head, with 300-hp. motors. There are to be three separate sources of power, in case of accident to any one.——Lessees on the Pat Connors lease of the Ibex are shipping more rich gold ore.——Another shift has started at the Big Five company's mine. Eight to twelve-ounce gold ore is being shipped.

In the Twin Lakes district, the Bengal Tiger-Gordon mine is again to be worked, after a lapse of 17 years. There is between 40,000 and 70,000 tons of $10 ore blocked out, as estimated by engineers in 1897, since which time the property has been tied up by litigation.——In this district are the claims at Hartman and Mock, which are yielding 10-oz. gold ore.

In the Lackawanna district, the Lackawanna Belle is proving a good mine, and 3-oz. gold ore has been opened for some distance. A new 1500-ft. adit is contemplated to cut the ore at a depth of 1100 ft.——The Miller mine also shows good ore.——From the Mt. Champion mine the monthly output is about 300 tons.——Lessees at the New Monarch are opening rich ore.

SAN MIGUEL COUNTY

The output of the Tomboy in September gave a profit of $21,000. An abstract of the annual report appears on another page.

TELLER COUNTY (CRIPPLE CREEK)

It is reported that lessees on the 800-ft. level of the Golden Cycle mine are producing ore worth $16,000 per month. They have a large block of ground.——Plans and specifications have been finished for a 100-ton mill for the Cripple Creek Cyanide Mining & Milling Co., and bids for grading and construction are required. The Company has made contracts for ore treatment from mine operators. Howard Shutz is secretary.——The Gold Coin shaft of the Granite company is to be sunk from 1200 to 1400 ft. depth. Water is being baled from the lower levels for this work, No. 12 having been flooded for several years. Good orebodies are said to exist at this point.

Anderson Bros., lessees in the Dexter mine near Battle mountain, have opened 4 ft. of ore worth $20 and over per ton, for 175 ft.——The Vindicator company is planning extensive development, and has ordered a large Ingersoll-Rand compressor from the Stearns-Rogers company of Denver, and will move a compressor from the Hull City mine to the Vindicator. To drive these machines, a 60-hp. motor has been ordered, being the largest in the district by 150 hp. About 20 motors, aggregating 300 hp., have been ordered for the ore-house, conveyors, and concentrating plant.

SILVER LAKE MILL, NEAR SILVERTON.

IDAHO

BLAINE AND CUSTER COUNTIES

The ore deposits in the Sawtooth quadrangle of these counties are discussed by Joseph B. Umpleby in *Bulletin* 580-K of the U. S. Geological Survey. This area is a high, mountainous district with summits at elevations of 9500 to 10,000 ft. above sea-level, and includes the divides between three large drainage basins. The Sawtooth mountains run sinuously across the quadrangle a little north of its centre. From the Salmon river they rise abruptly from a broad valley floor, 7000 ft. high, to 9000 to 10,000 ft. As seen from the north, the crest is very much like unto the teeth of a saw. The area has few trails and fewer roads, and travel is exceedingly difficult in most parts. A trail up Bois river goes to the old camps of Vienna, Sawtooth, and Carrietown. The earliest locations were made in Boulder basin in 1879. Work was active until 1890, but the output of silver-lead and silver ores is estimated at $5,000,000 for the period. Concentrating plants were erected at nearly all the camps to handle poor ores, and a 30-ton lead smelter at Galena. During recent years, only the mill in Boulder basin has been operated. The principal ore deposits are fissure veins and replacements along shear zones. Siderite and quartz are the characteristic gangue minerals of the silver-lead deposits; while the silver ores occur well within the main granite mass. There are a few gold and zinc lodes in the district. All of the mining districts in the quadrangle are described in the work.

SHOSHONE COUNTY

A general idea of the magnitude of the development of non-producing mines or prospects, and the large amount of money being expended in the Coeur d'Alene district in this class of work, is gained from a résumé of the outstanding assessments levied by corporations, according to advice received in Spokane, Washington, from Wallace, Idaho. Fifty-one mining corporations in the vicinity of Wallace have assessments levied, and in the course of payment. The total combined number of shares in these corporations aggregates 64,500,000, while the aggregate capital of these companies amounts to $62,250,000. Of these corporations 18 are capitalized for $1,500,000, 24 at $1,000,000, four at $1,250,000, two at $125,000 and three at $2,000,000. Assessments range from 0.1c. to 3c. per share on the outstanding capital stock. The total amount of money raised by these assessments, assuming that the capital stock of each concern is all issued, would amount to $279,625. It is fair to estimate that at least three-fourths of the capital stock of these corporations is issued and subject to assessments. This would return a net sum of more than $200,000 to the

treasuries of these various corporations for immediate use, in the development and other needs of the properties. Of the total amount paid in on assessments, more than half is paid to miners employed, and the remainder for machinery, tools, provisions, and necessary improvements. There are, without doubt, 200 corporations in the district that are developing their properties by the assessment system, and it is fair to estimate that more than $500,000 is annually collected and expended in the Coeur d'Alene district for the development of its many promising legitimate mining properties.

One foot of shipping and five feet of milling ore have been cut in a rise being driven from the lower adit of the Idora Hill mine, under lease to the Tuscumbia company, to connect with the upper 300-ft. workings of the latter Company.——Over 4000 ft. of work has been done in the Aurora-Sampson mine, near Wallace. The vein is being developed and shows iron ore with some lead and silver.——Development in the Great Eastern company's claims at Mace is very promising.——A 5-ft. vein of quartz and iron, containing lead and silver, is being developed in the Toledo, above Burke.——The district known as Vandetta gulch, above Murray, has attracted considerable attention for a long time. The area is somewhat rough, but heavily timbered. At the Vandetta Chief, Lucky Four, Giant Ledge, and others, a good deal of interesting work is under way.

MISSOURI

Jasper County

The output of the Joplin district during the week ended October 17 was as follows: blende, 7,534,235 lb., averaging $34.27 per ton; lead, 1,365,570 lb., at $39.57 per ton; and calamine, 169,180 lb., at $19.72 per ton. The total for 42 weeks is 397,410,183 lb. blende, 69,359,806 lb. lead, and 25,540,290 lb. calamine, with an aggregate value of $9,517,775. The greatest effect of low ore prices is noted in the heavy producing sheet-ground areas, not only of the Webb City district, which is the heaviest producer of sheet ores, but likewise from Duenweg, Carterville, Prosperity, and Joplin, all of which produce some sheet ore. Few sheet-ground mines can operate profitably at less than $40 per ton, and comparatively few can run at this figure and still make a profit.

The 250-ton concentrating plant moved to the Carter land, north of Webb City, is ready for work.——A mill is being constructed by Short and Carey in Cottonwood Hollow, northwest of Joplin. It will treat ore from a soft formation at 100 ft.——Gas for use under boilers at mines and manufacturing plants was discontinued last week by both the Kansas Natural Gas Co. and the Joplin Gas Co. Consumers were requested to make other arrangements for fuel throughout the winter. For a number of years both Companies have conserved their supplies through the winter months for domestic consumers and for heating purposes.——The 250-ton electrically driven tailing mill of Bendelari and Longacre has been completed at a cost of about $8000, and placed in operation. There is several years' supply of tailing on hand. Equipment consists of two large jigs and five tables, elevators, and other accessory equipment.

MONTANA

Fergus County

During September the Barnes-King mill produced gold worth $23,035.

Granite County

Machinery for the Granite County Power Co.'s plant at Maxville has been sent to the site from the Allis-Chalmers works at Milwaukee, and according to the consulting engineer, Walter Neal, it should be in operation by the beginning of 1915. Current at 6600-volt pressure will be transmitted six miles to the Royal Basin Mining & Milling Co.'s property, where it will drive crushing apparatus and the Field flotation process.

Silverbow County

'Muckle' McDonald, Joe Bradley, and four other disturbers of the peace at Butte refused to plead when charged by the district court last week, so a plea of not guilty was made for them.——Repairs to the Butte & Superior main shaft will take 60 days to complete. The 75c. quarterly dividend will be paid as usual. During September the mill treated 34,850 tons of ore yielding 10,223 tons of zinc concentrate, assaying 53.61%, with 89.69% recovery.——The Bullwhacker Copper Co. is being reorganized, and a meeting of shareholders was held at Phoenix, Arizona, on October 26. The new Company, with a capital of 1,000,000 $1 shares, is called the Butte-Bullwhacker Mining Co., registered in Montana. The old Company was indebted to Clark Bros. & Klein, of Spokane, for $121,000. The mill can be overhauled for about $20,000.

The East Butte company cannot make any profit with copper at between 11 and 12c. per pound, according to the manager, Oscar Rohn.——Save the Butte & Duluth property, all properties east of Butte are idle.

NEVADA

Clark County

The reported rich gold discovery on the old Quo Vadis mine, 23 miles southeast of Las Vegas, amounts to practically nothing, according to Charles D. Wilkinson, manager of the Yellow Tiger company of Goldfield. The prospector had about 20 lb. of rich ore from a 75-ft. adit. On the strength of this the country had been staked for miles around.

Esmeralda County

The pumps for the 1325 and 1750-ft. levels of the Merger mine have arrived at Goldfield. The pump for the former level is a 6½ by 15-in. triplex type, and that for the lower level a 6-in. centrifugal.——The Jumbo Extension net profit in October is expected to be about $75,000. On October 22 the Company paid the balance of $30,000 due to the Merger company for its Velvet claim.——The Talmage Gold Mines Co., operating on Vindicator mountain, northeast of Goldfield, is meeting with encouraging developments under management of C. W. Hays.——Underground work is to be resumed on the Yellow Tiger in a few days.——Lessees at the Vernal have shipped 19½ tons of $60 ore from the 200-ft. level.

The Goldfield Consolidated company reports as follows for September: The mill treated 27,871 tons of ore yielding $120,600 net profit. Lessees produced 1127 tons, worth $20,076, of which the Company received $10,546, less the cost of transport and milling. Mine development totaled 2318 ft. at $6.49 per foot, and nothing of importance was revealed. Costs per ton totaled $6.53 per ton of ore milled.

Humboldt County

A small stamp-mill with amalgamating and concentrating apparatus has been started at the Forvilly Rochester Mining Co.'s mine. It was erected by Cliff De Lorme and F. W. Kittle.

Mineral County

In order to install and connect up new equipment in the Aurora mill, the work will be suspended for about 10 days.

Nye County

At Tonogold, the new gold district near Tonopah, work is still of an interesting character. Saunders and Sorensen opened 24 in. of ore at 15 ft., of which 12 in. assays over $40 per ton. A shaft is to be sunk to 150 ft. Ten inches of $70 to $80 ore is being sacked in the Jarvis-Richard lease. Dougherty, Mooney, and MacNamara are cross-cutting at 50 ft. The joint shaft of these miners and the Jarvis-Richards people is down 30 ft., showing 2 to 5 ft. of $18 ore. Lumber is on the ground to timber the Murphy shaft to 100 ft. A hoist is working at the Campbell & Kelly lease. Kelly and Mullin have 24 in. of $40 ore at 15 ft. depth. Employees of the Montana-Tonopah mine have their Tennessee shaft down

38 ft. J. May is down 35 ft. and is sacking ore. A. Wardle is down 42 ft. At the Miner lease the shaft is 30 ft. deep, and is encouraging. It adjoins the Spencer and May, two of the best claims at Tonogold, according to *The Tonopah Miner*.

Eight mines at Tonopah last week produced 10,473 tons of ore, worth $204,474.——The attachment of the Jim Butler company against the West End company was dissolved on October 23 by Judge Mark R. Averill, who thought that it was unnecessary, inasmuch as an injunction already was in force giving sufficient protection.——Development in the Tonopah company's mines totaled 402 ft. last week. The mill is treating 2675 tons of $16 ore per week, with 92% recovery. ——The net profit of the Extension in September was $62,666 from 5447 tons of ore. Six Wilfley tables have been installed and started. Foundations for 20 stamps are nearly finished. ——In the Belmont, development amounted to 532 ft. last week. A shipment was made of 116,791 oz. of bullion.

NEW MEXICO

Otero County

(Special Correspondence.)—The well known Tiffany turquoise mines at Turquesa have been purchased by Frederick K. Gilbert. The principal supply of the United States is from these deposits. Litigation has retarded development in the past. The gem properties in this state are fully described in U. S. Geological Survey reports.

Turquesa, October 24.

SOUTH DAKOTA

Pennington County

The Rochford-Wyoming Oil Co., at Rochford, has a well down 670 ft., using a Star drill. Oil-bearing sand is expected at about 1500 ft., as two other wells are yielding oil nearby. About $3500 has been spent for labor, tools, casing, etc., during the summer.

The Homestake Mining Co. paid its monthly dividend of 65c. per share on October 26. The total this year and to date is $1,419,600 and $32,546,000 respectively. Shares are quoted at $115.——The Wasp No. 2 company paid 1c. per share, amounting to $5000, on October 15. Shares are quoted at 75c. About 30% of the ore for the mill lately has been mined from a porphyry dike in the southwest part of the open-cut, and yields profitable returns. The new locomotive and cars are proving useful in stripping operations.——Several additions have been made to the mill equipment of the Golden Reward at Deadwood. A tube-mill now grinds the roasted 6-mesh ore, and an L. C. Trent displacement tank and a Moore filter treat the slime.

UTAH

A permanent exhibit of the mining and metallurgical industries of the state is proposed for Salt Lake City, by mining men and manufacturers. One exhibit suggested is a *papier maché* relief plan of all the mining districts, 8 by 9 by 60 ft. in size. There will also be shown cases of minerals. The total cost is estimated at $3000, of which the Commercial Club will give $1000.

Carbon County

The Cameron coal mines, 1½ miles west of Castlegate, have been sold by F. N. Cameron and others, of Salt Lake City, to M. S. Browning and associates of Ogden. The area is 400 acres, and is producing 300 tons of coal per day. This is to be doubled in the near future.

Juab County

Four feet of good lead-silver-gold ore has been opened on the 700-ft. level of the Emerald mine in the Tintic district. J. L. Yundt is manager.——W. Nelson, a lessee on the Yankee Consolidated, has opened 8 to 12-oz. gold and 100-oz. silver ore in an old stope on the 100-ft. level.——The Lower Mammoth and May Day mines are shipping zinc and lead ore, respectively, the latter averaging 45% lead and 45 oz. silver per ton.

Summit County

A suit between the Silver King Coalition and Silver King Consolidated companies, at Park City, was ended last week, when the former deeded two mining claims to the latter, and the latter four claims to the former.——A 12-ton motor armature for the Consolidated was being hauled to the mine by a 26-horse team last week.

WASHINGTON

Ferry County

The first payment of $8000 on the Last Chance mine at Republic has been made by the Western Union Mines, which has a bond and lease for $187,500.——The property of the Keller & Indiana Consolidated Mining Co., sold under judg-

WHATCOM
Orville
Northport
Metaline
OKANOGAN
Republic
Colville
STEVENS
Conconully
Twisp
Chesaw
Okanogan
Loup Loup
Winthrop
Mazama
Methow
Mazama
Darrington
Monte Cristo
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Skykomish
Sultan
Snohomish
Everett
Stevens Pass
Leavenworth
Wenatchee
Cashmere
Peshastin
Ellensburg
Roslyn
Cle Elum
Thorp
Kittitas
Ronald
Liberty
Yakima
Selah
Naches
Ahtanum
Union Gap
Yakima
Toppenish
Sunnyside
Grandview
Prosser
Benton City
Kennewick
Pasco
Walla Walla
Dayton
Waitsburg
Touchet
Columbia
Garfield
Pomeroy
Asotin
Clarkston
Lewiston
Orofino
Pullman
Colfax
Palouse
Moscow
Genesee
Kendrick
Juliaetta
Troy
Deary
Bovill
Potlatch
Harvard
Princeton
Tekoa
Rosalia
Spokane
Medical Lake
Cheney
Fairfield
Latah
Rockford
Valleyford
Mica
Hillyard
Opportunity
Millwood
Dishman
Greenacres
Liberty Lake
Otis Orchards
Newman Lake
Chattaroy
Loon Lake
Deer Park
Addy
Springdale
Chewelah
Colville
Kettle Falls
Northport
Metaline
Metaline Falls
Ione
Usk
Newport
Priest River
Sandpoint
Bonners Ferry
Porthill
Kootenai
Clark Fork
Hope
Sagle
Dover
Coeur d'Alene
Rathdrum
Spirit Lake
Post Falls
Athol
Hayden Lake
Harrison
Wallace
Kellogg
Mullan
Osburn
Wardner
Pinehurst
Smelterville
Silverton
Cataldo
Kingston
Pinehurst
Mullan
Wallace
Kellogg
Osburn
Wardner
Pinehurst
Smelterville
Silverton
Cataldo
Kingston
Coeur d'Alene
Rathdrum
Spirit Lake
Post Falls
Athol
Hayden Lake
Harrison
Sandpoint
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Porthill
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Ione
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Metaline Falls
Metaline
Northport
Kettle Falls
Colville
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Springdale
Loon Lake
Chattaroy
Newman Lake
Otis Orchards
Liberty Lake
Greenacres
Dishman
Millwood
Opportunity
Hillyard
Mica
Valleyford
Rockford
Latah
Fairfield
Cheney
Medical Lake
Spokane
Tekoa
Rosalia
Princeton
Harvard
Potlatch
Bovill
Deary
Troy
Juliaetta
Kendrick
Genesee
Moscow
Palouse
Colfax
Pullman
Orofino
Lewiston
Clarkston
Asotin
Pomeroy
Garfield
Columbia
Touchet
Waitsburg
Dayton
Walla Walla
Pasco
Kennewick
Benton City
Prosser
Grandview
Sunnyside
Toppenish
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Skykomish
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Monte Cristo
Darrington
Mazama
Winthrop
Methow
Loup Loup
Twisp
Conconully
Okanogan
Republic
Orville
Ferry
Stevens
Pend Oreille
Lincoln
Adams
Whitman
Douglas
Grant
Chelan
Okanogan
Kittitas
Yakima
Benton
Klickitat
Clarke
Skamania
Columbia
Garfield
Asotin
Franklin
Walla Walla
Whitman
Lincoln
Spokane
Stevens
Pend Oreille
Ferry
Okanogan
Chelan
Douglas
Grant
Adams

$494,507, a total of $1,451,936.——A new vein at 140 ft. in the McKinley-Darragh property is yielding rich ore and a winze shows 4 in. of 8000-oz. material composed of calcite. So far the winze has produced $40,000. The mines are returning an average of between 125,000 and 150,000 oz. per month.

At Porcupine, a contract for 30,000 ft. of diamond drilling was recently let by the Dome Mines Co. Ten machines will be used in this work.——The Vipond mill is treating between 90 and 100 tons of ore per day. A refinery is to be built. Work in the mine is being done on three levels.——The Porcupine Crown winze at 500 ft. is being sunk to 600 feet.

The 800-ft. station in the Hollinger is now being cut. From this station a cross-cut will be driven to No. 1 vein, which is yielding ore at 675 ft. and upper levels. At the Acme the shaft is down 550 ft., and will be sunk to 800 ft. to connect with the new level of the Hollinger at that depth. A main central shaft, to serve the Acme, Hollinger, and Miller-Middleton mines, is being sunk 800 ft. south of the mill. It is down 70 ft., and from the 425-ft. level a rise will be driven to meet the shaft. This will be 8 by 32 ft., with six compartments, and two stations, one at 425 ft. and the other at 800 ft. An electric haulage system will be installed for the mines.

At the Kirkland Lake, air-compressors and machine-drills have been started at the Lake Shore and Kirkland Lake properties.

During August the Hollinger mine made a profit of $152,821 from the treatment of 19,828 tons of ore averaging $12.41 per ton. The approximate extraction was 93.01%, and the working cost $3.86 per ton milled, a reduction of 30c. compared with the preceding period. The surplus on hand is $1,043,957.

JAPAN

(Special Correspondence.)—The Hasami mine in Kysliu has been closed on the advice of Reiji Kanda. The Nippon Industry Bank, which had advanced money to the Hasami Gold mines, was obliged to order a cessation of work. In all, nearly $2,000,000 has been spent. A 100-stamp mill was built three years ago, and modern methods and machinery introduced in every department, but to no purpose. Below the main adit level the ore changed abruptly in grade, and in 1913 averaged but 34c. per ton. The occurrence is similar to that at Cripple Creek in Colorado, except that liparite, rather than andesite, is the country rock.

Tokyo, September 11.

MEXICO

According to *The Mexican Herald* of October 17, mining men in Mexico City state that there is a scarcity of cyanide in the republic, perhaps enough to last till the end of the year. Supplies are expected from the United States, while some companies will import from Scotland if possible.

Exchange on the above date was from 21 to 21.5c. U. S. per *peso*.

The International Mining Association of Mexico was formed in Mexico City on October 16. Its object is to aid the mining industry in every way. The following board of directors was elected: T. P. Honey, president; D. F. Calland, vice-president; Emil Berthier, secretary; Andres Aldasoro, treasurer; and A. F. Main, Frank Rule, A. P. Griffiths, Hugh Rose, and Ernesto Enriquez, directors. Among the companies represented at the meeting were: Pachuca and Real del Monte, El Oro Mining and Railway, Dos Estrellas, Mexico Mines of El Oro, La Blanca y Anexas, Maravillas y San Francisco, Sta. Gertrudis, Sta. Ana y Anexas, San Rafael, La Union, Chontalpan, El Barreno, La Esperanza, Guanajuato Consolidated, Peñoles, Santa Rosa Mining Co., El Alacran, Natividad, Blaisdell Coscotitlan, Beneficiadora de Pachuca, Peregrina, Pingiuco, Guanajuato Development, Guanajuato Reduction Mines Co., Ajuchitan, El Bote, Carmen Gold Mines, Beneficiadora de Metales, and Metalurgica y Beneficiadora de Zacatecas.

PERSONAL

Spencer Browne is at Toronto.

B. B. Lawrence has been at El Paso.

Howard W. DuBois is on his way to Alaska.

Lawrence Addicks has returned to New York.

Karl Eilers will be in the West for the next few weeks.

Theodore J. Hoover has sailed from New York for London.

J. Koltma is visiting metallurgical plants in the vicinity of New York.

William S. Mann is building a cyanide mill at La Trinidad mine, Cisco, California.

Ross B. Hoffmann arrived in New York on October 18, and will remain there for a time.

Cornelius B. Lakenan, general manager for the Nevada Consolidated, was recently in Boston.

Dr. James Douglas is expected to return to New York from Douglas, Arizona, about November 1.

Morton Webber has left for the West. He recently examined the McIntyre mine at Porcupine, Ontario, on behalf of the Nipissing Mines Company.

Ernest Bamberger, E. L. Carpenter, J. M. Bidwell, and W. H. Eardley are members of a committee for the permanent exhibit of the mining and metallurgical industries of Utah to be at Salt Lake City.

Operating officials at the Santa Gertrudis mine and mill, Pachuca, Mexico, during the past year were as follows: Hugh Rose, general manager; C. A. Lantz, assistant general manager; W. E. Crawford, metallurgist; F. H. Walsh, electrical engineer; and G. F. Johnston, office.

David T. Day has resigned from the U. S. Geological Survey to engage in private practice. Mr. Day has had charge of the work of gathering statistics for the government report on the production of petroleum for seven years, and this work will now be compiled by John D. Northrop.

Operating officials of the Camp Bird company, Ouray, Colorado, are as follows: William J. Cox, general manager; J. B. Glasser, assistant manager; Joseph H. Scott, mine superintendent; and Thomas H. Woods, metallurgist. The personnel has not been changed for twelve years, according to the recently published report of the Company.

Mining engineers on the American committee in London, the work of which is mentioned in an editorial paragraph of this issue, are as follows: executive committee, Herbert Hoover, J. P. Hutchins, A. F. Kuehn, A. F. Martin, and Edgar Rickard; members, A. Chester Beatty, Hart O. Berg, R. Gilman Brown, J. F. B. Erdletts, Jr., C. S. Herzig, Theodore J. Hoover, J. D. Hoffmann, T. J. Jones, Newton B. Knox, A. F. Kuehn, W. C. Madge, J. H. Means, D. P. Mitchell, Walter G. Perkins, C. W. Purington, Jerome Sharp, E. C. Thurston, H. A. Titcomb, C. E. Vigeon, and H. H. Webb.

The nominating committee of the American Institute of Mining Engineers has made the following nominations for officers of the Institute to be voted for at the annual meeting in 1915: For president, William L. Saunders, district O. For vice-presidents, Sidney J. Jennings, district O; and Philip N. Moore, district 3. For directors, Samuel A. Taylor, district 2; Robert W. Hunt, district 3; Hennen Jennings, district 9; George C. Stone, district O; and W. H. Aldridge, district 6. William J. Cox is chairman of the committee.

Andrew A. Bruch, manager of sales for the S. Flory Manufacturing Co., died on October 20. Mr. Bruch had been with the Company since its inception.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, October 29.

Antimony	12 —12¾
Electrolytic copper	13 —13¼
Pig lead	3.75— 4.70
Quicksilver (flask)	$50
Tin	36 —37½
Spelter	6 — 6¼
Zinc dust, 100-kg. zinc-lined cases	10

EASTERN METAL MARKET.

(By wire from New York.)

NEW YORK, October 29.—Lead is firmer at 3.50c., and spelter quiet at 4.30c. per pound. The export demand for spelter has improved. Electrolytic copper is dull at 11.25 to 11.30c. for cash and 11.35c. for 30 days.

A discussion of the metal and cyanide situation appears in the New York letter of this issue.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The following quotations were made during the past week: New York, 49⅝, 49⅛, 48⅞, 48¾, and 48⅛c.; and London, 22⅝, 22½, 22½, 22½, and 22⅝d. per ounce. During the past 81 years, silver prices, as published in the 'Press' of March 7, 1914, were only as low as the present level during the period of November 1902 to April 1903, February being 21⅞d. in London. The present situation indicates a weak market. The steamer 'Mongolia' took silver worth $224,908 (say 450,000 oz.) from San Francisco to Hongkong and Shanghai on October 24.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Oct. 22	3.50	Sept. 9	3.85
" 23	3.50	" 16	3.85
" 24	3.50	" 23	3.85
" 25 Sunday		" 30	3.75
" 26	3.50	Oct. 14	3.75
" 27	3.50	" 21	3.50
" 28	3.50	" 28	3.50

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.36	3.86	Oct.	4.37	....
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

The metal is firm at St. Louis at 3.35c. per pound. Curtailment of production by the St. Joseph Lead Co., Missouri, and several companies in Idaho will strengthen the position.

COPPER

Prices of electrolytic in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

Sales reported in New York during the month were as follows: October 7 and 10, 14.5c.; and 17, 21, 24, and 28, 14.25c. per pound. Exports are increasing, but ships carrying the metal run the risk of being captured and cargoes delayed. For the nine months ended September 30, exports from the United States totaled 569,632,000 lb., against 656,678,400 lb. during the same period of 1913.

The 'Boston News Bureau' makes the following estimate of the copper surplus:

	Pounds.
Surplus, July 1	106,000,000
Production, July, August, and September	400,000,000
Total	506,000,000
Domestic deliveries	130,000,000
Exports	156,000,000
Total	286,000,000
Surplus, October 1	220,000,000

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
Oct. 1	55.00	Oct. 15	55.00
" 8	55.00	" 22	50.00
		" 29	50.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mch.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	....
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Oct. 22	4.90	Sept. 9	5.50
" 23	4.90	" 16	5.25
" 24	4.90	" 23	5.00
" 25 Sunday		" 30	4.88
" 26	4.90	Oct. 14	4.55
" 27	4.90	" 21	4.73
" 28	4.90	" 28	4.90

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	....
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

The metal is 4.90c. per pound nominal in St. Louis. At Joplin, zinc ore buyers have been bidding better for ore, and prices rose to $41 per ton basis 60% zinc.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	30.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36.10	Oct.	40.61	....
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

Tin has risen to 31.75c. per pound. The steamer 'Troilus,' carrying 975 tons of metal from Singapore to London, was sunk by the German cruiser 'Emden,' while the 'St. Egbert' was captured with other lots on board. This has further reduced the visible supply, war risks on shipments have been raised, and buyers are shy of dealing in 'shipment' tin. The oil tanker 'Tamaha' brought 300 tons of tin to San Francisco from Singapore for the Standard Oil Co. on October 24.

The following are recent quotations for large lots in New York: ferro-manganese, $65 to $68 per ton; pig iron, $13.25 to $14.70 per ton; aluminum, 18 to 18.5c. per pound; antimony, 13 to 15.5c per pound; refined platinum, $48 to $50 per ounce; and quicksilver, $47.50 per flask.

MINERAL STATISTICS

The following data, covering the year 1913, is from the U. S Geological Survey

Mineral Output of New Hampshire

Total mineral output was valued at $2,218,925, of which quarries contributed $1,482,771.

Steel Ingots and Castings

The total production of all kinds of this material was 31,300,874 long tons, against 21,599,931 tons in 1912. Steel produced by electric furnaces amounted to 30,180 tons, compared with 18,309 tons in the previous year, and 55 tons in 1908. There were 19 complete electric furnaces at the end of last year.

Mineral Output of Connecticut

The total mineral output was valued at $3,795,297, a record total. The products are mainly from quarries.

Mineral Output of North Carolina

Production totaled $3,739,696, an increase of $370,773 over 1912. This is the leading producer of mica in the United States, the yield being $267,913. Other products are mostly from quarries, there being a little gold, silver, lead, zinc, and copper recovered.

Mineral Output of Vermont

Production totaled $9,647,985, of which over $9,000,000 was from quarries. The yield showed an increase of more than $1,500,000 over that of 1912.

Coal and Gas in Kansas

Out of the total mineral products worth $27,312,563, coal contributed $12,036,292 from 7,202,210 short tons, and natural gas valued at $3,288,394. These yields were an increase and decrease respectively. Portland cement manufactured was 3,291,818 bbl., worth $3,286,861, a decrease in output but an increase in value. Oil amounted to 2,375,029 bbl. worth $2,248,283, against 1,592,796 bbl. and $1,095,698. The zinc produced was 10,088 tons valued at $1,129,856.

Pig Iron Marketed

The iron marketed was 30,388,935 long tons, valued at the furnaces at $458,342,345, compared with 30,180,969 tons and $420,563,388, in 1912. The average price per ton in 1913 was $15.08, and in 1912 it was $13.93.

Ferro-Alloys Marketed

Ferro-alloys totaled 296,207 long tons, valued at $13,015,362, compared with 328,685 tons and $12,223,776, in 1912. Of the production in 1913, 121,517 tons was made from imported ores received from Australia, Brazil, Canada, India, Indo-China, and Russia.

Mineral Output of Oregon

This was as follows: total value, $3,563,919, an increase of $1,010,370; gold, $1,627,710, an increase of over 100%; clay products, $771,795; sand and gravel, 1,442,152 tons; stone, $357,498; coal, 46,064 tons worth $116,724; and several other minerals. The last four minerals showed increases.

Mineral Output of New Jersey

Clay products accounted for $19,705,378 out of the total of $37,271,129. Of the clay materials, brick was worth $10,866,833, and pottery $8,838,545. Zinc produced increased from 69,755 to 84,122 tons, but the value declined from $9,626,191 to $9,421,664. The cement output was 4,255,015 bbl., worth $3,638,755, a decrease of quantity but increase in value. Quarries in this state produced a large tonnage.

Metals in Montana

This is essentially a metal-producing state, the value of its copper, gold, silver, zinc, and lead representing over 89% of the total of $69,307,056 in 1913, a decline from the $71,620,873 in 1912. Copper produced was 287,828,699 lb., valued at $44,613,448, compared with 309,738,873 lb and $51,106,914 in 1912. Zinc recovered in concentrate was 44,337 tons, worth $4,965,693, against 13,459 tons and $1,857,403 in the previous year. This increase was due to the Butte & Superior mine. Coal mined increased from 3,048,495 short tons, valued at $5,558,195, to 3,240,973 tons and $5,653,539.

Metal Yield of Utah

This state ranks second in silver, third in lead, fourth in copper, sixth in gold, and seventh in zinc. The yields were as follows:

Metal.	1912.	Value.	1913.	Value.
Copper, pounds.	137,307,435	$22,655,735	161,445,962	$25,024,124
Silver, ounces	13,835,903	8,509,080	13,084,835	7,903,240
Lead, tons	70,156	6,314,001	83,063	7,303,579
Gold, ounces	206,360	4,265,851	172,468	3,565,229
Coal, tons	3,016,149	5,046,451	3,254,828	5,384,127
Cement, barrels.	760,668	937,119	950,469	1,233,421
Clay products	.....	724,978	.....	708,906
Total output	.....	$51,004,942	.....	$53,606,521

Iron Ore, Cement, and Copper in Michigan

The total value of minerals produced in this state was $72,143,211, against $80,062,486, due to a strike in the 'copper country.' Iron ore mined totaled 12,668,560 tons worth $33,479,954, a slight decrease in tonnage, but a decided gain in value. Cement manufactured was 4,081,281 bbl. valued at $4,228,879, against 3,651,094 bbl. and $3,145,001 in 1912. The yield of copper, 135,853,409 lb., worth $21,057,278, was only 60% of that in 1912. Michigan is a great salt producer, vying with New York for first place in the Union, and the output in 1913 was 10,829,307 bbl., valued at $3,054,532, a fair increase. A variety of other minerals are produced.

Mineral Production of Colorado

On account chiefly of the decreased production of coal, the total value of the mineral products of Colorado decreased from $58,167,399 in 1912 to $54,294,281 in 1913. The product of chief value is gold, the production of which in 1913 was almost exactly one-third the total value of the mineral products of the state, according to the U. S. Geological Survey. The production decreased from 899,222 fine oz., valued at $18,588,562 in 1912, to 877,857 fine oz., valued at $18,146,916. Second in importance is coal, but on account of labor troubles in the last quarter of the year, production decreased from 10,977,824 short tons, valued at $16,345,336, in 1912, to 9,232,510 tons, worth $14,035,090. The production of zinc, which showed a marked increase in 1912 over 1911, suffered a decrease in 1913, which was particularly emphasized in the diminished value of the output. The recoverable zinc content of the ores mined was 59,673 short tons, valued at $6,683,400, against 66,111 tons, valued at $9,123,374 in 1912. The zinc-mining operations are third in importance among Colorado's mining industries. Colorado leads all of the Western states in the manufacture of pig iron, but produces only a small quantity of iron ore. Silver ranks fourth in Colorado's minerals, and, unlike gold, showed an increase of output in 1913. Production increased from 8,212,070 fine oz. valued at $5,050,423, in 1912, to 9,325,255 oz., valued at $5,632,454. The recoverable lead content of the ore in 1913 was 43,949 short tons, valued at $3,867,502. The other mineral products which had a total value in excess of $1,000,000 in 1913 were clay products and copper. Other mineral products of the state are cement, ferro-alloys, fluorspar, fuller's earth, gems, graphite, gypsum, lime, manganiferous ore, mica, mineral waters, natural gas, petroleum, sand and gravel, sand-lime brick, sulphuric acid from zinc smelting, tungsten concentrate, and uranium and vanadium ores.

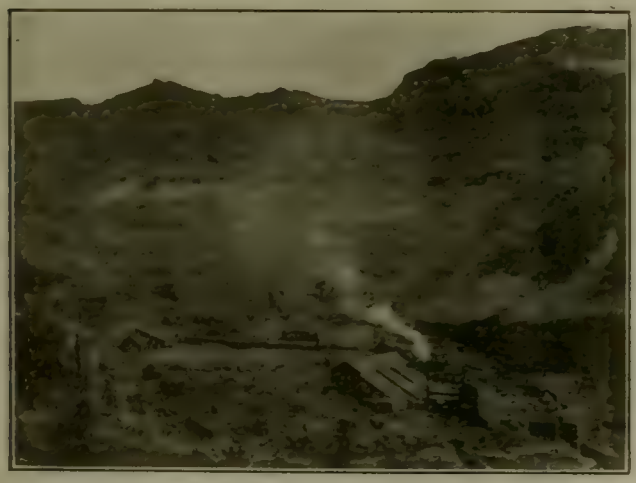
COMPANY REPORTS

TONOPAH MERGER MINING COMPANY

The report of the general manager, John G. Kirchen, covers the financial year ended April 30, 1913. The main shaft is now 1185 ft. deep, and 7106 ft. of general development has been accomplished in the mine. The Merger vein was cut in the shaft at 940 ft., where it was 14 ft. wide of $25 ore. On and above the 980-ft. level the shoot is 10 ft. wide, and extends 100 ft. above it, the length being 200 ft. At 1070 ft. No. 1 shoot is 180 ft. long, and 10 ft. wide; while No. 2, beyond a fault, is 300 ft. long, up to 50 ft. wide, assaying $10 per ton. Prospecting was done on this level in trachyte formation. At 1170 ft. the west drift showed 400 ft. of ore, which averages $20 per ton over 10 ft. Another shoot was cut in April, with a West End rhyolite foot-wall, and trachyte hanging wall. Up to May 1, it had been opened for 40 ft., exposing 6 ft. of $20 ore. A winze was started from this level, but water hindered work, but in the second week of September 1914 the flow was under control. Ore shipments totaled 14,728 dry tons, assaying 22.5 oz. silver and 0.27 oz. gold per ton, containing 332,057 oz. silver, and 3945 oz. gold. Ore sales amounted to $220,745, from which is deducted mining, $91,249; sampling, freight, and treatment, $93,374; general, etc., $18,555, leaving a profit of $17,668. Added to the previous balance there is a surplus of $170,704 at April 30, 1914.

TOMBOY GOLD MINES COMPANY, LTD.

In his report for the year ended June 30, 1914, the general manager, D. A. Herron, makes the following statement: At the Argentine claims, development was limited to the south end of the mine near manway 119 on the 2100-ft. level. At 60 ft. above the level a drift opened 3 ft. of ore containing considerable lead and zinc, but only $3 to $4 per ton in gold and



TOMBOY MINE, TELLURIDE, COLORADO.

silver. The winze from this level, started in 1911, is down to 2200 ft. and the vein is being opened. So far it is about the same value as at 2100 ft. Owing to a cave-in in the upper portion of the mine, it was necessary to draw all ore above the 50-ft. level in one area, while the remainder of the stopes above 500 ft. will be drawn during the current year. Pillars of ore supporting the level will be mined and dropped to 850-ft. level stopes. Reserves in the Argentine mine amount to 215,000 tons, of which 190,000 tons is broken in stopes. In the Montana mine, reserves are estimated at 237,000 tons, 137,000 tons being in stopes. Development in this area during the year was 4816 ft. Work at 1450 ft. and the Fortuna level has shown a shoot totaling 2500 ft. in length. Ventilation of the mine has been improved greatly. The aerial tramway worked successfully, only being interrupted by a snowslide which wrecked the Midway tension station and two towers below it. The profit was $40,000, and adding that of the last five months of the previous financial year, the total was $59,000, or $8000 over the cost of erection.

Ore sent to the mill consisted of 80% Montana and 20% Argentine product, against 41 and 59% respectively last year. There was a decrease in concentrate output, as the Montana ore contains less sulphides. This eliminated recovery of zinc middling as a concentrate product, and consequently experiments with flotation and electrostatic processes were abandoned. As the result of tests by the consulting metallurgist, W. K. Betty, Tomboy ores were proved to be amenable to cyanidation. A 400-ton plant was planned, and in the middle of August 1914, erection of the building was well under way. The mill treated 137,456 tons of ore yielding bullion worth $385,612, and concentrate valued at $573,447.

With dividends from the Tomboy Tramway & Tunnel Co., boarding house, rents, etc., the total revenue was $1,013,918. Mining, treatment, freight, and general expenses totaled $604,377, or $4.40 per ton. Dividends absorbed $297,600, and a balance of $230,000 was carried forward. The consulting engineer, P. L. Foster, rendered valuable assistance in all departments of the Company's operations.

LAKE VIEW & OROYA EXPLORATION, LTD.

This is an English concern holding debentures and preference shares in 8, and ordinary shares in 13 companies operating oil, power, copper, zinc, gold, and dredging properties throughout the world. The report is for the year ended June 30, 1914. The profit was £76,225, and the previous balance of £22,351 made a total of £98,576. Of this, £36,095 was paid as two 5% dividends, the issued capital being 721,909 shares of 10 shillings each. Of the balance, £40,000 was transferred to the reserve account, and £22,481 carried forward. For the current year the first distribution of 5%, or £18,048, has been paid.

The technical committee, consisting of J. A. Agnew, Theodore J. Hoover, J. H. Cordner-James, and A. F. Kuehn, made the following report on some of the interests held by the Company, dated September 25, 1914:

Lake View & Star, Ltd.—The holding Company owns about 62.5% of the capital of this Company, which operates at Kalgoorlie, Western Australia. During the six months ended August 31, its mine yielded 110,917 tons of ore for gold worth £127,735, with a profit of £21,585 above Australian expenses. Dividends totaling 16% were paid in the past financial year, and 5% so far for the current year. Development at 2100 ft. in the Lake View is encouraging, while at and below 700 ft. to 900 ft. the Hannans Star mine is showing good ore. Reserves in the mines total 35,000 tons.

Queen of the Hills Mine.—This is at Meekatharra, Western Australia. During the year ended June 30, 1914, the Holman pneumatic stamps and cyanide plant treated 43,309 tons of ore for £70,200, with a profit of £24,538. The main shaft is down 455 ft. At No. 4 level there is 202 ft. of sulphide ore, 4 ft. wide and worth $7.80 per ton. Cross-cuts indicate a further 3 to 5 ft. of ore. No. 5 level is proving satisfactory also. Ore reserves are 51,246 tons of oxidized and 29,000 tons of sulphide ore. Tests with 731 tons show that the latter ore can be easily treated.

Yuanki Gold Mines, Ltd.—The Lake View & Oroya company holds 169,036 out of the 350,000 shares of this Company,

operating near Black Range Western Australia. A miners' strike from June to August interfered with mining and milling. West in the Oroya Black Range mine failed to disclose any additional ore. Several tributes have been let. The Yuanmi mine made £8100 profit for the five months ended May 31. The shaft is down 519 ft. Reserves are about 40,000 tons averaging $9.12 per ton. The financial condition of the Company is quite satisfactory.

Zinc Corporation, Ltd.—Owing to the war in Europe this Company's South Blocks mill and the flotation plant are closed, although measures are being taken to overcome this situation. During 1913 there was mined and milled 162,956 tons of lead ore, with a recovery of 87.6% of the lead and 70.3% of the silver. The flotation plant handled 350,120 tons of all products, for a recovery of 80.7% zinc, 43.4% silver in zinc concentrate, and 21.8% lead and 37.5% silver in lead concentrate. Ore reserves amount to 971,784 tons averaging 14.8% lead, 2.4 oz. silver, and 9.5% zinc. Development since this estimate, to 1310 ft., indicates another 1,000,000 tons of probable ore. Zinc-tailing dumps at the end of 1913 contained 1,664,000 tons. The profit in 1913 was £225,680. The ore milling plant is being enlarged to treat 300,000 tons per annum.

Burma Corporation, Ltd.—Out of 1,000,000 shares authorized, the Lake View & Oroya holds 100,000 shares. The Burma company is mainly occupied in developing the Bawdwin mines and lead smelter in Burma, India. Development has proved the Burman and Shan lodes to extend to 430 ft. The Chinaman orebody at 1700 ft. is 1300 ft. long. Reserves are 612,000 tons worth £6,920,000 for each 100,000 ft. of vertical extension in depth. The smelter produces about 650 tons of silver-lead bullion and soft lead per month.

Central American Mines, Ltd.—The capital of this Company is 600,000 shares of five shillings each, of which 450,014 have been issued, and the Lake View & Oroya holds 159,824, also £35,000 of debentures. The labor situation at the mines has improved, partly by introducing Spanish miners, and more particularly owing to a more settled state of the country. Water has interfered with underground work. Ore reserves are 61,250 tons worth $9.60 per ton. The mill treated 3602 tons in August. The cyanide plant is being reorganized.

Babilonia Gold Mines, Ltd.—Of the 170,007 £1 shares issued, the holding Company owns 150,007 shares. New pumps have been installed in the mine. Underground work shows about 31,000 tons of $10.16 ore. There is also 25,000 tons of accumulated sand and slime, assaying $6 per ton. The old mill treated 4395 tons of ore for £7578 during the first half of 1914. The new slime plant is in operation. With the exception of the gas engines and electric generator for the new mill, other equipment, including the new Holman No. 3 pneumatic stamp and rock-crusher, have been delivered at the property.

Granville Mining Company, Ltd.—This Company derives its income from the Canadian Klondyke Mining Co., Ltd., and the Canadian Klondyke Power Co. During the 1913 season the four dredges handled 6,363,000 cu. yd. of gravel, yielding 85,899 oz. gold worth $1,331,000, with a profit of $851,000. Results for the 1914 season to September 12 show 49,820 oz. recovered, against 48,499 for the same period of last year. Income of the Granville company from these two companies is more than enough to pay interest on its debentures.

General Petroleum Company.—This Company owns large areas of proved oil lands in California, together with pipelines, refineries, etc. During the quarter ended July 31, 1914, there was 1,319,301 bbl. of oil produced, 725,530 bbl. purchased, 1,396,834 bbl. sold, and 524,587 bbl. added to storage. The total storage at July 31 was 1,501,869 bbl. The interest on notes and debenture stock is in arrear, but on this scale of operations it appears to be amply covered.

The diamond industry of British Guiana has been crippled by the lack of a market. The gold output to September 10 was $682,378, against $943,989 in that period of 1913.

RECENT PUBLICATIONS

U. S. Bureau of Mines publications, Washington, D. C., 1914:

Hints on Coal Mine Ventilation. By J. J. Rutledge. *Miners' Circular* 16. P. 22.

A Study of the Oxidation of Coal. By Horace C. Porter and O. C. Ralston. *Technical Paper* 65. P. 30. Illustrated.

United States Coals Available for Export Trade. By Van. H. Manning. *Bulletin* 76. P. 15. Map. Exports in 1913 totaled 16,083,101 tons, of which 11,500,000 tons went to Canada, and 450,000 tons to South American ports. Good coal is available for export, and transport and loading systems are well developed. The fields and respective shipping ports are as follows: Pocahontas and New River fields in West Virginia to Norfolk and Newport News; Maryland and Pennsylvania fields to Baltimore or Philadelphia; Virginia, Kentucky, and Tennessee fields to Norfolk, Newport News, or Charleston; Alabama fields to Mobile or New Orleans; Western Pennsylvania fields to New Orleans; Illinois and Indiana fields to New Orleans; and Washington fields to Tacoma and Seattle.

Quarry Accidents in the United States in 1913. Compiled by Albert H. Fay. *Technical Paper* 92. P. 76. Mention was made of this compilation in the editorial paragraphs of the *Press* of October 17.

U. S. Geological Survey publications, Washington, D. C., 1914:

Advance chapters from 'Mineral Resources of the United States, 1913':

Gems and Precious Stones. By Douglas B. Sterrett. P. 60. This deals with the agate, amethyst, beryl, diamond, feldspar gems, jade, jet, lapis lazuli, lazulite, obsidian, and opal mining in each state, also the diamond output of Africa.

Copper in 1913. By B. S. Butler. P. 59. The output last year was 1,224,484,098 lb., against 1,243,268,720 in 1912, while that of the world was 2,198,732,130 lb., compared with 2,259,101,580 pounds.

Statistics of Clay-Working Industries of the United States in 1913. By Jefferson Middleton. With notes on the occurrence and use of flint clay, by J. H. Hance. P. 104. The total value of clay products was $181,289,132, against $172,811,275 in 1912. Brick and tile accounted for 79.04%, and pottery, 20.96% of the total.

The Shinumo Quadrangle, Grand Canyon District, Arizona. By L. F. Noble. *Bulletin* 549. P. 100. Ill., maps, index.

The Iditarod-Ruby Region, Alaska. By Henry M. Eakin. *Bulletin* 578. P. 45. Ill., maps. An abstract was printed in the *Press* of October 24.

Ore Deposits in the Sawtooth Quadrangle, Blaine and Custer Counties, Idaho. By Joseph B. Umpleby. *Bulletin* 580-K. P. 29. Maps. An abstract appears in the news pages of the *Press* of this issue.

Colorado Ferberite and the Wolframite Series. By Frank L. Hess and Waldemar T. Schaller. *Bulletin* 583. P. 75. Illustrated.

Bibliography of North American Geology for 1913. With subject index. By John M. Nickles. *Bulletin* 584. P. 183.

The Constitution of the Natural Silicates. By Frank Wigglesworth Clarke. *Bulletin* 588. P. 128. Index.

Profile Surveys in the Basin of the Clarke Fork of Columbia River, Montana-Idaho-Washington. Prepared under the direction of R. B. Marshall, chief geographer. *Water-Supply Paper* 346. P. 6. With 22 plans. This river is about 420 miles long and drains an area of 25,800 square miles.

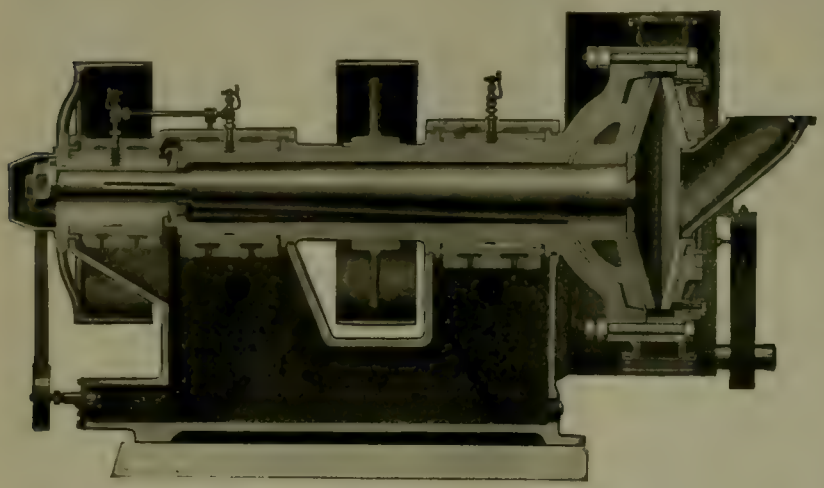
Contributions to the Stratigraphy of Southwestern Colorado. By Whitman Cross and Esper S. Larsen. *Professional Paper* 90-E. P. 12. Illustrated.

New Machines and Devices

Disc Crushers

Disc crushing is an old principle the application of which to large scale milling operations has been accepted but slowly by metallurgical engineers. The past decade, however, has developed new ideas and refinements in the application of this principle, with the result that disc machines are finding a place in modern metallurgical plants and have given efficient service after passing the experimental stage.

The accompanying halftone presents a cross-section of one type of disc crusher manufactured by the Symons Brothers Co., of Chicago. This crusher is being used in a number of crushing plants and is reported to be giving satisfactory service. The machine is ruggedly constructed with manganese wearing parts. There is no grinding action, the action of the machine being a simple crushing movement. A general idea as to the service of the machine is supplied in a letter from a Canadian operator, who has had a disc machine in service for the past two years.



CROSS-SECTION OF SYMONS DISC CRUSHER.

"The crusher in this instance is a 48-in. disc machine crushing ore composed of greenstone, epidote, magnetite, and a little granite. The granite was much the easiest to crush of any of the four. The greenstone is hard and tough, and has a compressive strength varying from 30,000 to 50,000 lb. per square inch. The material is abrasive because of the large percentage of silica in both the rock and the magnetite.

"The crusher has been used at different times with different sizes of feed. One size being a product from a No. 8 gyratory crusher giving slabs of about 4 in. thickness and a breadth and length much greater. The machine easily handles pieces as large as this, and it would seem will handle pieces up to 6 in. in thickness with equal results. The size of the feed to the machine is only limited by the size of the spout which admits it. The product from the machine will all pass through a $1\frac{1}{2}$-in. revolving screen.

"The capacity of the machine is 50 gross tons per hour, with the machine set to give a product as stated. This machine is driven by a 75-hp. motor and probably uses an average of 60 hp. The inertia in starting is great and it requires a motor of heavy starting torque, and a coil-wound rotor motor is used for this purpose.

"I have no way of knowing, in the absence of data, whether this particular type of machine will make a more dusty product than a gyratory, but observations lead me to believe that there is little difference, if any.

"In studying the machine, one will come to the conclusion that, in view of the fact that there is no differential rotation between the two discs, but simply a nip and, of course, a quick discharge because of centrifugal force, that the machine sizes its product with the largest opening of the discs and not the closest. There is a great amount of tramp steel from the mine going into this crusher and it brings it to an almost instantaneous stop, throwing off the belts and choking down the machine. This, of course, is severe on any machine, but I am unable to remove the tramp steel in the ore with a magnetic separator, since the ore itself is magnetic. This steel getting into the crusher has caused little damage, as during the entire time of operation, nearly two years, only one part, the outer spider, has broken. The machine is rugged and stands a great deal of abuse without apparent injury."

Commercial Paragraphs

Morse Bros., Denver, Colorado, have issued a folder in which there is listed its large stock of second-hand machinery. Specifications giving details as to size and conditions will be sent on request. The list includes boilers, feed-water heaters, steam and gas engines, direct connected units, motors, generators, water wheels, pumps, compressors, blowing engines, drills, hoists, furnaces, stamps, and other equipment.

General Filtration Co., Pittsburgh, has recently published an attractive booklet entitled 'Filtros.' The booklet discusses the manufacture of this new porous mineral ware, its application to physical separations, filtration, and agitation. The booklet is fully illustrated and contains a large amount of information regarding this interesting product.

Elspass Engineering & Machinery Co., Denver, Colorado, has for distribution a catalogue, 'The Modern Machine for Uniform Ore Grinding.' The mill discussed is of the well known Chilean type, but involving a decided change in construction and operation. It consists essentially of a heavy, rigid, revolving bed, the bottom of which carries a heavy steel die ring, and upon this ring rest three massive stationary rolls. Instead of these heavy rolls being dragged around upon the die ring by a central moving journal as in the old style of mills, the bed below carrying the die ring is made to revolve beneath the rollers, which remain in a stationary position and merely revolve upon their respective journals as the die ring passes beneath. A number of advantages are claimed by the manufacturers of this mill over the old mill, and details of construction are shown in halftones and line drawings.

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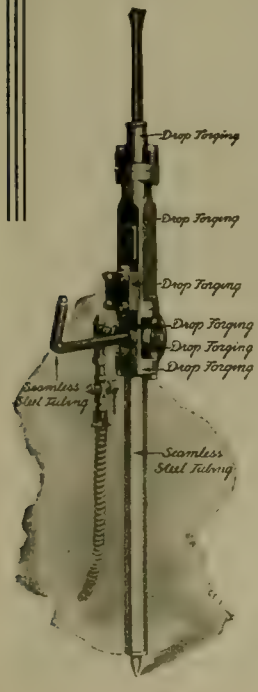

because it *keeps down* in the mine and *keeps down* the cost of drilling.

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"Laid up for repairs" is a distasteful phrase to the man of action, but when the fact is known that crystallization is the cause of breakdown of castings, and when, also, the fact is known that the parts of

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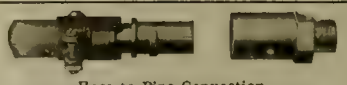

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The U. S. Steel Corporation spent $7,000,000 last year in various forms of betterment work among its employees. Other large concerns are making similar expenditures. The reason lies in the fact that the cost of labor forms so large a part of the cost of manufactured products that money spent in increasing its efficiency brings as good returns as when spent on improving machinery. The methods of this work have been much studied by the Y. M. C. A., and are explained by Mr. Rindge, who, as secretary of the Industrial Department, has an intimate knowledge of what can be accomplished and how it can be done.

RECOVERY OF GOLD IN DREDGING.
By Charles Janin 717

To measure the recovery in gold dredging it is necessary to know the gold content of the ground and of the tailing. Difficulties in accurately sampling each makes it necessary to rely upon the law of averages. Careful records show that nearly 90% of the gold saved is caught on the first four tables, and apparently the metallurgical work of a dredge is good despite the occasional re-dredging of tailing. That dredge recovery runs above or below drill reports of small areas is not significant. It is the total result that counts.

NEW RELIANCE MILL PRACTICE, WITH PARTICULAR REFERENCE TO CONTINUOUS DECANTATION.
By Jesse Simmons 722

Continuous decantation is one of the newer processes which, where it proves applicable, makes a material saving in plant. The New Reliance mill was one of the pioneers in working it out. Here decantation is supplemented by filtration, the Portland filter being used. The sand tailing assays 2 to 3c. per ton in gold and the slime tailing, 2 to 5c. Filtration of slime costs $0.00568 per ton for repairs. The total cost for mining and milling is $3.04 per ton. A tailing dam is used to form a settling pond for water from the mill.

THOMAS JOHNSTON GRIER—A PIONEER MINE MANAGER..... 725

A record of the life and work of the late manager for the Homestake G. M. Co. Grier was a Canadian who came West as a telegraph operator and whose whole mining career was connected with the Homestake. His management was characterized by establishment of close personal relations with his men, and this, when the test of a great strike came, won the case for himself and his company.

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EDITORIAL

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HELP THE BELGIANS

The appeal for help for the starving non-combatants in Belgium is one deserving of prompt response. There will be suffering and distress in all the countries at war, and even in such neutral states as Holland, which find themselves surrounded by warring neighbors, but for the present the acute want is in Belgium. However we may divide as to the issues of the war itself, and wherever our sympathies may lie as between the contending countries, we can find common ground in relieving the sufferings of the people of Belgium, driven from their homes, their crops ruined, their food supplies commandeered, and themselves forbidden to take any active part in the warfare. The fight was not of their seeking, though fate placed them at the inevitable centre of the conflict. The disaster that has overtaken this people is beyond comparison with any of the so-called great disasters in our own country such as have frequently called out the generous response that has come to be regarded as characteristic of America. In this instance our own country must take the lead in whatever relief work is accomplished. The other nations are fully occupied, and, too, it is food that is needed, while the Americas form the only available source of supply.

The Belgians are a fine people. Sober, industrious, frugal, they have formed a group in the modern world more important than mere numbers could claim. The Belgian mining and metallurgical industries have contributed much to the world's advancement. The 'Belgian retort' is the basis of zinc smelting, and with but one exception every American zinc smelter uses retorts of Belgian type. So recently as when the United States Bureau of Mines was organized, Watteyne, the head of the Belgian mine inspection service, was called to this country, along with representatives of Germany and England, to advise with Washington officials as to the scope and methods of work to be adopted. There are many ties between the metallurgists and miners of this country and ours, and we owe it to ourselves to help them in this their time of need. That the relief work is under direction of an American mining engineer is a special reason why mining men should take part. That superbly useful citizen, Mr. H. C. Hoover, has asked his fellow citizens here at home to help him in this work, and the response should be quick and generous. We printed last week the names of the mining men serving on the American relief committee in London, and we are glad to note that in the work for Belgium the mining men are equally prominent. Aside from the men in London assisting Mr. Hoover, Mr. Millard K. Shaler is acting as field agent in Holland and Belgium. Having lived in Brussels for the past few years as representative of the Société Internationale Forestière et Minière du Congo, he knows the country and the people thoroughly. On the committee at San Francisco, Mr. M. L. Requa is an active member, and we have no doubt that other mining men will find place in the work as it expands. Support them vigorously.

What is needed now is food: bacon, beans, wheat, canned goods; anything that is staple and can be shipped. A loaded steamer has already been sent from New York by the Rockefeller Foundation, and others will follow. It is proposed to send one or more from San Francisco, and for this purpose supplies will be received and shipped free if delivered to the railroads addressed 'Belgian Relief, San Francisco Chamber of Commerce, Port Costa, California.' Money and checks may be sent to the 'Belgian Relief Fund, Chamber of Commerce, San Francisco, California.' If there is any confusion as to shipments, write or wire to the last given address. While it is food and supplies that are mainly needed, anyone finding it more convenient to do so may send money, which the committee will expend in purchase of supplies. The cost of the transportation has been assumed, we understand, by the London committee. A little economy in your home kitchen or mine boarding house may well permit you to save a Belgian family from starving.

THE medal of the Mining and Metallurgical Society of America is to be awarded this year for 'The Advancement of the Art of Ore Dressing.' Members are invited to submit to the secretary nominations for the honor.

CODE addresses registered prior to July 1, 1914, may now be used in cablegrams sent to Great Britain, France, Russia, Belgium, Japan, and their possessions. Cablegrams sent to Great Britain may be put in code, provided the A. B. C. (fifth edition), Scott's (tenth edition), Western Union, or Liebers be used and indicated. Coded messages are, however, subject to delay incident to translation and submission to the Censor. Messages to Germany and Austria may be sent in Eng-

lish, German, French, or Spanish, by way of Tuckerton, New Jersey.

IN connection with the tribute to the late Thomas J. Grier appearing upon another page, it is interesting to recall that he never owned a share of stock in the great mining company for which he worked. While Homestake shares are not the basis of speculation, Grier preferred to be free from any possible implication of serving self interest in case they rose or fell.

MEMBERS of the Geological Society of America have recently been notified of the nomination to correspondentship of Messrs. A. Lecroix, professor of mineralogy, Museum of Natural History, Paris, France; Charles Lapworth, professor emeritus of geology, University of Birmingham, England; Albrecht Penck, professor of geography, Royal University, Berlin, Germany; J. J. Sederholm, director Geological Survey of Finland, Helsingfors, Finland. The election of these men at this time emphasizes the welcome fact that in science there are no national boundary lines that must be respected, and in honoring such scientists the Society honors itself. The annual meeting of the Society is to be held at Philadelphia, December 29 to 31, inclusive, and Mr. G. F. Becker, the retiring president, will lecture upon 'Isostacy and Radioactivity.' A pleasant feature of the plans for the meeting is the suggestion from the secretary that if fellows of the Society will indicate the names of students who might wish to attend the meeting, invitations will be addressed to them. It is a good thing to see that the beginners have every opportunity.

COMPARISONS between the value of ground as shown by drilling and the recovery made in gold dredging are difficult and usually uncertain. The figures that Mr. Charles Janin presents on another page are much the most accurate that have come to our attention. If one but stand on a dredge while it is at work he will realize quickly the practical impossibility of running an accurate dredge test comparable to a modern mill test. The situation would be similar if the ore went through the mill without crushing. How is an accurate sample to be taken? How can the dredge master really know the value of his feed, and, without it, how is he to know accurately his metallurgical losses? He cannot, and does not. What he does is to watch the tailing, especially the fine material. Incidentally he is fortified in his conclusion that the metallurgical work of the dredge is well done by the fact that adding plates and tables improves recovery little. The great bulk of the gold is saved, as Mr. Janin shows, on the first few feet of tables. Possibly a time will come when closer saving will be attempted on part of the material, but till now the easier path has been to reduce costs by increasing capacity, and results would seem to have justified that course. As to valuing the feed, reliance is still placed upon testing the ground in place. The difficulties and dangers in this process have been indicated in the discussion on 'Valuing Placer Ground' that has been running for some time in the *Press*. We believe one most important factor is the relative uniformity in size of the gold particles, but must reserve discussion till another time.

THE United States Bureau of Mines has begun the collection of a general library of petroleum literature, under the direction of Mr. W. A. Williams, chief petroleum technologist. The details of this work have been assigned to Mr. David T. Day, who has recently been transferred from the United States Geological Survey. The importance of such a library is so manifest that it is hoped all technologists will aid in the work by exchanging with the Bureau all available books and maps on this subject.

RESIGNATION of Mr. George E. Roberts from the directorship of the Bureau of the Mint to assume the presidency of the National City Bank, after serving under an administration in which Mr. W. J. Bryan is Secretary of State, suggests interesting changes in American life. When Mr. Bryan first ran for President, in 1896, Mr. Roberts was editor of a country paper in Iowa. Those who remember the famous 'free silver' campaign waged by Mr. Bryan will recall 'Coin's Financial School,' one of the documents of the crusaders that put half truths in a striking and plausible form that made them especially effective. Mr. Roberts set out to answer that book. Always a student, he went first to the State Library at Des Moines to brush up and renew his earlier studies of financial matters. Having got to the bottom of the matter, he wrote 'Coin at School in Finance,' which proved the most effective of the various replies called out by the troublesome booklet of the free silver advocates. Mr. Roberts' work was recognized, and McKinley offered him the post of Director of the Mint, which he has held since, except for a short period when he occupied an important post with the Commercial National Bank at Chicago. His duties at the Mint have been most congenial, and while he has written little, his studies have been deep and thorough. He has been a frequent visitor to the mining districts of the West and has come to be widely known in person among mining men as well as among financiers. The modest looking Mint reports issued by him are mines of accurate knowledge, and it is not surprising that he has been called to the important post in New York, though there has been no hint of friction at Washington. The various honors that have come to Mr. Roberts are a pleasing indication that in all the hurry of American life, with all its reputed rush for effect and immediate results, the modest honest student does nonetheless get recognition if his work is good and he but keep his feet on the ground as well as his head in the clouds. The National City Bank is a powerful organization. Its move in establishing branches in South America and in beginning publication of *The Americas*, a monthly devoted to upbuilding trade between the United States and Latin America, indicates the broad policy that is being pursued. In this organization Mr. Roberts will find congenial helpers and in his new position a wide field for usefulness.

LABOR AS AN INVESTMENT

In every individual organization, labor is the principal item of production cost, often amounting to 80 per cent of the total. The effect of competition in the industrial world has been to compel close study of production costs and methods, with the result that both equipment and methods are constantly being improved. But labor, as a part of production cost, although the largest item, involves the personal factor, and has been the last to be the object of scientific study. Notable results have already been attained, but largely in roundabout ways. Thus, for example, a manufacturer who is obliged to compensate his workmen for injuries sustained has their eyes examined to find out whether their sight is keen enough to enable them to avoid injury, and incidentally learns that a near-sighted workman gives a poor return for the wages paid him. Furnishing him with glasses costs the company a small sum which is returned in the form of increased output or better work within a short period. On another page Mr. Fred H. Rindge, Jr., secretary of the industrial department of the Young Men's Christian Association, points out some of these aspects of the study of labor problems.

The world grows more intelligent yearly, and has outgrown many narrow-minded views that were formerly held. An employer can now make evident his wish that his employees should keep away from saloons, fix up their houses and gardens, and even go to church on Sunday, without being considered a pious crank or one who would deny amusement to the laboring man. The general public is now intelligent enough to see that a workman who spends his time off shift in getting drunk and picking a fight is a poor workman while he is working and the cause of a lot of trouble when he is not. The right of the employer to control in some degree the private life of his employee will inevitably win recognition in the end. The attempt of labor unions to compel the employer to pay an inefficient employee the same wages as an efficient one cannot possibly be permanently successful, for it is contrary to natural laws, and though such attempts are often for a time successful they necessarily break down in the end. Another narrow-minded view that is also passing is that Christianity essentially consists in the pious observance of certain religious ceremonials, such as the singing of psalms and the reading of the Bible. As a matter of fact, Christianity introduced, into a world governed only by selfish considerations, the vital idea that a proper regard for the welfare of the other man is the first essential in securing our own best interests, and not even the many absurd and contradictory features which zealous but mistaken adherents have foisted on Christianity have been able to obscure this real contribution to human life.

It is in this fundamental sense that the Y. M. C. A. is a Christian Association, and it is because of this, and also because of its emphasis on the care of the human body that the work of the Association has prospered and will continue to prosper. In other industrial fields the Association has been a useful ally of the employer, and we believe that mining companies generally have too much neglected an opportunity for cooperation with the Association which would be greatly to the advantage of the companies.

PRECISION OF THOUGHT

One of our contributors recently protested at what he thought to be an error made in printing his article. He had written, "Of the tonnage hoisted, 626,000 tons *were* crushed," and supposed our use of the singular form of the verb a misprint. We were glad to explain to him that his own error had, in matter of fact, been corrected. As this error, using the plural of the verb following a collective subject, is exceedingly common, it is well to refer to it at some length, since it illustrates a principle and may serve to point a moral.

The verb following a collective noun may be either singular or plural, according to which is meant, and everyone who cultivates precision of thought and of the use of language will be careful to use the singular when the singular conveys the desired meaning and, similarly, the plural when it is required. Thus we may say "the football team has gone to Annapolis"; meaning that the team, considered as a unit, has proceeded to that place. It would be correct to say "the football team are enjoying themselves in Annapolis, following the game," the meaning here being that the individual members of the team are enjoying themselves, each in his own way. Many similar instances will at once occur to the reader. To say that the 600,000 tons were crushed would imply that each ton was separately crushed, like 60,000 walnuts cracked with a hammer. But this was not the process employed; a quantity which is expressed in terms of tons was crushed, and no individual entity is implied. It might be correct to say that five tons were crushed, if there were five one-ton lots of ore, each of which was crushed separately. Such form of expression is undesirable, however, for it was ore that was crushed, not a ton. There may be many who think that the observing of such distinctions is a useless refinement of language, but nothing could be further from the truth. Thought and expression are closely linked, and a man who is habitually careless in his speech and writing will necessarily be careless in his thinking as well. Putting this thought in another way, it may be said that careless speech is the outward expression of loose thinking, and as accuracy of judgment is a prime virtue in an engineer, it is well worth while for him to cultivate precision of speech in order that he may not be suspected of loose thinking, which will inevitably lead to wrong decisions. Nor can the reflex action of speech on thought be neglected. Care and precision of expression, both oral and written, will inevitably be followed by an increase of ability to think clearly and precisely, one of the attributes of an engineer that is most worth while cultivating.

A LESSON IN MINING TO A CLASS OF ALIENS.

Big Returns on an Investment

By FRED H. RINDGE, Jr.

Big returns on an investment? What kind of an investment? An investment in which practical business men are becoming more vitally interested every day. An investment which is increasingly essential to the largest success in any industrial operation. An investment which pays in terms of human kindness and in dollars and cents. An investment in men. Arthur D. Dean, of the University of the State of New York, has expressed this idea in a recent commencement address:

"The scientific world knows that a pound of coal, black and inert mass that it is, has locked within it elements which will give us heat, or power, or light. If we wish to have warmth of body, we burn the fuel in our fireplace. If we wish to feel the throbs of industry, we develop horse-power through the expansive force of steam. If we prefer light for the printed page, we pass electrical energy through the tungsten filament. Excepting the perpetual motion believer, no one dares to say that the 16-candlepower lamp has more energy than the one-tenth of the horse-power of a lathe, or the equivalent number of heat units extracted from the coal. To the mechanical engineer it is all a question of what he or his client desires—whether to keep warm, to manufacture, or to see in the darkened night. To the social engineer, the lump of humanity may be blackened, its possibilities locked up and inert, or it may turn the materially productive wheels of a modern industry with its workers as unsocialized and mechanical as the very wheels themselves; or this lump of humanity, by the inventive genius of the progressive, may

A CLASS BEING INSTRUCTED IN FIRST-AID WORK.

become a source of light—a glowing mass of an enlightened humanity."

In these days, who is the progressive? Surely he is manifest that spirit of loyalty so prominent in some companies and so lacking in others—this man will in the long run be the one who can maintain the highest stand-

COLLEGE MEN AND WORKING MEN GETTING TOGETHER: (1) OUTING FOR WORKING BOYS; (2) ENGLISH TAUGHT TO FOREIGNERS IN THESE BOX CARS BY COLLEGE MEN; (3) YALE MAN TEACHING HYGIENE AT NOON; (4) EVEN THE KITCHEN BECOMES A CLASS ROOM; (5) ANOTHER SCHOOL ROOM; (6) INDOOR GAMES FOR WORKING BOYS.

the engineer, the manager, the employer of labor who is interested not only in his machinery, but also in his men. The industrial leader who understands his men, who is interested in improving the conditions under which they work, live, and recreate, who is fair and just in all treatment of his employees, and whose men ard of efficiency and who receives the largest returns, both human and material.

Scope of Betterment Work

No student of modern tendencies can doubt that the whole country, in fact the whole world, is being forced

to pay more attention, directly or indirectly, to the 'man on the job.' Big business is spending enormous sums of money in industrial betterment work, and there seems to be not the slightest doubt of big returns on the investment. During 1913 the United States Steel Corporation and its subsidiary companies expended over $7,000,000 in improving the condition of its workmen. Over $3,000,000 of this was for relief of injured men and their families, over $660,000 was spent in accident prevention, and more than $1,600,000 was spent in sanitation and welfare work. From this, the world's greatest corporation, employing about 230,000, down to small concerns employing as few as 30 men, employers are more than ever alert to their human responsibilities. To be sure, an expenditure for welfare work is no proof that evils do not still exist, and it has been said by some critics that welfare work is only a salve to cover certain evils and to heal otherwise open sores. Nevertheless, this expression of interest in men, whether it be from the human or economic motive, is certainly a great step in the right direction.

An Example or Two

I have just read the welfare booklet of a well known company and was impressed by this paragraph:

"This company, like many corporations of the present day, realizes the importance of educational courses in the efficient management of business. Two factors enter largely into the success of a business—the quality of goods sold and the quality of service rendered. The man who stands behind the counter, who receives business over the telephone, who canvasses for customers, is now being taught his work as fully as is the technical apprentice who is learning to produce the goods. Another point of view fully considered in maintaining our educational courses is the immense advantage to the employee himself." Education pays.

Thomas Darlington, secretary of the Iron and Steel Institute, who has accomplished so much in sanitation and health work, has repeatedly proved the relation between health and efficiency. He even goes so far as to say, "The efficiency of employees depends on several factors, of which health is the most important." Wholesome food, pure drinking water, proper housing, right clothing, good ventilation and lighting, sanitary surroundings, accident prevention, etc., may have more influence in determining a man's real value than we generally imagine. Surely the Panama canal could never have been built unless our government officials had given primary attention to the health and recreative conditions surrounding the workers. Physical welfare pays.

And how about leisure conditions? An employer recently said to me: "I don't care what my men do outside the shop. That's not my business. They can go to the devil for all I care!" Needless to say, his business is nothing to boast of. Wide-awake employers do care what men do outside the shop. It makes a lot of difference with Monday's output, whether the men have been spending Sunday in rest and recreation or in drink and dissipation. That is one reason why so many companies provide good homes, playgrounds, libraries, clubhouses, and the right opportunity for wholesome social intercourse. Social welfare pays.

There is a fourth thing, more important than education, physical welfare, or social welfare. Careful students of this whole problem would probably agree that at the base of individual inefficiency lie many causes, but at the root of these causes is one underlying, namely, a lack of that almost indefinable something which we may safely call character. The man who possesses good character is certainly more likely to be efficient than the man who lacks character. His character may in large measure determine his ambition, his desire for education, his outreach after health, his friends and associates; in short, those things which, altogether, make him the kind of man every employer wants and needs in his business. The building of character pays.

When I say that all these things pay, I do not wish to give the impression that industrial betterment exists only because it pays. It is probably fair to say, even though the fact that it pays is a very important and fundamental reason, that most employers are interested or soon become interested in the human side of their business as well. Mining operators are not exceptions in this particular, and I have met scores of mine superintendents, managers, and other company officials who are interested in their men and who are sincerely trying to help them. To be sure, there are also mining men who are selfish and blind to the movement.

Reasons for Failure

Other mine operators are somewhat embittered because they have attempted welfare work and failed in whole or in part. Experienced welfare experts will probably agree, however, that such failures can be traced to very definite causes. Among these might be mentioned paternalism, failing to secure coöperation of the employees, neglecting to give the workers representation and responsibility, initiating the work and expecting it to run itself without competent paid supervision; attempting to maintain the activities without an experienced welfare secretary or his equivalent in charge; promoting one activity, instead of all-round activity which would help the whole man; making the welfare work an advertising feature. Other causes for failure are the ideas prevalent among the employees—whether justified or not—that the company is promoting welfare activities instead of improving wages; attempting to cover real evils by clubhouses; using welfare work to retain good help; to prevent employees feeling a need for a larger share in the control of industry; and the feeling (even without any special reason) that the company is trying 'to put one over.'

Work of the Y. M. C. A.

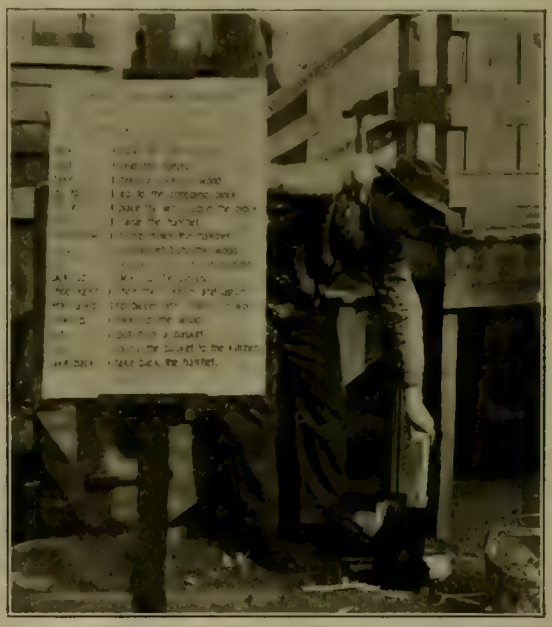
It is interesting to note that the Young Men's Christian Association, in its industrial betterment program, has generally prevented in its own work these very

causes of failure. Many employers prefer to let the Association promote their welfare work rather than promote it themselves. It then becomes the Association's work, and the Association enters the field as an independent agency working in the zone of mutuality and cooperating with both employer and employee. The company contributes, the men pay membership fees; the employer advises, the employees suggest, and there can be no paternalism. An experienced Association secretary is placed in charge, and he is carefully supervised by state and international committees. Through these supervisory agencies there is a constant inflow of new principles, new ideas, new methods, and the thing naturally succeeds.

All this is fact, not theory. Some may be surprised to learn that the Young Men's Christian Association in North America has in its large membership nearly 100,000 industrial workers, while 400,000 more are reached in extension activities. This does not include 500,000 men served by Railroad Associations. During the past eight years the Association has also been dealing very effectively with the immigrant. Fifteen secretaries are now serving foreigners as they embark at fifteen different ports of Europe;* others teach them English and give stereopticon lectures, etc., in the steerage; a dozen other secretaries with remarkable linguistic ability continue the chain of service at Ellis Island and other ports of entry; others meet immigration trains at points of inland destination. Then the final service begins in the form of finding suitable lodgings, securing employment, teaching English and citizenship, and acquainting the newcomers with American customs, laws, and institutions.

A special method of teaching English to foreigners has been devised by Peter Roberts, one of the secretaries of the Industrial Department of the Y. M. C. A. International Committee. This is being used with special effectiveness because the lessons deal with practical daily experiences. Special mining lessons have been prepared, and one book published by the Scranton Y. M. C. A. and the D. L. & W. R. R. company contains lessons on 'Mine Accidents and their Prevention.' Pictures and dramatic action make these lessons very interesting and easy to learn. The method has been illustrated in 'talking motion pictures' by Thomas A. Edison, Incorporated. During the past year over 310,000 foreign men were helped by the Young Men's Christian Associations.

One very interesting development of the Association's work is what is known as the Industrial Service Movement. Realizing the problems and opportunities already indicated, this movement is helping to develop the right kind of industrial leaders for the future. It is in very close relation to the colleges and engineering schools of the country, and is helping to bring to the fore the human side of the engineer's job. During the past year the movement has enlisted, through the coöperation of student and city branches of the Association, 3500 college men in practical service for industrial workers. These students, coming from 160 colleges, have helped 60,000 working men and boys, and the work has made an impression on the lives of both student and workingmen which neither group will ever forget. The collegians have taught foreigners English and civics, instructed American workingmen in mathematics and other subjects, led clubs of industrial boys, and rendered many other forms of service. In this personal contact, engineering students particularly have come to understand industrial men. They have developed many of the desirable qualities for successful industrial leadership already mentioned, and are graduating from college with a new vision and a new determination to be leaders rather than drivers of men.



ENGLISH LESSON ILLUSTRATED BY MOTION PICTURES.

Many of these leaders have already entered the mining industry. In fact, all of this work which has been mentioned is bound to make an impression on mining and other industries of the country. J. Parke Channing, vice-president of the Miami Copper Co., recently wrote: "It is needless to say how much I am interested in the Industrial Service Movement. The principle is to my mind undoubtedly a sound one, and I can already, in my own experience, begin to see the good effect it has, not only upon the young men who are engaged in this work, but also upon the men to whom they are devoting their energies. You may be sure that I will do everything possible to forward the movement, which will undoubtedly tend to better efficiency in all industrial work."

The Association is operating successfully in connection with eighty special industries—mining, lumber, cotton, quarrying, and others. The Association has for sev-

*This port work has been temporarily interrupted by the war.

eral years been operating in coöperation with many coal, copper, iron, and silver mining companies. J. A. Holmes, director of the U. S. Bureau of Mines, says: "I am interested in the Y. M. C. A. because during the past twenty-five years, as I have passed up and down through the great mining regions of Pennsylvania, I have seen places transformed through its work." The work has been especially promoted among the coal miners of Pennsylvania, West Virginia, and Kentucky; among the copper miners of Michigan and Arizona; and among the iron miners of Tennessee and Michigan.

THE BENHAM CLUBHOUSE

Cyrus H. McCormick, president of the International Harvester Co., speaking at the opening of the Y. M. C. A. building at Benham, Kentucky, said: "In the effort to make Benham an ideal mining town, we are glad to provide this clubhouse. Directors formerly felt that corporation funds could not be applied to the erection of such a building as this, but within the past twenty-five years this has changed; the corporation has developed a consciousness, and no longer is corporate action permitted to hide behind the anonymous character of its organization. The Y. M. C. A. is an organization for the betterment and uplifting of mankind, for the development of a strong, manly Christian character and for promoting good fellowship. It has long passed the experimental stage. Its influence is world-wide and its work is invaluable in every community." An illustration of the Association's adaptability is furnished at Buxton, Iowa, where the work is for colored miners. The general manager writes: "The Company considers the money well spent. The influence of the good your organization is doing is felt throughout the entire state. Long may it continue."

One may rightly ask, "What does the Association do in a mining community?" Here is a list of activities actually being carried on:

To Increase Industrial Intelligence.—Reading-room, library, educational lectures, practical talks, educational clubs, mining clubs, bands, debating societies, first-aid corps, garden clubs; classes in writing, arithmetic, grammar, theory and practice of mining, mechanical drawing, designing, manual training, domestic economy, hygiene, and other subjects.

To Conserve Health.—Gymnasium classes, shower and plunge baths, bowling, billiards and pool, barber shop, health talks, physical examinations, medical examinations, athletic contests, baseball, tennis, and other games, camping and swimming, tramps and hikes.

To Cultivate the Moral and Religious Interests.—Religious meetings, illustrated talks, life problems classes, Bible classes, noon-hour meetings, union Sunday-schools, cottage meetings, training classes, men's meetings.

To Aid the Community Life.—Clean-up campaigns, campaigns against tuberculosis, flies, mosquitoes, etc., community meetings, village fairs and picnics, May day, safe and sane Fourth of July, circus (local talent), stereopticon entertainment, Boy Scouts, Lyceum features, savings funds, civic leagues, health lectures, flower and vegetable planting, reading-rooms, moving pictures, home talent clubs, refreshment counters.

To Provide a Social Centre.—The building is a social headquarters. Social meetings, social games, and social clubs are promoted, and all activities are pervaded by the social spirit.

Every mine-worker holds in his hands the lives of his fellow-miners and the property of his employer. He can cause far-reaching suffering and untold damage to property by a stupid or vicious act. Any agency which can improve the education, physical welfare, social welfare, and character of men will increase their efficiency. Such an agency is worthy of serious consideration on the part of the operator. Practical money-making, industrial leaders (even the unsentimental ones) have found that such a factor in modern industry develops trustworthiness, higher standards of workmanship, and makes possible that kind of intercourse between employers and employees which begets good will; and good will raises all other forces in industry to a higher power. The right kind of an investment in men will yield big returns.

CUSTOM MILLS are operated in Western Australia by the government, and in 1913, according to the Department of Mines report just to hand, there were 37 stamp-mills, sand, and slime-treatment plants at work. A total of 60,573 tons of ore was crushed yielding gold worth £185,699 by amalgamation. Sand and tailing treatment dealt with 41,378 tons, slime treatment 6089 tons, and 8032 tons of tin ore. The total tonnage of all material was 106,072. The revenue received by the department from all plants was £47,991, and expenditure £55,362, making a loss of £10,531 for the year: but adding profit, etc., at two mills, the net loss was £7712. Since the inception of government owned mills in the state, 960,989 tons of gold ore has been treated for £3,528,996 by amalgamation, £478,383 from sand treatment, £101,942 from slime treatment, and £80,835 from 64,920 tons of tin ore; a total value of £4,189,955. Capital expenditure on all the plants to date amounts to £332,378; total revenue, £937,604; operating loss, £48,112; interest and sinking fund on capital, £149,015; depreciation, £216,838; and a grand loss of £413,965. The benefit of these mills in opening remote districts, and mines which otherwise would never have been developed, has been of the greatest value to the mining industry.

DURING the four weeks ended September 20, the Mt. Morgan mine in Queensland produced 708 tons of copper and 8580 oz. gold; also 1747 tons of concentrate containing 134 tons copper and 1320 oz. gold. Matte on hand contains 105 tons copper and 1230 oz. gold. Owing to the great amount of gold in its copper ore this mine can continue to operate its smelter and concentrating plant. The approximate value of the copper and gold output during this period is $210,000 and $198,000 respectively.

Recovery of Gold in Dredging

By CHARLES JANIN

The percentage of recovery made by a dredge as regards either the actual gold content of the material dredged or the yield indicated by prospecting, has always been an interesting question. It is generally acknowledged that the modern dredge, with its improved washing plant and large area of gold-saving tables, recovers, except where considerable sticky clay is present, a high proportion of the gold in the material washed. The percentage of gold recovered out of the amount estimated to be in the ground is a different matter, and requires the consideration of several factors not directly connected with the metallurgy of gold dredging. Obviously, to determine the difference between the actual content of the ground and the recovery by the dredge, it is necessary to know:

1. The gold content of the ground previous to dredging, or
2. The loss in the tailing.[1]

Too much dependence placed on a vendor's statement of past production or his estimate for the future often accounts for a wide discrepancy between the expectation and the fulfillment. The same may be said concerning careless or inexperienced sampling, or, in some cases, the entire absence of sampling. In the early days of dredging, inexperience in the use of drills for sampling placers was often the cause for an overestimation of the gold content, this accounting in part for the fact that the first dredges recovered a low proportion of the gold indicated by drill-sampling. Experience has minimized this danger, so that the results obtained over a period of years have shown that there is little reason today for a wide discrepancy between the actual recovery and the content estimated by prospecting, provided the work has been done by an engineer accustomed to this line of work, with sufficient funds and time at his disposal.

The thorough sampling of a placer property is by no means the simple matter the uninitiated often believe it to be. Much depends upon the care taken and the experience of the engineer in charge. A great deal has been written on the investigation of placer areas by a number of engineers familiar with this class of work, and it is not my intention to go deeply into the matter at this time.

If great care has been exercised in taking samples, the work being done properly in every detail, each sample will then represent as nearly as possible the mineral content per cubic yard of the place sampled. While each hole may then be taken as indicative of the content of that portion of the ground where it is sunk, the placing of holes is an important factor. The location and distances apart at which samples should be taken can be determined only after a study of the ground has been made. There is no hard and fast rule to follow. Some areas have been considered sufficiently prospected with one drill-hole to ten acres; on other areas the engineer has not been fully satisfied with one hole to one acre. Preliminary holes are generally sunk and carefully sampled to determine if the gold occurs in wide or in narrow channels, and if it is fairly evenly distributed throughout the deposit, or occurs in irregular pay-streaks. Holes badly spaced with too many sunk in the richer portions would yield too high an average content. As stated above, there is no rule as to the number of holes to be sunk, but on ground that shows spotted or irregular contents, obviously more tests will be necessary than where fairly uniform samples are obtained. Where sampling discloses the existence of a channel or narrow belt having a higher mineral content than is found in the area as a whole, then the outlines of such a channel or belt should be determined as closely as is warranted for the purpose of the examination.

Sometimes it is feasible to segregate certain portions of a property, eliminating low-grade areas. On large tracts, where time for the examination is limited, tests to confirm the samples indicated by preliminary prospecting may be concentrated on a piece of a sufficient size to determine the advisability of purchasing the property and installing at least one dredge. The accuracy of the average mineral content of placer ground indicated by the examination depends, therefore, upon the care taken in sampling, the number of samples taken, and the situation of the holes in relation to the character of the deposit. All hinges upon the experience and judgment of the man in charge.

In estimating the recovery from dredging ground after determining the average content indicated by prospecting, most engineers take a proportion, generally 75 or 80%, of this indicated content as the amount recoverable by the dredge. These figures are based upon actual tests made to determine the dredge recovery, and also upon the percentages of the prospecting content recovered from certain areas that have been dredged after careful prospecting.

Some engineers, when sampling by means of drills, use a different factor in their calculations than that generally used: that is, they reduce the metal content per cubic yard of the place sampled by an amount which, in accord with their experience, represents recovery. The use of this factor, which is practically a combination of drill factor and recovery estimates, discounts the content that otherwise would have been assumed from the regular drill factor. Engineers following such a practice should mention it clearly in their report. Failure to do so might cause the future of a property to be further discounted by those to whom the report is pre-

[1] A few of the figures in this paper were previously used by me in an article published in *The Eng. & Min. Journal*, January 27, 1912.

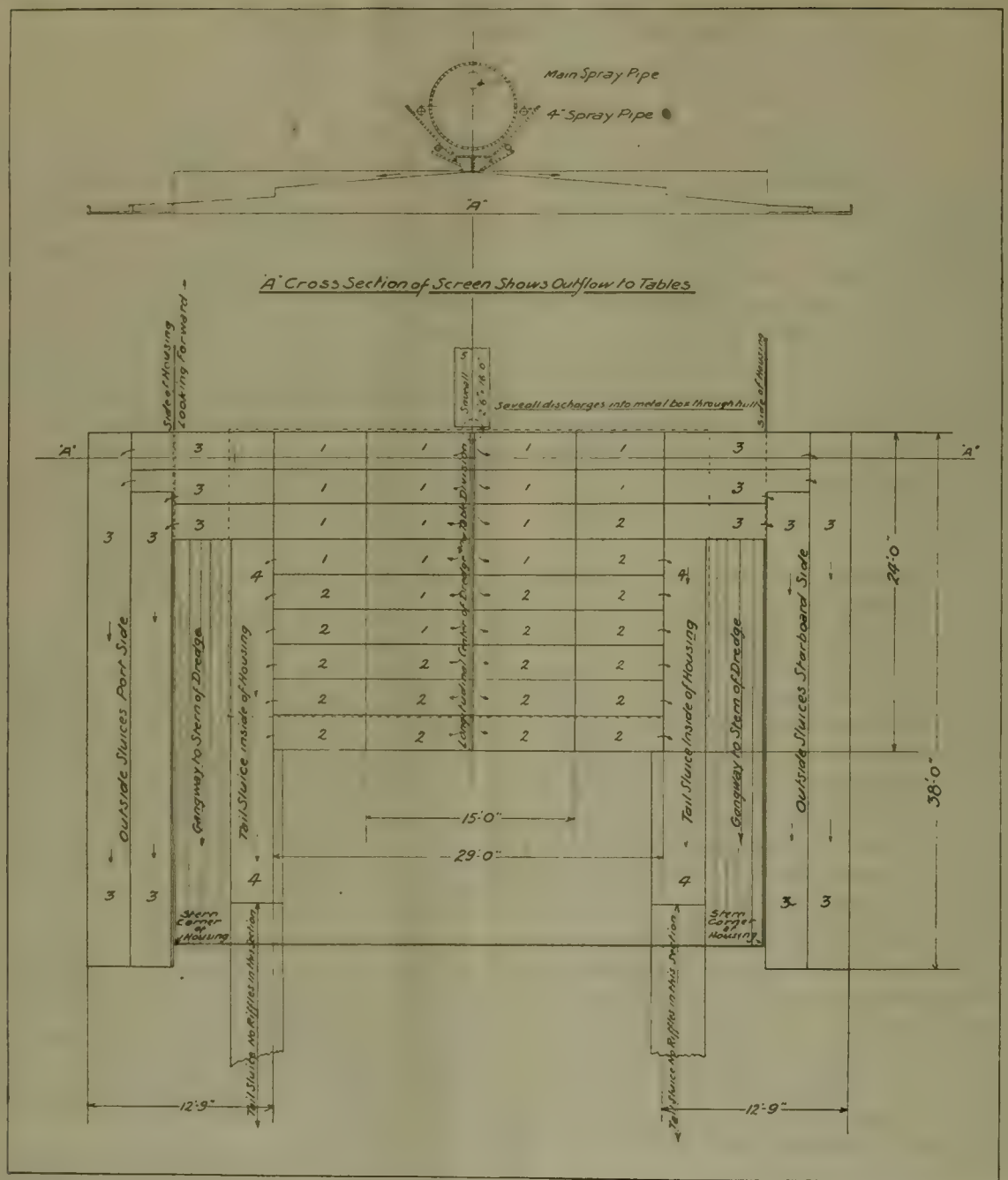


TABLE PLAN OF REVOLVING SCREEN DREDGE SHOWING GOLD-SAVING AREA, DISTRIBUTION OF FLOW, AND RECOVERY FROM SEGREGATED AREAS, IN PERCENTAGE

→ Arrows indicate direction of flow.
----- Dotted line means tables enclosed.

Area of sections	1 = 292½	sq. ft.,	gives a percentage of recovery of			88.98
" "	2 = 360	"	"	"	"	4.68
" "	3 = 557¼	"	"	"	"	2.13
" "	4 = 208	"	"	"	"	1.08
" "	5 = 40	"	"	"	"	3.13
Area of total...	1457¾	sq. ft.				100.00

Percentage of recovery based on weight of amalgam, covering a period of three years.

sented, if not conversant with the computation methods.

The following reference to the Pato property is taken from the report of the Oroville Dredging company, dated September 30, 1911, showing the prevailing practice of discounting prospecting indications. "The original estimates by the engineers give us an area containing 13,637,347 cu. yd. of material, yielding gross $3,202,986, there having been deducted 25% for variations, possible losses, etc."

The Gold-Saving Table

The accompanying sketch of the gold-saving table of a 6-cu. ft. close-connected bucket-dredge, furnished by W. H. James of Oroville, shows the percentage of the total gold recovered from different portions of the table, careful data having been kept at each clean-up for a period of three years.

The total table-area is 1457 sq. ft., 89% of the gold recovered being arrested on 292 sq. ft., as shown on those portions of the table marked I. Including the recovery from the save-all, 92.2% of the gold was obtained from 332 sq. ft., and 4.68% more was recovered from 360 sq. ft. additional. Thus, 96.9% of the total gold recovered on this dredge came from 692 sq. ft. of table-area. The remaining 3.1% was obtained on the additional 765 ft. While the total table-area on this dredge was 1457 sq. ft., that on a dredge having the same bucket capacity but designed for ground containing much clay and difficult to wash was increased to 3800 sq. ft. Table-area varies with the ideas of designers and with the conditions to be encountered. From the first dredges with only a few square feet of table-area to the modern 15-ft. dredge with 8000 sq. ft. is a long step, as is also the capacity of 10 or less cubic yards per hour of actual running time as compared with 500 cu. yd. per hour for months at a time as achieved by some modern boats.

The sketch herewith is interesting as showing how large a proportion of the gold recovered is obtained on the upper part of the table. The bulk of all the gold recovered is actually taken from the first three feet at the top end of the table. It is advisable, however, to have as large a table-area as space on the dredge will permit, even though it is not often necessary to clean up the lower end. Few operators have ever complained of having too great a table-area on their dredge, and many would add to the existing tables if space permitted.

It is difficult to sample the dredge-tailing. Any test, to be trustworthy, must extend over a considerable period. Practically all such tests have indicated an appreciable loss, but the tests, in most cases, did not, so far as I know, determine the gold recovery with any accuracy. Most statements of exact percentages of loss of gold have proved, upon investigation, to be merely guesses made by the dredge-master. In connection with one of the most thorough tests made for this purpose, at Oroville, a small bucket-elevator was used, the material being taken by means of perforations in the bottom of the tailing-sluice. This passed to a small wooden sump in which the lower sprocket-wheel of the elevator was mounted. The material was somewhat concentrated, owing to the method of collection, but this could not be avoided. The speed of the elevator was arranged so that approximately two cubic yards of material would be collected during the shift. This collected tailing afterward was carefully washed through a rocker, and panned. All of these tests showed an appreciable loss of quicksilver and amalgam, but no definite figure of loss that could be compared with the total gold content of the material handled was obtained. In general it may be said that the loss of gold in the tailing is less than the amount lost in front of the boat from bucket-spill that is not caught in the hopper and save-all. It is estimated, by those competent to judge, that the average recovery of the actual gold content, while varying under different conditions of operation and efficiency of labor, is not less than 90% under normal conditions, and in some cases it may be considerably in excess of this figure. Compare this with the following extract from *The Canadian Mining Journal* of January 30, 1903, in reference to the old Cobeldick dredge at Lytton: "The director who was sent out from England to investigate for the company the working of the dredge made the *discovery* that of the gold dredged up from the bottom, less than 10% was recovered on the tables, the remaining 90% going off again with the tailing, although the saving appliances on this machine were about the most complete of any in British Columbia." It would be interesting to learn what tests the director made to arrive at this conclusion: probably the recovery was only 10% of the estimated amount, and the blame was put upon the gold-saving appliances, and not where it rightly belonged.

In a careful test to determine dredge-recovery, 22 holes were sunk on a measured area. Results were from 3 to 52c. per cu. yd. and averaged 19c., the regular drilling factor being used in these calculations without allowing any discount for recovery. In working, the recovery was, as near as I can remember, 17c. per cu. yd., or about 90% of the content shown by averaging the samples obtained in drilling. Those companies in California that get the highest recovery of the estimated content are those that previously have discounted the prospecting indications by 20 or 25%. To have much value the recovery percentages based on prospecting must be founded upon bank-measurement of the yardage handled, not upon the size of the dredge-bucket and the running time of the dredge.

The following results, obtained by a California company operating one dredge only, are of considerable interest, as careful records were kept from the beginning of operations.

Acres dredged	144
Cubic yards	6,980,800
Gold content per cubic yard as shown by drill holes before discounting, cents	21.05
Actual recovery	12.92
Percentage of recovery of amount indicated by drill-holes	61.38
Drill-holes to area: approximately 1 hole to 3 acres	47

RESULTS FROM A SMALL AREA

Acres dredged	40
Cubic yards dredged	1,232,868
Prospecting content, cents	17.18
Recovery	15.35
Percentage	89.34

Six holes to 40 acres.

The results obtained from the dredges of the Natomas Consolidated and those of the Yuba Consolidated are of special interest on account of the magnitude of their operations. The amount handled by the dredges of the Natomas Consolidated from the commencement of operations to December 31, 1913, have been in excess of 102,000,000 cu. yd. In regard to the recovery, the following excerpt is taken from C. M. Rolker's report on the Natomas Consolidated, made in 1909. "The writer wishes to emphasize that according to the statement of the general manager, Newton Cleveland, the values of the different bore-tests, which are marked on the Company's map, are the original values calculated, reduced by 15% to make them representative of recovery." In 1913, Frank Griffin, the president of the Natomas company, stated that the recovery made by the dredges was 15% less than the engineers estimated. This would be about 72% of the yield indicated by the drill-holes previous to the 15% reduction, mentioned in Mr. Rolker's report. It should be noted, however, that all of the ground has not been dredged, and it is only when the property is worked out, that the actual recovery of the gold assumed to be in the ground will be ascertained. If the dredges of the Natomas company have been operating in its best ground, then a lower percentage of recovery than that stated will be obtained for the total ground handled. The dredges of the Yuba Consolidated have handled over 100,000,000 cu. yd. to February 1913. The actual recovery as compared with that estimated is not yet ascertainable, but, according to a large shareholder, it figures about 75% of that indicated by prospecting. Final figures will be interesting, as the Company has never been advertised; the stock is privately held; and it is the most productive gold dredging company in the world, over $8,000,000 having been paid in dividends.

The California dredges of the Oroville Dredging company have handled nearly 47,000,000 yd. to January 1914. At the time when the property was floated in London there were estimated to be 38,500,000 yd. with an average content of about 17.2c., and the Bear River property was stated to contain an average of 12c. The prospecting results as indicated by drill-holes on some of this ground had been discounted, previous to the consolidation, but evidently not on the larger part of the property. The average recovery from dredging 44,800,000 cu. yd., exclusive of Bear River gravels, was 11.17c. per yd., a recovery of approximately 65 per cent.

The Bear River area was even more disappointing. The average from 1,832,586 yd. during three years was 5.26c., or about 44% of the estimated content. The recovery made by the Pato dredge, operating on the holdings of this Company in Colombia, have been the subject of considerable comment, as the yield has been at times far in excess of the average gold content as estimated for the entire area. It is clearly understood by those with experience in such matters that the recovery made by a dredge over short periods often varies greatly. Discrepancies of recovery over such periods compared with the average gold content assumed for the whole area are worthy of no more importance than should be given to a few high drill-holes as compared with the average of the property, other than, perhaps, to indicate a richer spot or 'channel' in the area. That is, because the recovery from a property for a short period in the beginning of operations is higher than the average for such property, there is no reason to expect the whole area to exceed the average assumed.

RESULTS AT PATO

The results from Pato at this writing show that 750,000 cu. yd., yielding an average of 62.4c., have been dug in an area of 92 acres, which were estimated to contain a total of 3,780,000 yd. having an average content of 40.4c. While the recovery of the dredge, per cu. yd., has been 54% above the estimated content, as indicated by the drill for the whole 92 acres, this only means that the dredge is operating in the richer portions of the 'tested area.' No comparison of recovery as compared with prospecting content can rightly be made until a much larger part of this area is exhausted.

It has been stated[2] by the Colorado Gold Dredging Co., operating in Colorado, that the recovery from its dredge under the best conditions averaged about 80% of the gold previously estimated to be in the gravel. Other Colorado companies, however, did not succeed in obtaining as high a recovery. In fact, a number of the earlier dredging ventures in Colorado proved unprofitable, though doubtless the gold content assumed to be in the ground was sufficient to justify the business.

While the tests mentioned have been figured from prospecting done under the direction of careful engineers, there are numerous instances, particularly of early drillings, where the recovery made by the dredge has been 40% or less of the assumed average gold content of the ground. The dredges of one California company handled 8,156,571 cu. yd. and obtained a recovery of 40.6% of the gold indicated by prospecting.

At times, a poor recovery is made by a dredge on account of careless or inexperienced work during the examination. One company in West Africa, where the bore-holes indicated from 5 to 13 grains per cu. yd., never recovered more than 2 grains per yard.

Mention may also be made of a property near Nome, in Alaska, where less than 20c. per yard was recovered from gravel that it was claimed would average over $1. It is needless to say that this was not so much a case of poor recovery, as one either of poor prospecting or fraudulent representation. What was needed here, and

[2]'Dredging at Breckenridge, Colorado,' by A. H. Bradford and Roy P. Curtis, *Mining and Scientific Press*, September 11, 1909.

would be valuable under like conditions, is not so much a factor representing dredge recovery as one to discount vendors' statements.

Some of the ground dug during the early stages of dredging will undoubtedly be re-dredged at a profit in the near future, when lower operating costs are made possible by increasing the dredge capacity. It is probable that dredges with a bucket capacity of 24 cu. ft. will some day be used to advantage in gold dredging as they are now used in harbor work, as discussed in my paper, 'Present-Day Problems in Dredging,' read before the American Institute of Mining Engineers at the San Francisco meeting in 1912.

Some ground that was re-dredged in California in moving boats to new positions returned from 1 to 3c. per yd.; not sufficient to pay operating expenses, but from one area a dredge recovered 10c. per yard when working through tailing. This led to an investigation, and the re-dredging of a considerable part of the tailing at a profit. Imperfect washing of the material due to the poor arrangement of the washing-plant and gold-saving tables, and perhaps the desire to make yardage records with the earlier dredge, was the cause of the poor recovery in this instance. In other cases where the gravel contains much clay or cemented gravel, the recovery of gold may be low and the tailing show sufficient gold to make re-dredging practical.

In northern California, the recovery recently made by a dredge was 15c. per yd. when working through the tailing from a dredge which formerly worked on the property. The reason for this was that the earlier dredge had not reached bedrock. The first dredge did not prove a financial success, but the second has been a profitable venture from the beginning.

The following table, prepared by one of the most careful California operators, is of considerable interest, and is based upon the following data: In dredging the property, it was found frequently that there had been a drill-hole at or near the centre of the ground dredged during the clean-up period of 15 days. In that case, the recovery was compared with the content indicated by the drill-hole. If a hole was reached at or near the end of the clean-up period, an average of two clean-up periods would be used as the recovery figure for comparison with the content indicated by prospecting.

It is shown in this case at least that a single drill-hole cannot be regarded as representative of the actual gold content of the surrounding area. This has also been the experience of other operators. In one case, when dredging where the drill-hole indicated 2.58c. per yd. as indicated on the table, the dredge recovered 15.5c. or 600% of the content given by the drill-hole; in another, from ground where the drill showed a content of 59.8c., the dredge recovered 20.7c. or 34.6%; and in a third, where 26.2c. was indicated only 4.6c. or 17.5% was recovered.

Any estimate to be at all trustworthy can only be made from the average of the content indicated from a number of drill-holes that have been intelligently placed and carefully sampled. If the work of prospecting has been done properly, an estimation of the gold content of a property can be made with some degree of accuracy, but if the work has been carelessly performed by unreliable or inexperienced engineers, the results obtained will be so worthless as to render any refinement of calculation merely ridiculous.

TABLE OF COMPARISON SHOWING DRILL SHEET VALUES AND ACTUAL DREDGING RESULTS AT OROVILLE, CALIFORNIA

(Arranged in order of highest drill-sheet results and reduced to percentages of recovery.)

Holes	Drill-sheet value.	Actual dredge value	Per cent recovered
	'A'		
	Cents per cubic yard		
F	59.80	20.72	34.60
G	48.51	26.50	54.60
C	42.30	19.56	46.30
E	33.53	13.36	39.80
U	32.79	15.56	47.50
I	26.20	4.60	17.50
L	23.81	14.83	62.30
A	21.35	9.25	43.30
N	21.23	10.37	48.80
V	20.80	14.00	67.30
M	20.25	11.17	55.16
K	18.52	14.80	80.00
J	15.47	7.97	51.50
A_2	14.30	13.28	92.90
D	11.14	17.00	152.60
B_2	10.76	5.77	53.60
T	8.31	13.82	166.30
B	7.53	10.40	138.00
Y	6.02	19.35	321.00
Z	2.58	15.50	600.00
X	1.85	7.25	390.00
	'B'		
6	77.18	23.58	30.00
2	41.28	14.00	35.00
14	29.75	10.05	33.78
5	26.14	12.00	46.00
4	25.76	10.25	40.00
3	22.12	12.93	59.00
7	20.61	11.50	51.00
8	6.24	5.24	84.00
16	4.47	4.60	103.00
	'C'		
F	60.40	20.72	34.30
6	54.54	23.58	43.20
W	36.78	28.00	76.10
15	34.22	16.86	49.00
h	33.53	30.00	90.00
a	27.72	15.24	54.10
C	27.10	19.56	72.00
j	22.24	17.80	80.00
b	21.15	8.30	39.20
i	18.88	15.44	82.39
d	18.37	20.60	112.20
5	17.83	12.00	67.30
e	17.49	19.16	109.50

Three sets of drill-sheet figures are given as per results obtained by different engineers, 'A,' 'B,' and 'C.'

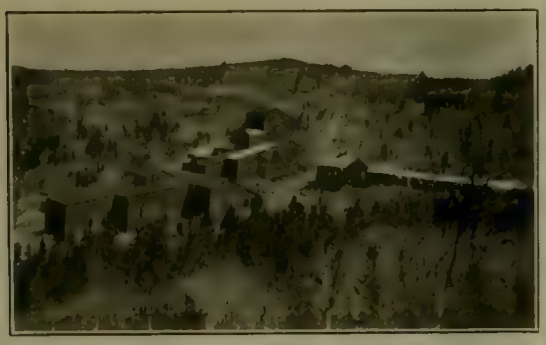
Where holes are designated alike on any two sets of figures it means a hole was drilled to check a former result.

All check holes drilled by 'C.'

New Reliance Mill Practice, With Particular Reference to Continuous Decantation

By JESSE SIMMONS

At the New Reliance property, in the Black Hills district of South Dakota, is the first plant that made a success of fine grinding on Bald Mountain ores. It is also the only mill in the district treating slime without agitation, and it was the first to install and operate the continuous decantation, counter-current system. A pioneer in a new field—the mill was started in August, 1912—the manager, F. C. Bowman, has solved numerous problems, and by constantly seeking to improve, has evolved a mill practice that is second to none in treating the refractory silicious ores of the Bald Mountain district. At the time this mill was started, there were but one or two others in the United States working along similar lines. The idea had been worked out on paper, but every metallurgist knows to his sorrow that ideas on paper and mill-runs are two separate and



NEW RELIANCE MILL.

distinct matters. So Mr. Bowman had to work out his own salvation, excepting that occasionally he heard of difficulties overcome at the other mills. The process as it is working today is about as follows.

The ore supply, amounting to about 100 tons per day, first passes through a gyratory crusher, is then elevated to bins, and is fed to the thirty 1000-lb. stamps, which operate in single-issue mortars. The stamps drop 96 times per minute, a distance of 7 in. Two sizes of screens are used, both of Tyler ton-cap pattern. One is No. 538, with an opening of 0.025 in., and the other is No. 423, with an opening of 0.024 in. The dies are made by Hogarth, at Deadwood, of old chrome steel and scrap iron. These give about 60 days' service. The shoes are of chrome steel, purchased in the East. The ore is particularly hard, silicious material, and is crushed fine, accounting for the rather low stamp-duty, which is a little over three tons per day. The ore contains no free gold. At the stamps, cyanide solution in the ratio of 6 tons to 1 ton of ore is added.

From a Dorr duplex classifier to which the stamp product flows direct, the sand, amounting to 40% of the product, goes to leaching vats, which are served by a revolving distributer. When there is about two feet of sand in the tank, the filtrate runs clear and percolation is started, the solution as drawn off going to the precipitating boxes. About 50 to 56 hours is required to fill a tank. Mill solution is then run on for two to three days, or until the gold content of the filtrate is too small to give good precipitation. After this the tank is drained fairly dry and barren solution run on, and a percolation with it kept up for three to four days, thus getting all of the recoverable gold. Treatment is completed by a wash with water, which, like the barren solution, goes to the mill sump. Sand tailing as discharged carries 24% moisture and an average of 2 to 3c. per ton of dissolved gold.

Slime Treatment

Slime from the Dorr classifier goes to a 20-ft. cone, from which the clear overflow solution goes to the mill sump, and the underflow, containing about 70% moisture, is run to thickener No. 1, the first unit of the continuous decantation system. At this point the pulp is united with the clear overflow from thickener No. 2, effecting a dilution of about 3 to 1. Ordinarily the overflow solution from this first thickener goes to the mill sump, although if there is a scarcity of precipitatable solution being drawn from the sand vats then being leached, it is diverted to the zinc-boxes. The thickener tanks are 4 in number, 3 of them 20 by 13 ft. and the other 20 by 10 ft. Each is equipped with a Dorr thickener. They are so placed that the solution runs from one to the other by gravity; the slime pulp is lifted by diaphragm pumps. Thickened pulp contains 60 to 65% moisture.

With a slight modification from the style as delivered by the manufacturers, these pumps are giving highly efficient service. The change made consisted of lengthening the standard, or rod, about four feet, thus permitting the removal of the pump jack that distance from its ordinary position alongside the pump, where spattering slime caused excessive wear on bearings and gears. Diaphragm pumps, so operated require almost no attention; their upkeep, aside from the diaphragms, is trifling; power consumption is so small as to be almost negligible; and, finally, they deliver a thicker product than air-lifts. Altogether, Mr. Bowman is well pleased with their operation, and is careful to point out that through their use an important sum is saved monthly in power consumption.

They are operated at a speed far in excess of ordinary practice. But at a speed of 26 to 55 strokes per minute they give good service. On 4 pumps in 12 months there were used 30 diaphragms, costing about

$2 each. Much depends upon the quality of the diaphragms, the highest and best grades of rubber having been found to give the best service at the lowest unit of cost.

Control of the duty of the pumps is effected by opening or closing a pet cock on the suction. There not being any convenient method of changing the speed of any particular pump, this scheme was tried and found to work perfectly: Using a 'T' in place of an elbow where the suction pipe makes a right-angle turn to connect with the pump, a bushing is placed in the upper branch of the 'T' and the pet cock screwed into it. The pump's duty is cut down by opening the cock. Some such regulator is necessary where the pumps must be operated at constant speed.

Operation of Portland Filter

Completion of the slime treatment is made on a 12-ft. diameter by 7½-ft. face Portland revolving drum filter, where the solution is drawn off, a little wash water added, and finally discharged with a moisture content of 36%. This might easily be made much lower, but if any thicker the slime would not readily flow to the dump. From the last thickener in the series the slime runs by gravity to the filter-tank, and in order to prevent it from settling in this tank, it is circulated once every 8 hr. with a diaphragm pump. Dissolved gold in the slime tailing from the filter, under normal conditions amounts to from 2 to 5c. per ton of dry slime.

For simplicity of operation, low cost of maintenance and repairs, the revolving drum filter is giving good results at this property. Under ordinary conditions, the cake made is $\frac{3}{16}$ to $\frac{1}{4}$ in. thick, and, as has been noted, could be drawn off with a much lower moisture content if it was desired to do so. Repairs are practically *nil*. They are to cloths, wire, and strips, a full set of which, giving the filter an entire new cover, costs about $27. From them is secured a service of from four to six months, handling 1200 to 1500 tons of slime per month. About the only other wearing parts are the worm gear and the scraper. In 22 months one renewal has been made of each of these parts, the gear costing $19.90 and the blade costing $4.50. In the same length of time there have been 5 changes of cloths—using 5 cloths, 5 sets of strips, 5 sets of wire, and 2 burlaps. These supplies, with the worm gear and scraper blade, are all that have been used, and the total cost of the whole was $150. Since 26,400 tons have been filtered, the repair cost was $0.00568 per ton.

To put on a new cloth requires about 20 hours, during which time 3 men are used for 8 hr., 2 men for 5 hr., and 1 man for 7 hr. Not over ½ hp. is required to operate the filter at its regular speed of 1 revolution in 3 min. In addition there is a 7 by 6-in. vacuum-pump and a 4½ by 4½ air-compressor supplying 11 cu. ft. per minute. The pump at 76 strokes per minute supplies a 15 to 17-in. vacuum.

No additional labor is required to operate the filter, as with some other types; it is practically automatic. Aside from regular inspections, and the occasional repairs and acid treatment, it runs itself. It might be mentioned that the slime does not contain any colloidal material. On the other hand it is, even in minutest particles, somewhat gritty and sandy. This fact, no doubt, has some bearing on the service obtained from the filter. Both the thickness of cake and length of life of the cloths probably would be different with material containing much alumina and clayey matter.

Tests on Settling Rate

Tests have been made to ascertain the settling rate of slime of various characters, as determined by screen analyses. It has been found that slight amounts of sandy material (larger than 200 mesh) have decided effects on the work of the thickeners. Taking 50 grams of dry ore, adding 200 c.c. of solution, placing in a 300-c.c. graduate, given enough agitation to get the mass

TAILING LAUNDER.

thoroughly mixed, the settling rate was noted in terms of clear solution settled out at various intervals. In the following table are given the amounts at the end of 5 and 30 minutes:

No.	Mesh −60+100.	Mesh −100+200.	Mesh −200.	Clear solution settled at end of 5 min.	Clear solution settled at end of 30 min.
	%	%	%	c.c.	c.c.
1	6	29	65	78	164
2	5½	27	67½	72	161
3	5	25	70	72	156
4	4½	23	72½	66	158
5	4	21	75	60	158

It will be noted that the extreme variation of the sand in these samples was but 2%, and of the slime 10%, but that the settling rate of the first 5-min. period showed wide differences. Not so great a difference is apparent at the end of 30 min. Screen analyses of material actually being handled in the mill give an idea, also, of the effect of the fine sand on the ability of the thickeners.

A material with 3.3% +100, 11.7% +150, 10% +200,

and 75% −200 mesh gave a muddy solution overflow from the thickeners, and a material consisting of 1.9% +100, 15.4% +150, 9.6% +200, and 73.1% −200 mesh gave a clear solution overflow. In these cases the sand, or +200 mesh, varies only 1.9%. Similar ore was going through the mill in the two cases cited; all conditions were apparently the same, but this slight difference in the percentage of sand was enough to mark the difference between satisfactory and unsatisfactory work. In this connection it might be mentioned that on a slime of the analysis given in the table herewith, containing 63% of −200 material, excellent work is done, with plenty of clear solution overflowing from all of the thickeners. Naturally, the underflow from the thickeners shows a variation in moisture content; when the effluent solution is clear, the moisture content is low; when the effluent solution is muddy, the underflow will contain a high percentage of moisture. This is a vital point, as the process of continuous decantation and counter-current solution system depends upon the thickeners yielding an underflow with a minimum of moisture; this means that the gold-bearing solution is to a satisfactory degree being replaced by barren solution.

Miscellaneous Data

Mill solution has a strength of 0.9 lb. KCN and 1.8 lb. CaO per ton. Consumption of cyanide is 0.3 lb. and lime 10.75 lb. per ton. The cost for mining and milling, from August 1, 1913, to February 1, 1914, on handling 11,677 tons of ore, was $3.04 per ton.

For acid treatment of the filter, there was used during 22 months 1250 lb. of commercial HCl, costing $58, or $0.0022 per ton. Power used is about as follows: 30-hp. motor on crusher, 11 kw.; 3 motors of 25 hp., each driving 10 stamps, 18 to 20 kw. each; 1 hp. on classifier, 0.36 kw. Everything that has to do with slime department, including filter, thickeners, vacuum-pump, compressor, diaphragm pumps, and solution pumps, is driven by a 20-hp. motor consuming an average of 10.25 kw. Water supply is secured by pumping from wells and springs, using one 5-hp. and one 3-hp. motor, consuming 2.5 and 2 kw., respectively.

There is ordinarily precipitated in the zinc-boxes two to three tons of solution to each ton of ore milled. In this connection it might be stated that no clarifying filter is used prior to precipitation. Several months ago the solution men were offered a bonus of $2.50 per month, each, if during a month no ore slime found its way to the precipitation boxes. A fine of $1 is imposed on the man allowing it to happen. With three solution men it has cost $7.50 per month, but is money well spent, as there has been no ore slime in the precipitating department for six months. This system is probably just as efficient as a filter, does not cost much, if any, more, and gives the men a moral lesson in watching not only this matter, but others of importance. The entire mill is operated with a crew of 8 men, namely, cyanide foreman, crusher man, 3 battery men, and 3 solution men.

Tailing Disposition

Situated at the head of Annie creek, which drains into Spearfish creek, it is necessary to impound the tailing so that none shall escape into the latter stream. A dam 160 ft. long and 50 ft. high in the centre has been constructed at a narrow point in the gulch half a mile below the mill. The face of this dam is composed of two thicknesses of 2-in. plank with a single thickness of tar-paper between. The plank is laid on 4 by 12-in. and 3 by 12-in. joists, which rest on a heavy frame of 8 by 12-in. and round peeled timbers. The latter material is used for all mud sills and cribbing. The face of the dam has a slope of 37 degrees.

This serves as a settling dam, and over the apron the overflow is practically clear. Sand tailing from the mill is carried in a wooden box launder to a point in the gulch 200 yd. above the dam, where the launder is turned directly across the gulch, dumping the sand in an embankment forming a dam to hold back the slime. The launder, a view of which is given in Fig. 2, is constructed of 6-in. and 8-in. boards, forming a box 6 by 6 in. inside. For a portion of the distance immediately below the mill, the launder is set on a grade for 9.5 in. in 16 ft.; the remainder of the distance to the turn across the gulch, the grade is 11.5 in. in 16 ft., and crossing the gulch the grade is 12 in. in 16 ft. Although these figures indicate a light gradient for a launder to carry sand, it works to good advantage.

Screen Analyses, New Reliance Mill

Mesh.	Battery discharge.* %	Filter heads. %	Sand. %
— 20 and + 40	8.4	...	40.7
+ 60	13.8	...	18.7
+ 100	17.9	5.7	25.2
+ 150	17.9	22.8	10.5
+ 200	8.2	8.5	1.6
— 200	33.8	63.0	3.3
	100.0	100.0	100.0

*This is separated by classifier into 60% slime and 40% sand.

The Amalgamated Zinc (De Bavay's) Co. of Broken Hill reported that during the half-year ended June 30, 1914, the flotation plant treated 247,386 tons of tailing for 69,918 tons of concentrate, assaying 48.6% zinc, 6.1% lead, and 8.9 oz. silver; also 687 tons of lead concentrate, containing 53.5% lead, 53.1 oz. silver, and 14.1% zinc. This is a small decrease compared with the previous term. Including adjustments on previous concentrate produced, the profit was $297,000. Owing to the war, contracts for the sale of products were suspended, but some arrangement has been made for final settlement with the buyers.

Manganese ore shipped from the Brazilian port of Rio de Janeiro during 1912 amounted to 154,870 metric tons, worth $7.22 per ton. Since the end of that year no ore has been sent from Bahia. Cost of mining, transport, lighterage, export duties, etc., is $2.80 per ton in the state of Bahia.

Thomas Johnston Grier—A Pioneer Mine Manager

Thomas Johnston Grier, superintendent for the Homestake Mining Company, at Lead, South Dakota, died at Los Angeles, California, September 23, 1914, at the age of 64 years. The cause of his death was stated to have been valvular leakage of the heart. He was born at Packenham, Ontario, Canada, where he received his early education, his school days not extending, however, beyond the course of the high school of his native town. Upon leaving school he was appointed deputy in the post-office at Packenham where his father was postmaster. While thus employed he took up the study of telegraphy, which was at that time a comparatively novel occupation, and whose mysteries had invited his attention promptly. In a few months he had advanced sufficiently to secure an appointment as operator in an office at Montreal, Canada, where he became one of the most rapid as well as accurate operators in the Dominion. The call of the West reached him in his Canadian home, and he went to Corinne, Utah, on the line of the Central Pacific railroad. Corinne was at that time a prosperous and typical frontier town, and he thus early came in direct contact with the rapidly shifting, cosmopolitan, and somewhat unruly element of the West, and so gained a knowledge of men from many classes and nationalities, which experience in later years was to be of great value to him in directing the work of thousands of employees, many of whom were foreigners, and not always the most tractable.

A Telegraph Operator in Utah

His work as telegraph operator at Corinne was so satisfactory that he was transferred to the Salt Lake office of the Western Union, where he was placed in charge. It was at Salt Lake City that he made the acquaintance of George Hearst, who was prompt to recognize the executive ability of the young chief operator, and in 1878 sent him as head bookkeeper and telegraph operator to the Homestake at Lead, South Dakota. Grier arrived at the Homestake when it was still a comparatively small enterprise. The construction period was just beginning. The first Homestake mill of 80 stamps was built in the summer of 1878, and the Golden Star and Highland mills of 120 stamps each followed soon thereafter. The other great mines of the 'Homestake belt' were being developed, mills were under construction or were being planned, and large shafts were being started. Samuel McMasters was then superintendent at the Homestake. He was a big, brawny Scot, inured to hardship, a hard worker, with experience gained on the Comstock. He was a commander of men, but a peculiar combination of hard, practical sense, inflexible fidelity to his employers, and of ruthless disregard for personal friendship if it in any way interfered with the interest of his company—a good organizer and executive. He planned far ahead, for those days, and, foreseeing its necessity, built a narrow gage railroad 50 miles in length out into the timbered region of the Black Hills in order to supply the demand for timber and fuel. He also acquired about all of the water available by gravity, and began mining at the Homestake on a large and ever increasing scale.

During all of the years of activity, Thomas J. Grier familiarized himself with every portion of the property, and with every phase of its operation, literally growing up with the business. He was nominally head bookkeeper and was well known and recognized in the community as a genial though rather quiet man. He was always courteous but never brusque; in this respect differing from McMasters, who on occasion could be pleasant or quite otherwise.

Superintendent of the Homestake

The heavy responsibilities of the conduct of the large and constantly increasing business of the Homestake company undermined the constitution of the big Scotch manager, McMasters, and failing health necessitated several vacations in the early '80s. These extended over periods of several months. During these absences, the responsibility for the operation of the mines devolved upon Grier, who performed the duties to the full satisfaction of his employers. In 1884, McMasters, whose health had continued to fail, passed away, and many wondered who could be found to assume the duties of the position left vacant. To the surprise of many, the Homestake mills did not hang up a stamp. The announcement of the name of the new superintendent was looked for with much interest by the mining communities of the Black Hills, but no announcement was made. Grier was not prominently mentioned, but he continued to discharge the duties of superintendent, just as he had during the several periods of absence of its late chief executive. A year or more passed, Grier acting as superintendent the while, yet modestly refraining from assuming the title of manager or even of superintendent. One day in conversation with the late G. C. Moody, who was then attorney for the Homestake company, Grier brought up the subject of the superintendency of the Homestake mines, and Moody suggested that as Grier was acting in the capacity of superintendent, he not only assume the title, but take the emoluments of the position as well; which Grier accordingly proceeded to do. On the recommendation of Grier, other properties on the 'Homestake belt,' as it is known, were acquired by the Homestake company, until this concern became the owner of a tract of mineral land over 2000 ft. wide and about two miles long. The great mills of the early days were enlarged, until there were six containing in the aggregate 1000 stamps. These have crushed more than 4000 tons of ore every 24 hours for many years. Six large shafts were sunk to hoist the

ore and to handle the men and supplies; two large cyanide plants were built after a long and costly series of experiments conducted by C. W. Merrill and his assistants, and later a third and still more expensive plant was added to treat the slime. A great new water system was planned and built whereby water is pumped over a mountain from the cañon of the Spearfish river and sent to the Homestake mills, and to the cities of Lead and Deadwood. Improvement after improvement, one expansion after another, was made. The Company now employs in all over 3000 men. Only mining men can understand and appreciate the magnitude of this enterprise, with its miles upon miles of underground workings, its great mills, its problems of transportation, and the vital matter of a never-failing water supply for the mines and for the inhabitants of the cities of the vicinity. Notwithstanding the magnitude of the operations of the Homestake company, Thomas J. Grier was thoroughly familiar with every detail, and knew the ramifications of the mines as a man knows the passages and rooms of his own home. In the early years of his career as superintendent it became evident that improvements in mining methods were desirable. The great timbered stopes were unsafe, some of them having already caved. Grier surrounded himself with a staff of competent engineers and experienced, capable, practical miners, and a period of evolution in mining practice at the Homestake began. Change after change was made where it seemed an improvement could be introduced. He invited suggestion from the men and made many far-sighted and valuable ones himself. New ideas were tried out and adopted or rejected as they proved to be betterments or the reverse. Grier never thought that men were cheaper than timbers, and no expense was spared to render the operation of the mines of the Homestake company safe and sanitary, and it is a matter of note that under his direction the percentage of accidents steadily decreased as newer and better methods of mining were introduced.

Thomas J. Grier was a man who fully sympathized with his men. He was a personal friend and adviser as well as a superintendent. Through his efforts the city of Lead has splendid schools, a fine library, first-class sanitary arrangements, paved streets, a model fire department, and in many respects came to be a model mining town.

Homestake Fire

The duties of superintendent, arduous as they were, were at times greatly increased. On the evening of March 25, 1907, the city of Lead was startled by the ringing of the fire bells, and soon the dreadful news spread throughout the town that the Homestake was on fire somewhere on the lower levels. When discovered, the fire was beyond control, and the great volumes of carbon dioxide being generated by the fire made it impossible to approach anywhere near the seat of the fire. Grier arrived on the scene within a very few minutes of the first alarm, and every effort that experience and skill, backed by heroic courage, could make was tried to extinguish the flames. It soon became apparent that ordinary methods were fruitless. Scores of miners ventured into the mine only to fall fainting in the poison-laden galleries, whence they were dragged to safety by companions. For a week Grier fought this fire, and then ordered all men out of the mine workings, having decided that it was useless to attempt further to fight the fire in the mine workings. Small streams of water were sent down into the mine through various shafts and open workings, but the fire still gained headway. Finally, on April 22, Grier decided to apply heroic measures. He ordered the water of the entire canal system turned into the mine, over 1500 ft. in depth with several miles of levels. A flume over 3000 ft. in length was hastily built in the cañon of Whitewood creek and nearly all of that stream was also turned into the mine through an old adit. In this way over 500,000,000 gallons of water was poured into the burning mine, the streams never stopping until the water appeared at a drainage adit. It was then known that the fire was submerged and must, of course, be out. Then began the work of unwatering the workings. It took months to accomplish this, but it was finally done, and the damage to the mine was found not to be very great, as the mining had been so well done that few serious caves occurred. During this interval, Grier took advantage of the enforced idleness of the mine to make various changes that he had long contemplated, but which he could not very well carry out without interfering with regular operations. These changes, when completed, reduced still further the expense of mining by reason of increased efficiency, and when the workings were finally unwatered it was in better condition for operation than ever before.

Labor Trouble

Although in the matters pertaining to the policy of the Homestake Gold Mining Co. toward its employees and toward the communities that had grown up about it, the superintendent had the fullest authority, and in the exercise of this power Grier had been almost parental in his humane and kindly treatment of the men in the things that most concerned them socially as well as in in the mine, yet there was a time when all of his painstaking care of their interest seemed to be almost wholly unappreciated. As early as 1878 a miners' union was organized at Lead, with branches at Central and Terraville, small towns on the lode. Nearly all the miners were members of one or the other of these unions. The objects of these organizations were fraternal and beneficiary. Wages were as high as were paid in the West for mining, and working conditions were as good as at the best, and superior to most others. The unions were conducted in a fair and friendly manner, and for over 30 years prospered under the direction of wise and conservative officers. Here the miners had their homes, here their children were born, and here they expected to remain. There were good schools, a clean city, and there had never been a moment's anxiety about pay day, for their checks were always ready as sure as the day ar-

rived. There was perfect harmony between the miners' union and the superintendent, who aided it as an organization in various ways. All went well until the arrival at Lead of agitators of the Western Federation of Miners in the fall of 1909. An active and somewhat belligerent campaign was started to gain a foothold in the Black Hills. So aggressive were these officials of the Western Federation that by November of that year they had succeeded in gaining a large membership. They then felt strong enough to make a demand that all miners not already affiliated with them join within a specified period or take the consequences. The records of Cripple Creek and other districts where the Federation was in power indicated only too plainly what those consequences might be expected to be.

When things had reached this condition, Mr. Grier could no longer safely ignore it. This was his first serious labor trouble. A very large percentage of Homestake employees had either voluntarily or under duress joined the Western Federation. With characteristic fearlessness he issued a notice to the effect that after January 1, 1910, the Homestake company would employ only non-union men; that the same scale of wages as previously paid would be continued, the shift being 8 hours; and that anyone who desired to secure employment must declare that he was not a member of any union and must register his name in the Company's books by December 15, 1909. It took courage of no unmistakable kind to issue an ultimatum such as this, but Grier was equal to just such an emergency. He felt that the Homestake company had dealt fairly with its men for over 30 years and that it had not only done all that it should have done, but more, and he accordingly resented vigorously this outside interference.

Breaking the Strike

The effect of the publication of the notice above referred to was electrical. It had been unexpected. The strangers who had worked up this interesting situation felt so strong that they were sure the superintendent of the Homestake company, seeing the vast majority against him and the great amount of property at stake, would quietly submit to the inevitable, but they did not know the fighting spirit of Thomas J. Grier. Upon the appearance of the notice, the Federation officials waited upon Grier for the first time, and with loud and threatening talk tried to coax, wheedle, and bully him into coming to their terms. They 'laid down the law' to him and demanded to know what he meant by the publication of the offensive notice. Grier informed them that it meant exactly what it said and that it would not be modified in the slightest degree. They blustered and threatened, pointing out the fact that an overwhelming majority of his workmen had joined the Western Federation, and that only loss and peril awaited his opposition. All of this Grier quietly ignored, and as a result the Federation officials, at a meeting on November 21, 1909, declared a strike against the Homestake company, to become effective as soon as their action could be ratified by the Denver headquarters.

Grier anticipated them by 24 hours, for on that evening no night shift went on and men were laid off by the hundreds. A comparatively small crew of faithful employees worked, removing the machinery and other readily movable and perishable paraphernalia from the mine workings, and the great mine was idle—the shut down was complete. Guards were employed to protect the property and the town waited in silence the outcome of the battle. The Western Federation published the names of 49 of the men who stood by the Company. This was another boomerang, and led to the organization of a new association called the 'Homestake Loyal Legion.' In three days hundreds of men had signed the Company's register and soon the number was over 1000, all of whom joined the Loyal Legion. Not only miners, but merchants and professional men became members. Public opinion was decidedly opposed to the Western Federation and in favor of Grier, who for more than 30 years had proved his worth as a citizen and friend. Within a week the Western Federation had lost its cause and soon the great mines and mills were running at full capacity as though there was not a Federation in existence. The following summer a new organization was formed by the Homestake company called the Homestake Employees' Aid Fund, to which both the men and the Company contributed. Grier was elected treasurer of this organization by the men, which showed how highly they regarded him as a true friend.

The death of Thomas J. Grier has taken away a man who cannot easily be replaced. Another and capable superintendent has been found, but it will be long before he can take the place of Grier in the minds and the hearts of the men of the Homestake mines. He was most loyal to his friends, and particularly to those who stood by him in the hours of trial and danger, when fire was destroying and civil war was imminent. He was always just but firm. He considered all problems affecting the welfare of the men under his direction with seriousness, and having determined upon the proper course adhered to it. His loss will be mourned by thousands of men throughout the mining world.

A LARGE COLORED WALL MAP, showing the petroleum resources and the natural gas deposits of the United States and also the thousands of miles of trunk oil pipelines, has just been printed by the U. S. Geological Survey. The map shows the areas underlain by known oil pools and known gas pools, as well as general localities which are productive in either oil or gas, and also areas where there are noteworthy occurrences of either oil or gas but where there is no present production. The map is 49 by 76 in., printed on the scale of 40 miles to 1 inch, in 5 colors. It is printed in two sheets and is sold, unmounted, by the Geological Survey, Washington, D. C., at $1 per copy. This map not only shows graphically the oilfields and pipe-lines, but is an excellent general map of the United States.

NO COBALT, MOLYBDENUM OR NICKEL was produced from domestic ores in 1913.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Flotation and the Patent Law

The Editor:

Sir—In an editorial entitled 'Flotation and the Patent Law,' appearing in the *Press*, issued October 17, 1914, a digest of an address delivered by James M. Hyde, before the San Francisco session of the American Institute of Mining Engineers is given, which credits me with two statements which do not exactly represent what I intended to state.

I am there quoted as giving as one of the reasons why the present legal procedure in patent cases should be changed, that "the judges are not capable of understanding the technicalities of inventions and disputes arising over them." I did not intend to make any such general statement as this. While many patent cases involve questions of such technical detail that it is too much to expect the judge with non-technical training to comprehend all that is involved, justice to our present judges demands recognition of the fact that through their decisions certain of them have shown that their comprehension of involved patent issues is very acute. Such a patent court as was suggested as more advantageous than the present practice of having the federal court pass upon these matters could well draw several of its members from the present federal bench to sit with other judges selected principally for their technical qualifications.

Referring to the work done by the Butte & Superior Copper Co. during the first half of 1914, the statement is made that "the total milling cost was $2.02 per ton of ore, of which Mr. Hyde estimated the flotation cost as between $0.50 and $0.60 per ton." The milling cost of $2.02 per ton is that announced by the Company in its reports, no analysis being given of the items making up this total cost. In the address it was stated that the original investigation made upon this ore at a time when water treatment alone was costing $1.50 per ton, indicated that additional costs for flotation concentration in the plant at that time being used at Basin, Montana, would probably be between $0.50 and $0.60 per ton, and that it was interesting to note that the total cost in the Butte mill, where various factors were different from those in the mill at Basin, had arrived at a total milling cost of practically that which had originally been estimated. The correction is offered, as no analysis of costs has been presented to the public, and it should not be understood that the statement referred to assumed that flotation costs at Butte are now $0.50 to $0.60 per ton, as the various items of cost of labor, water, etc., differ in the two plants, and the total undoubtedly is made up of somewhat different items than those taken into account in arriving at the preliminary estimates for the Basin plant.

James M. Hyde.

San Francisco, October 29.

Electric Power v. Mules in Coal Mines

The use of electric locomotives and mechanical devices is the only means by which the anthracite coal operators of Pennsylvania have been able to keep pace with the increased cost of mining due to thinner veins, longer hauls, and deeper shafts. It is only by increased efficiency in every department that modern mining can be made to pay. In the last decade, from 1902 to 1912, the horse-power developed at the mines increased from 354,237 to 680,700, or 326,463 horse-power.

By far the greater part of this increase was in transportation below ground. This was formerly accomplished almost exclusively by the patient mine mule. But a good mule is now worth $240. If this 326,463 additional horse-power had been added in mules, supposing such a number obtainable, the investment since 1902 in power alone would have been nearly $80,000,000, without replacing any mules that died during that period.

As a matter of fact, the number of mules decreased from 16,139 in 1902 to 15,187 in 1912. On the other hand, the number of electric locomotives increased from 53 to 951, and the number of steam locomotives on the surface from 373 to 575. For short hauls and steep grades, no adequate substitute for the mule has been found, except a gathering apparatus consisting of a rope on a reel extended from the electric locomotive; but on long hauls and moderate grades, steam and electricity are saving millions of dollars annually.

But the increase in other necessary forms of energy makes the problem of operating the mines at a profit one of careful selection of the most economical means. In 1912 the consumption of powder was 41,401,015 lb., and of dynamite 13,685,062 lb., in addition to 2,037,026 lb. of other permissible explosives. This is 1,128,335 lb. less of powder than in the busy year of 1903, but was 8,367,640 lb. more of dynamite, and no other explosives were used in that year. This increase of over 9,000,000 lb. in explosives, wholly disproportionate to the amount of coal produced, is largely due to the great amount of rock work which now has to be done.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

MINING COSTS at the Camp Bird mine, Colorado, during the past financial year totaled $5.12 per ton, a high charge due to small tonnage milled, a narrow vein, and hard rock.

CHINESE MECHANICS employed at the Shanghai Dock & Engineering Co.'s works in China, are quite satisfactory and receive 50 cents per day. The ordinary coolie is paid about $3.50 per month. This firm can compete successfully with Japanese shipbuilding concerns in bidding for contracts throughout the Far East.

CRAWL GIRDERS OR BEAMS should have an uninterrupted run from end to end of a battery-house, and every facility should be insured for executing repair work in the minimum of time and with the minimum of labor. Space and light are generally the cheapest of commodities. A badly laid-out mill building will cause more loss than is ever ascertainable.

DYNAMITE used in the mines of the Oriental Consolidated, Korea, amounts to approximately 4000 50-lb. boxes per year. Also 1,000,000 detonators. Government explosive regulations stipulate that only 250 cases of *fracteur* may be stored in each magazine, while special permission was obtained to keep 180,000 caps in each, both to be kept in separate magazines.

SOME of the German cyanide, as has been mentioned before in this journal, is manufactured from the residue of beet sugar. Growing beets for sugar has attained enormous proportions in Germany, especially in the Magdeburg district. There is a total of 1,342,420 acres under crop, and the last season's output is estimated at a minimum of 2,500,000 tons of raw sugar. At present there is 200,000 metric tons available for export, and probably 900,000 tons will be at a later date.

AFTER AIR ENTERS A MINE, the breathing of men and animals, burning of lamps, decay of mine timbers, and firing of shots take oxygen from the air and add carbon dioxide to it, but in well ventilated mines the air depletion from these causes is small. Much more important changes are those caused by oxygen being taken from the air by the coal; and by gases from the coal, the roof, and the floor being added to the air. The most important gas given off in many mines is methane, or marsh gas, which most miners call 'gas.'

GUN-COTTON, used in torpedoes, is made by treating cotton from spinning machines (cotton waste) with a mixture of 1 part nitric acid and 3 parts by weight of sulphuric acid. The contact is up to 12 hours, considerable heat being generated during the reaction, necessitating the vessels being surrounded with water. Excess liquor is removed from the treated material by a centrifugal extractor. The cotton is then washed in water suddenly to remove the remainder of the acid, further drained and washed, and reduced to pulp in a rag-engine as used in paper mills. It is again washed in warm water for about 48 hours, a little lime, soda, or ammonia being added to neutralize any trace of acid. The pulp is finally molded as desired, it containing a little moisture to avoid explosion during cutting, etc. When gun-cotton is enclosed in a strong case, such as a torpedo, and exploded by contact, rapid decomposition takes place, and Berthelot has estimated that the pressure produced by the detonation of the explosive, compressed to a density of 1.1, is 24,000 atmospheres, or say 160 tons per square inch, only half the pressure assigned by him to the detonation of mercuric fulminate.

QUICKSILVER is used mainly in the manufacture of fulminate for explosive caps, amalgamation of gold and silver ores, drugs, and various apparatus. Out of the 20,213 flasks produced in the United States in 1913, it is said that about 10,000 flasks are used for fulminate for caps. Fulminates are prepared by treating mercury with nitric acid and alcohol. In the first reaction, the solution contains mercuric nitrate, nitric acid, and nitrous acid. When all the metal is dissolved, the required quantity of alcohol is added. A brisk action results, and the fulminate separates as a crystalline precipitate. The fume from this action is very poisonous. The fulminate is collected, washed free from acid with water, and air dried. The salt or fulminate has a gray color, and explodes easily, giving off gray fume of mercury, as $HgC_2N_2O_2 = Hg + 2CO + N_2$. The specific gravity of the explosive is 4.4, and the gas and vapor from detonation would occupy over 1340 times the volume of the solid salt at ordinary temperatures. At the moment of detonation it would occupy a greater volume, on account of the heat evolved in its decomposition. It has been estimated that a pressure of 48,000 atmospheres (720,000 lb. per sq. in.) is produced. The explosive nature of the fulminate is due to its containing an oxidizing group, Hg linked to O, and a cyanide group, Hg linked to CN. In the manufacture of percussion caps the explosive force of the fulminate is lessened by adding potassium nitrate or chlorate. Powdered glass, or sometimes antimony sulphide, is mixed to increase the sensibility to explosion by percussion in military caps.

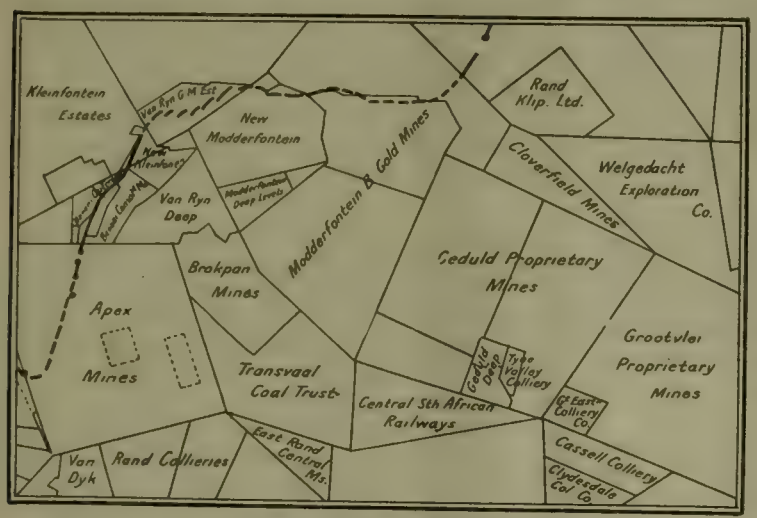
REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

LONDON

GEOLOGY, DEVELOPMENT, AND PROSPECTS OF THE NEW MODDER, MODDER B, MODDER DEEP, AND GOVERNMENT GOLD MINING AREAS IN THE FAR EAST RAND.

At the present time, the group of mines in the far east Rand, usually included under the general name of the Modderfonteins, is attracting the chief attention among Transvaal properties. The banket in these areas has no outcrop, as the pre-Cambrian series containing it is overlain by coal measures and other deposits of later date. The beds are of basin shape, and the banket is supposed to have another outcrop on the ancient surface, but still covered with more recent beds, to the south and east. The chief evidence to support this supposition is provided by the Nigel group of



CLAIM MAP OF MODDER GROUP OF MINES.

mines in the Heidelberg district. Boring has been done extensively throughout this basin area, and only recently the results at the Daggafontein bore-hole were announced as indicating a banket deposit 4 ft. thick, averaging $8 per ton at 3500 ft. depth. Two mines at Modderfontein are large producers, the New Modderfontein and the Modderfontein B. Below them on the dip are the Modderfontein Deep Levels, and the Government Gold Mining Areas (Modderfontein). The first two belong to the Rand Mines group, the third to the Goerz, and the fourth to the Barnato. The two latter have been extensively developed, and their equipment has been so far completed that milling should commence by the end of the year. The New Modder is often called the greatest gold mine on the Rand at the present time. The actual area covered is not quite as great as that of the three great consolidations, Crown Mines, East Rand Proprietary, and the Randfontein Central; and as the dip is flatter the amount of 'reef' per unit of horizontal area is not so great. But the area is big, measuring 1.6 by 2.25 miles, the mine contains large reserves of high-grade ore, and the current developments are excellent. From a speculator's point of view, there are better prospects here than in the other properties. About one-sixth of the area has been stoped, and a similar portion has been developed. The remaining two-thirds remains to be exploited. Four incline shafts are in use, and recently a circular vertical shaft has been sunk at 2000 ft. from the southern boundary, and two levels opened there. Development was started as far back as 1888, and the first mill, of 40 stamps, commenced in 1896. It was not, however, until 1907 that the first dividend was paid. At the present time the metallurgical equipment consists of 180 stamps and 7 tube-mills, and has a capacity of 52,500 tons per month. It is intended to erect another mill near the circular shaft with a capacity of 40,000 tons per month. The ore developed recently is of higher grade than previously, and the reserve has been greatly increased. During the past 12 months the figures have risen from 4,351,000 tons to 5,913,700 tons, and the average content from $8.26 to $8.46. The profit, after allowing for every possible item of expenditure, is about $3.60 per ton at present, so that the total distributable profit that may be expected from the developed ore is $22,000,000. This does not include 420,000 tons of ore left as pillars, which under the modern system of stope-filling will be eventually reclaimable. During the past 12 months the revenue from the sale of gold was £990,354, obtained from 537,000 tons hoisted, of which £707,243 was won by amalgamation and £283,111 by cyanide. The amount of profit, that is to say, the dividends distributed, was £420,000. These figures go to prove that the New Modder is one of the great mines of the world.

The Modder B adjoins the New Modder on the east, and is of only recent development, the Company only being formed in 1908. Milling started in 1911 with 80 stamps and 5 tube-mills, and the first dividend was paid 18 months ago. In the area close to the New Modder, recent work has disclosed ore of unusually high grade, as much as 585,000 tons averaging $12.50 per ton has been added to the reserve during the year 1913. The total reserve is now nearly 3,000,000 tons averaging $8.40 per ton. Unfortunately, the ground in the eastern portion is considerably faulted, and development is difficult. It is interesting to note that the extension of the mill put into operation this month consists of 16 Nissen stamps. This type of mill has won its way in Africa after unprejudiced competitive results.

As regards the other mines, the Modder Deep is on the dip of the New Modder. Shaft-sinking commenced in 1910, and by the end of June last nearly 2,000,000 tons of ore averaging $8.40 per ton had been developed. The plant contains 60 stamps and 6 tube-mills, and its erection should be completed by the end of this year. The method of development of the property is based on the German coal mining system, and the two shafts required by law for ventilation purposes are situated only 100 ft. apart. This property is a small one compared with its neighbors, and consists of a wedge between the New Modder and the Government Gold Mining Areas. A point in its favor with regard to the possibilities of future

development is that it is bounded on the west by the Van Ryn Deep, another mine of recent date that has a large and valuable ore reserve.

The Government Gold Mining Areas (Modderfontein) Consolidated, Ltd., is a Company that suffers from the folly of its godfathers in the matter of name, and the difficulty is to find a convenient colloquialism that will act as an efficient substitute. The Company was formed in 1910 to acquire property from the Transvaal government on terms not previously known on the Rand, though similar to those ruling with the Premier Diamond Mines, Limited. No cash purchase price was demanded, but the government asked for a share in the profits on a sliding scale, the maximum under present conditions being 40% of the distributable profits. Barnato Brothers were given the lease, after public advertisement of the terms, and it may be a curious coincidence or not, that the same firm has gradually bought control of the Premier. The property is to the south of Modder B and Modder Deep, and has the Brakpan on the west and the Geduld on the east. The area covered is more than twice as great as that of the New Modder. Four vertical shafts have been sunk, each measuring 42 ft. 6 in. by 6 ft. 6 in. and intersecting the banket at depths varying from 2275 to 3600 ft. On June 30 the developed ore was estimated at 1,800,000 tons averaging $6.48 per ton. The treatment plant, now nearly ready, contains 100 stamps and 10 tube-mills, and has a capacity of 600,000 tons per year.

The South African School of Mines, at Johannesburg, has been closed temporarily, owing to the number of students called out to join the defense force of the Union. Those students not so absorbed have been engaged by the Consolidated Gold Fields mines.

WASHINGTON, D. C.

Influences at Work on the Bill to Codify the Mining Laws of the Country.—First-Aid for Gas and Electric Shock.

It appears that considerable influence opposing legislation in Congress proposing the creation of a commission to codify the mining laws of the nation, is made up of men in the mining world who fear that such a commission may wish to revise the laws relating to apex mining, and fearing any tampering there they are opposing any codification whatsoever. It is felt by these that the apex laws, and the interpretation of them by the courts are now so well established and understood, that to revise them or to create new mining laws appertaining to extralateral rights might completely disorganize the present status of mining, and lead to great confusion until such a time as the courts could once more by their decisions bring order out of chaos. And apparently there is something to be said for this point of view. There has been some question why no progress was made in Washington in the late session, in the legislation purposing to create a codification commission, and it was generally attributed to the fact that the bill in the Senate carried an appropriation of $25,000 to meet the expenses of the commission; but it now seems that, although this has been a reason for the attitude by Congress, it has been but a minor reason, and that the chief one has been that provided by those who fear that a codification of the mining laws would also probably mean new laws bearing on the apex question.

There is this much to be said: the conclusions of the commissions would not necessarily mean that they would become law. The commission would be powerless to enact any laws. Its province would be only to recommend. The commission would report to Congress, which would refer the report to a committee, one in each house, or possibly a joint committee, and this, or these, in turn would draft a bill embodying as much of the recommendations of the commission as they chose, or rejecting its conclusions entirely or in part, possibly and probably substituting the ideas of the committees themselves, if in their judgment these are preferable. The bill would then have to run the gauntlet of both houses of Congress. And it would be a gauntlet indeed, as Congress always takes its time in passing bills codifying the laws of the United States, consuming usually therein months of the session, examining closely the contents of the bills and debating them thoroughly. As there are in Congress not a few members who are well posted in mining law, a thorough debate might be expected. No crude, radical, or ill-advised legislation could be expected from such a procedure. The mining world would, in addition, certainly be given an extensive hearing.

The committee of university authorities, headed by W. B. Cannon, professor of physiology at Harvard, has made its report to the Bureau of Mines, which appointed it, on what are the most efficient methods to be administered to miners overcome by electric shock or gas where a physician or surgeon cannot be reached in time to apply life-saving methods. In consequence, Joseph A. Holmes has recommended certain procedure in first-aid, which has been published in pamphlet form for distribution.

NEW YORK

Further Discussion on the Copper Situation and Export Trade.—Nevada Consolidated Report.—Minerals Separation Suits.—Tonopah Mining Co. in Nicaragua.—Peruvian Finance.—Antimony.—Society Meetings.

The situation in the copper market took a serious turn last week when the British government seized the Italian steamships *San Giovanni* and *Regina d'Italia* at Gibraltar, on account of the cargoes of copper consigned to Italy which they contained. The *Kroonland*, an American steamer, with 1300 tons of copper consigned to Italy, was detained as well. The result of this was that the Sicilian-American and Lloyd-Sabaudo lines have refused to take shipments of copper except under a guarantee by the shipper that the copper shall not be reëxported from Italy, a guarantee which the shippers here, of course, could not give. Since exports of copper in the last week, which were fairly heavy, were more than half consigned to Italy, this is a serious state of affairs, and is likely to cut down exports by nearly half, unless some way out of the difficulty can be found. The State Department is considering making a protest, but no immediate relief can be expected. It is also reported that ships carrying copper to the Scandinavian countries have also been detained at ports in Scotland. The result of this is that England and France are practically the only countries to which American copper can now be shipped without fear of seizure. As a result, the price of copper is weaker than ever, and domestic buyers seem to be holding off in the expectation that it will go even lower. It will soon be impossible to obtain marine insurance on copper, unless the exporters can give a guarantee that the metal will be consumed in the country to which it is consigned. The destination of the consignments of copper made week before last is of much interest as indicating the direction which export shipments are taking.

Destination.	Pounds.	Destination.	Pounds.
Genoa	6,946,288	Christiania	986,202
Naples	3,833,805	Göteborg	925,553
Liverpool	2,913,717	Bergen	447,935
Havre	1,738,122	Marseilles	134,496
Manchester	1,278,096	Glasgow	112,259
London	1,120,098		

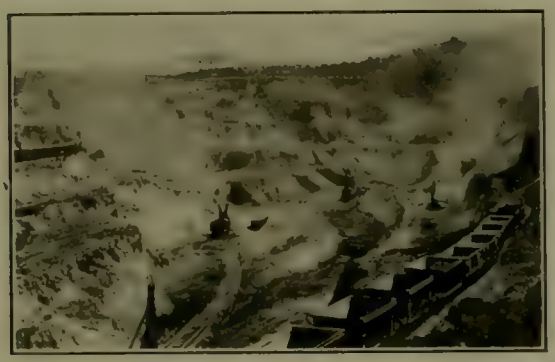
Very likely some way out of the difficulty will be found before long, but meanwhile the effect on the price of copper will have been felt, and not improbably it will be necessary for the producers to further decrease their output. The cut in production made by the mines is now beginning to show

in the refineries, so that stocks of copper will not increase so fast from now on as they have in the past three months.

The third quarterly report of the Nevada Consolidated Copper Co. contains the following information:

	Third quarter.	Second quarter.
Ore milled, tons	599,126	831,589
Average copper content, per cent	1.52	1.38
Copper produced, pounds	11,258,421	14,322,807
Earnings	$422,750	$926,736
Dividends	.....	749,796
Depreciation and ore extinguishment.	164,481	272,072
Surplus	258,244	95,157

The pits at the various mines supplied 96% of the ore, and 4% from underground in the Veteran. The Giroux Consolidated also sent 11,322 tons to the mill. On August 6, on account of the war in Europe, production was reduced to 50% capacity. Copper on hand and in transit at the end of the term amounted to 25,150,319 lb. Undivided profits are $2,786,627.



OPEN-CUT MINING AT ELY, NEVADA.

Antimony was as radically affected by the war as any of the metals. In October, an unusual transaction was the reshipment of metal to Europe, whence most of it had come. A few months ago there was a glut of antimony in the port of New York. Today spot supplies have been practically depleted. Both England and Russia made heavy demands upon American stocks, wanting the metal for the manufacture of bullets, particularly those used in shrapnel. The steamer *Dwinsk*, which sailed from New York, October 15, for Archangel, Russia, carried 172 tons of antimony, and other steamers followed with still larger quantities aboard, the total shipment amounting to several hundred tons. Arrivals of Japanese antimony are expected to relieve the domestic situation. On October 6, quotations were about 13c. for Cookson's, 12c. for Hallett's, and 11c. for other grades. On October 20 prices were about 1c. higher for each grade, and October 27 the quotations were 16 to 17c. for Cookson's, 15 to 16c. for Hallett's and 14 to 15c. for other brands. These prices were for spot metal, futures being obtained at considerably less.

It is reported that the petition of the Minerals Separation, Ltd., for a hearing of its appeal from the San Francisco district court to the Supreme Court of the United States has been granted, and that the trial will proceed. Meanwhile the Minerals Separation has begun a suit against the Miami in the Delaware district, hoping it possible to get a favorable decision there and expecting thereby to bring the suit to the Supreme Court. It is to be hoped that this litigation can be settled soon, as it is causing both the Minerals Separation and the producers to spend a lot of money unproductively, and is delaying the application of flotation to the treatment of copper ores.

The Tonopah Mining Co. is evidently going ahead with the development of its property in Nicaragua, the Eden Mining Co. having been formed to take it over. At any rate, a charter has been secured for the Tunkey Transportation & Power Co. to build a railroad connecting the property with some other point in Nicaragua which has not yet been fixed. The Company has been incorporated in Delaware, and will be a subsidiary of the Tonopah Mining Company.

There has been a good deal of financial distress in Peru through the temporary closing of the principal banks. The result of this has been that considerable gold coin has been withdrawn from circulation, and the circulation of silver coin has been reduced. At the end of August the government of Peru authorized the national mint to coin any silver that was brought to the mint by individuals, charging a seigniorage of 10%. The government has reserved the right to increase the rate of seigniorage after a period of 30 days.

The Geological Society of America will hold its twenty-seventh annual meeting at Philadelphia, in conjunction with the annual meeting of the American Association for the Advancement of Science, on December 29 to 31. The sessions will be held in the building of the Academy of Natural Sciences. The address of the retiring president, George F. Becker, will deal with 'Isostacy and Radioactivity.' Edmund Otis Hovey is secretary of the Society.

The Montana branch of the American Institute of Mining Engineers met at Butte on October 23. There were 50 engineers present, presided over by E. P. Mathewson, of the Anaconda company. There was lengthy discussion held on the subject of mining claims on the forest reserves. The government's point of view on the question was presented by Chief Forester Silcox, of Missoula. He declared that until recently the government's attitude toward prospectors and miners has been open to much criticism, but that the grounds for this criticism have been removed, and that all possible is being done to encourage prospecting on the reserves.

TORONTO, ONTARIO

THE NICKEL INDUSTRY AND EXPORTS.—IRON MINING INVESTIGATION.

The Sudbury nickel mining industry, which was seriously depressed at the outset of the war, shows signs of reviving. The International Nickel Co., about 75% of the trade of which was with Germany, has only had two of its six furnaces at Copper Cliff in blast, but has recently started two more. The only one of its mines being worked at the last report was the Creighton, but others may be opened shortly. The only other producing company in the field, the Mond Nickel, all the output of which goes to the British market, has kept busy, and is working five mines, the Victoria, Garson, Kirkwood, Levack, and Worthington. The Mond company is also buying ore for its new smelter at Coniston, from the Alexo nickel mine, near Porcupine. Since the war commenced, attention has been directed to the fact that the Canadian nickel mines have furnished the German government with material for their war vessels, and in fact constitute their only source of supply, and an agitation has been set on foot by the press for prohibiting the export of nickel to foreign countries. As Canada is committed to an active participation in all Imperial wars, it is not at all probable that the present anomalous condition can continue, and government action to compel the refining of all nickel to be done in Canada, and restricting the export of the metal to the British Empire may be expected in the near future.

The Canadian government, which during the last session of parliament gave the iron and steel interests reason to hope that something would be done to encourage iron mining, has appointed a special committee to inquire into the condition of the iron-mining industry. This body comprises four mem-

bers of the staff of the Department of Mines, O. E. Leroy, G. C. Mackenzie, E. Lindeman, and John McLeish, the last named being secretary. The investigation will have a wide scope.

PORCUPINE, ONTARIO

CONDITIONS AT PORCUPINE; MEN EMPLOYED, AND WORK AT THE DOME, VIPOND, DOME LAKE, SCHUMACHER, AND HOLLINGER RESERVE MINES.

Production of gold at Porcupine shows a steady increase, largely on account of conditions created by the war. Canadian gold mining companies, under arrangements effected between the Bank of England and the Dominion government, are disposing of their bullion to the bank and delivering it in Ottawa. They are credited with the value at par, and can sell exchange on London to anyone having debts to liquidate in Europe at about 2% above par. The additional premium gives a stimulus to the activity in mining, resulting in a considerably increased output. P. A. Robbins, general manager of the Hollinger, estimates the number of men directly employed around Porcupine at about 2500, and the total number of wage-earners in industries and trades dependent upon mining to be at least as many more. The output during the first half of the present year was over $2,000,000, and the material increase in the production of the leading mines since then indicates that the total production of the year will be over $5,000,000. The Dome has shown the most decided improvement, increasing the monthly tonnage treated to about 22,000, a specially important feature being the reduction of the cost to a trifle less than $2.50 per ton. The grade of ore will soon be decreased to about $3.50, there being about 3,000,000 tons of this grade in sight. At the Vipond, the new Hardinge mill is working well. Ore reserves above the 300-ft. level are estimated to keep the plant going for 20 months. Several new veins have been discovered on the surface.——The new 100-ton stamp-mill of the Dome Lake is in operation. The main shaft is down to 400 ft., where a level is being driven. The ore, assaying between $18 and $25 per ton, is estimated at over 12,000 tons.——The McIntyre company has picked up the contact vein which had faulted on the 500-ft. level, and is endeavoring to cut it at 600 ft.——An arrangement has been effected with the Schumacher to develop the area of McIntyre territory underlying Pearl lake through one of the shafts of that Company.——Hollinger Reserve has gone into liquidation, with liabilities of about $75,000. The mine has ore on the dump valued at about $65,000, but was unable to obtain funds owing to financial conditions.

SILVER CITY, NEW MEXICO

THE MOGOLLON DISTRICT.—PECOS VALLEY OILFIELD.—FIERRO GOLD AND IRON DEVELOPMENT.—BURRO MOUNTAIN EQUIPMENT.—SIERRA COUNTY MINES.—ORGAN AND STEEPLE ROCK DISTRICTS.

Shipments of gold and silver bullion from the large operating companies of Mogollon, Socorro county, to their New York agents were larger during the week ended October 17, than they have been for some time. The Socorro Mining & Milling Co. shipped 24 bars; the Ernestine Mining Co. 21 bars to Eugene Meyer Jr. & Co., and the Deadwood mill 6 bars. There is enough cyanide in the district to last six months. All producing companies are running mines and mills full time, there being no curtailments in any way.——The Precious Metals Exploration Co. is shipping milling ore to the Deadwood mill, and is about to undertake extensive development work in its lower adit.——A cableway has been erected across the Gila river by Thomas Lyons at Gila, and is safely transporting freighters, auto-trucks and all vehicles going and coming on the Mogollon highway. The Gila river is the highest it has been in many years, and operators at Mogollon suffered on account of a lack of means to cross it. They were much gratified at Mr. Lyons' great and much needed improvement. It is reported that one of the Mogollon custom mills is to enlarge its equipment and production.——Assessment work is at a standstill, pending the action of Congress toward the exemption bill, which will not pass unless more interest is shown in the field. There seems to be an equal number in favor of and against the passing of the measure. A similar law was enacted in 1893 and 1894.

The Pecos Valley oil and gas field, in Eddy and Chaves counties, is the scene of considerable drilling, although many have given the field up as hopeless. One company pulled the casing from its 2680-ft. well, and dynamited the hole, removing the rig to Oklahoma. Another has now taken its place and is contemplating the leasing of a large area east of Carlsbad. Drillers were hired in the valley last week. The Carlsbad Oil & Gas Co. is down 2825 ft., and is in oil-bearing sand. Casing is in progress and hopes are high. The district has been quite a disappointment to many, but may yet reveal a deep gusher.

At Fierro, operators of the gold veins discovered in the grano-diorite basin have ceased mining. Several shipments were made to the El Paso smelter, but the veins were not wide enough to be profitably worked. The Colorado Fuel & Iron Co. continues to mine and ship 300 tons of iron ore per day from the Snow Flake cut of the Brockman estate. Phelps, Dodge & Co. has taken out the pumps and stopped all work on its claims at Fierro.

The Burro Mountain Copper Co., at Tyrone, has started 40 men at the site of the proposed 1000-ton mill, who will be engaged all winter in erecting a machine-shop, carpenter shop, ore-crushing house, and sundry other buildings in connection with the mill. Work on the mill proper will not be started until the method of concentration has been fully determined. The experimental mill near the Niagara haulage adit is treating 50 tons of ore per day. The flotation unit installed did not prove satisfactory, and was discarded. A Towne unit was substituted, and from last accounts was giving fairly good results. Regulation of the agitation and oils will doubtless bring the concentrate up to the desired quality. Flotation will be incorporated in the mill to be erected later, and not used as an auxiliary method. Mine waters will solve the wet concentrating problem. The first Carel type Diesel engine installed in the power-plant was successfully started. Another will be tested in a few weeks. The train schedule from Deming to Tyrone is now in operation three days a week, and will not be increased to seven days a week until the camp is producing.

At Steeple Rock, near Duncan, Arizona, George Utter, recent purchaser of the Jim Crow, Carlisle, and other well known gold mines, is unwatering several shafts and doing general road building. A large consignment of mining machinery was received recently. It will probably be several months before shipments will be made.

Sierra county is comparatively active again, and several shipments of silver-lead ore have been made from the Kingston area. The Overlook mine shipped on September 20.——The Bi-Metallic Mining & Milling Co., at Sierra Blanca, has received an air-compressor, drills, and engine. Installation will be made at once. The Company is reported to have opened high-grade ore.——Ore is being opened in the Amethyst mine at Kingston.——There are many promising mines open for lease and bond throughout the district. The Empire Zinc Co. is heavily interested in the Sierra County zinc and lead mines.

The Organ mining district, near Las Cruces, Don Ana county, is having a revival. The Memphis mine is being worked by two experienced mine operators, and shipments to the El Paso smelter are made now and again. The Stephenson-Bennett property upper level is under lease, and good grade copper-silver ore is being mined.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press

ALASKA

A complete report of the preliminary surveys for the railroads in the territory will be submitted to the President of the United States early in 1915 following the conference of President K. Lane, Secretary of the Interior, and William C. Rowe and Thomas Riggs, Jr., of the Alaska Engineering Commission, in San Francisco. Mr. Riggs has stated that since June the surveyors and prospectors have run 1000 miles of territory and established definite locations over 200 miles. The Alaska railway, as provides for connecting an open port of the Pacific with the navigable waters of the interior. There are at present three routes under consideration. One extends from Cordova and takes over the Guggenheim road and the Copper River & Northwestern line from Cordova to the Kennecott copper mines; the second route would take over the Alaska Northern for a distance of 71 miles, while the third line from Valdez is without construction. The branch lines running from these lines extend into the Matanuska and Bering River coalfields which were recently reopened to locations under the coal leasing law passed before Congress adjourned. The work has been done in spite of many difficulties. The coal commission will meet in Washington on December 1.

Kennecott

Special Correspondence.—The war has put a damper on most of the copper properties in this district, the Rush and Brown mines being the only producers at present.——Some work is planned at McKinley's arm on a large property copper prospect and a drift will be driven into the mountain in hope of cutting unexplored mineralized ore. It is also intended to drive for a 1,500-ft. vein of mineralized copper-gold ore at a depth of 400 ft. by putting in a crosscut 300 ft. from the main drift.——Good returns have those financed by English capital, are being developed at Herm bay. Thorn Arm, Hirons and Jessom.

Kennecott, October 20.

Nome

About 2000 people will winter at Nome. The steamer Victoria was the last for the season, left on October 16. The total output of Seward Peninsula is estimated at $3,000,000 or $750,000 over that of last year.

Valdez

As mentioned in the *Press* of October 17 the Valdez Creek Placer Mines Co. of Boston, finished its ditch, pipeline and considerable other work. The work was done on a short time and is a credit to the mining superintendent, Alfred H. Brooks and to the Joshua Hendy Iron Works of San Francisco, which supplied the hydraulic plant and two four-inch pipe lines. The ditch pipe will carry 2,000 inches of water per 24 hours. There were 74 men employed during the greater part of the season. On September 20 cleaning was started up on account of freezing weather and the sluices were cleaned, piped up $4,000. From this it is estimated that the pit on bedrock will return over $10,000 this season. The placer mining in 1913 averaged $.77 per cubic yard and allowing for a working season of 120 days with 600 cubic yards per day yielding only $1 per yard the total output this season may be $360,000.

ARIZONA

The first unit filed under the state mine tax law has been reported to the tax commission, the Arizona Copper Co. of Clifton. Greenlee county, appealing against the valuation on its producing mines for 1914. The assessment is about $[illegible] which the Company wishes reduced to about half. Last year it paid taxes on $[illegible]. The Company wants the Commission to take the cost of recent improvements out of the net and thereby reduce the valuation for 1914. But the Commission has refused allowing but 10% on cash from it being estimated that the improvements will last at least 10 years.

Mohave County

The Tom Reed and Gold Road mines continue to produce about $[illegible] and $[illegible] per month, respectively. The former is opened to 950 ft. and the latter to 900 ft. Large reserves of ore have been developed.

Pinal County

The new 150-ton concentrator of the Kelvin-Sultana Copper Co. started operation on October 26. The mill was designed and built by O. N. Brown. In the mine, three shifts are working and stoping is in progress on No. 2 vein on the 700-ft. level while No. 1 west drift on the 500-ft. level has been advanced 45 ft. Preparations are being made to draw ore from the stockpile that has been accumulating for two years.

CALIFORNIA

The committee in charge of organizing an association of California mine operators met at the Crocker building Thursday, acted on the articles of association, and made arrangements for perfecting the association. It is proposed to call the new organization the California Metal Producers Association. The membership fee will be $25 for companies employing 25 men or more and $10 for those employing less. Dues will be based upon the payroll. The association is planned to take an active part in improvement of mining conditions in California. The committee in charge consists of Albert Burch, George W. Starr, G. W. Metcalf, Newton Crawford, J. C. Hutchinson, C. E. Knox, and Seeley W. Mudd.

Amador County

A restraining dam is being constructed by the Central Eureka company on the Allen estate to hold the tailing from its mill. An 8-ft. reinforced dome, 25 ft. long, is being built at a cost of $[illegible]. Where this crosses the main Sutter Creek and Jackson road it will be 75 ft. high. A steel head frame and concrete house are planned for the mine which is producing good returns. J. E. Davis is manager.

Nevada County

At the Golden Center of Grass Valley the new shaft has been sunk 200 ft. in 60 days. Good ore has been opened on No. 1 level.

Shasta County

A suit for $[illegible] damages and an injunction against operating has been started by George Bever, a farmer owning 320 acres of land across the river from Redding, against the Mammoth Copper Co. of Kennett, alleging that fume destroyed crops and vegetation. The distance between the farm and the smelter is about 12 miles. The injunction suit between the Farmers Protective Association and the Mammoth Copper Co. has been continued for three weeks.

Trinity County

(Special Correspondence.)—The Bonanza King company has cut an orebody in No. 4 adit, approximately 200 ft. below the crosscut from No. 3 level. The vein is said to be show-

ing good ore, and is probably the main shoot which yielded rich ore in the upper levels. The management has decided to move the mill to the mine, thus avoiding the use of the aerial tramway constructed several years ago when a 40-stamp mill was constructed. The capacity of the mill has since been reduced to 10 stamps. San Francisco people are interested. —The Alta Bert Dredging Co. continues to operate with good results near Carrville. —The Trinity Exploration Co. is drilling placer ground along the Trinity river and tributary streams, and has prospected a large area of ground. This work has been in progress nearly a year, and it is understood the management has practically decided to close a deal for the greater part of the land under option. —A. Belli and sons are developing a good body of ore in their property near Coffee. A recent crushing is said to have yielded over $40 per ton.——Considerable prospecting is going on in the Coffee district, mostly on the account of owners.——The Trinity Dredging Co. has insta'led a new tumbler on its dredge at Lewiston. The boat is the largest operating north of Oroville in California, having 11-cu. ft. buckets. H. L. Cheesebro is superintendent.

Carrville, October 24.

COLORADO

Lake County (Leadville)

The new zinc smelter is shut down temporarily in order to enlarge the bag-house, which will contain 80 more bags.—— The Big Five company has constructed a tram from the shaft to the railroad siding, 760 ft. below. This obviates hauling

ZINC OXIDE PLANT AT LEADVILLE. FROM LEFT TO RIGHT: FURNACE SHED, FUME PIPE, BAG-HOUSE, LABORATORY AND OFFICE.

with teams. An electric pump has arrived for the mine.—— The Connors lease has shipped 4200 lb. of ore, from which 141 oz. metallics was separated, the remainder assaying 75 oz. gold per ton.——Surface work at the Penrose shaft is progressing well. A 165-hp. motor is to drive the hoist. This property is being prepared for the Down Town pumping scheme.

Summit County

Net earnings of the Tonopah Placers Co., controlled by the Tonopah Mining Co. of Nevada, totaled $145,096 during the quarter ended August 31, 1914.

Teller County (Cripple Creek)

During October the estimated gross value of ore treated in the Cripple Creek district was $1,220,315, from 81,283 tons, an increase of $129,244, and a decrease of 2105 tons. Smelting ore showed an increase of $118,700, the average shipped being $55 per ton. The Golden Cycle output was 28,000 tons, worth $560,000; Portland, 28,050 tons, worth $248,916; Stratton's, 10,828 tons, worth $30,320; Colburn-Ajax, 4305 tons, worth $29,489; while the Wild Horse, Kavanaugh-Jo Dandy, Gaylord-Dante, Isabella, and Free Coinage mills treated from $2 to $4 ore.

An accident to men removing forms from a new concrete magazine at the Cresson mine on October 27 which apparently had not set after five days resulted in one death and one man badly bruised. —At the Gold King a man was thrown down an incline shaft, resulting from the breaking of the rope. He is in a serious condition.——The new Sullivan air-compressor at the Vindicator is ready for work. — Three grades of ore are being shipped by Oscar Fogelman from the W. P. H. mine. —An 18 drill Ingersoll-Rand compressor has been purchased for the Blue Bird mine on Bull hill. —There is increased activity in the El Paso property by the Company and lessees.

A suit for $29,000 has been started by J. E. Cooper against the Colorado Gold Mining & Development Co., and others, for breach of contract.

IDAHO

Clearwater County

About $20,000 has been spent by W. J. Harris, of Spokane, in testing 300 acres of gravel on Quartz creek, 30 miles east of Orofino. The 'pay' is from 6 to 14 ft. deep, and pits and drills have proved 4,000,000 cu. yd., containing from 10 to 15c. per yard. An electrically-driven dredge will be constructed at a cost of $75,000, to handle 2500 cu. yd. per day. A company is to be formed with the name of the Quartz Creek Placer Mines. The Pierce district, in which the area is situated, has had a large gold production in the past.

Lemhi County

According to Ralph C. Nichols, a considerable amount of development is being done around Gilmore, and over 100 men are employed at the three producing mines. The Latest Out produced 400 tons of ore assaying 30% lead, 12 to 15 oz. silver, and 75c. gold per ton in October. It also contains an excess of iron. The main shaft is 650 ft. deep on the incline. Water-level is about 700 ft. lower.

Owyhee County

According to J. B. Hamman mineral inspector of the General Land Office at Salt Lake City, Utah, who has recently returned from the South Mountain district, that country is not a good field for prospectors. Spokane people have claims in this district. Mineral deposits in the restricted area are in schist and limestone, around which is a large lava flow that has covered the country.

Shoshone County

The Caledonia, at Wallace, is producing some rich ore. One car recently, from the 300-ft. level, assayed 313 oz. silver, 17% lead, and 7% copper; and one from 500 ft. averaged 486.2 oz. silver, 5.2% lead, and 15.45% copper. The mine is now well developed for mining purposes. It is operated through the Bunker Hill & Sullivan company's Kellogg tunnel. Charles McKinnins is manager.——The Bunker Hill & Sullivan company paid dividend No. 206, of $81,750, on November 4. The total to date is $15,628,500.——A large body of zinc ore has been opened in the Silver Cable, east of Mullan.——The National Copper Co., at Mullan, has suspended work at the mine on account of the metal market.——Adjoining this mine is the Copper King, in which a winze has been sunk 50 ft. in 2 to 2.5% copper and 20 to 30-oz. silver ore.——The Idaho Gulch district, near Murray, is proving a promising area, although it is difficult of access. At the Silver Dollar several adits have been driven and a vein of quartz, galena, and iron is being opened.

The decision of the District Court of Idaho, in the suit of the Bunker Hill & Sullivan company of Idaho, against the Stewart Mining Co., has been upheld by the U. S. Circuit Court of Appeals at San Francisco on November 2. Jonathan Bourne owns the patented mining claim Ontario, which has been worked for some years by the Bunker Hill company. The Stewart company owns the Senator Stewart Fraction, a claim

which adjoins the Ontario. Suits were first brought in the state courts by the Bunker Hill to prevent the Stewart people from working underneath the Bourne claim. The Stewart company set up the plea that its ore extended underneath the Bourne claim and claimed ownership on the theory of extralateral rights. The state courts decided in favor of Bourne. In the opinion of the circuit judges the apex alleged by the appellants does not exist.

ILLINOIS

St. Clair County

The Granby Mining & Smelting Co. announces that it will begin operating the Rose Lake plant January 1 and will employ about 1000 men.

MICHIGAN

Houghton County

The Isle Royale mine is producing 2100 tons of 'rock' per day, or 300 tons above the period before the strike in 1913, and with about the same number of miners. The output of copper in September was 605,280 lb., at a cost of under 11c. per pound.——There are 340 men at the Mass, and the daily output is 1000 tons, but if copper remains at its present price, there must be either a reduction in wages or the property close.——The Superior is working at normal pace, or 700 tons per day.

MISSOURI

Phelps County

The School of Mines and Metallurgy of the University of Missouri, at Rolla, has issued its forty-third catalogue. It contains details of the faculty, history of the school, finances, buildings (which are shown), regulations for admission, and courses. The institution is in Phelps county, comparatively near the lead district of Flat river, zinc district of Joplin, and the smelter, coal-mining, clay-working, and cement industries of the state.

NEVADA

Churchill County

The Nevada Wonder Mining Co. declared a dividend of 5% on October 28, payable November 21 to stockholders of record October 31. Books close October 31 and open November 8. This is the fourth semi-annual dividend paid by the Company, the other three being 10c. per share. J. A. Burgess is superintendent.——The Nevada Hills produced 5317 tons of $7.16 ore in September, with a profit of $4597. Resources on September 30 totaled $246,748, including silver worth $12,467, about 24,000 ounces.

Clark County

Platinum was recently found in the Boss mine in the Yellow Pine district; now it has been identified in the Aura Amigo claim, one mile north. The Boss ore occurs in limestone and is quite flat. It is reported that the Boss mine has been sold to Seeley W. Mudd and others, of Los Angeles, for $250,000, of which $50,000 has been paid.

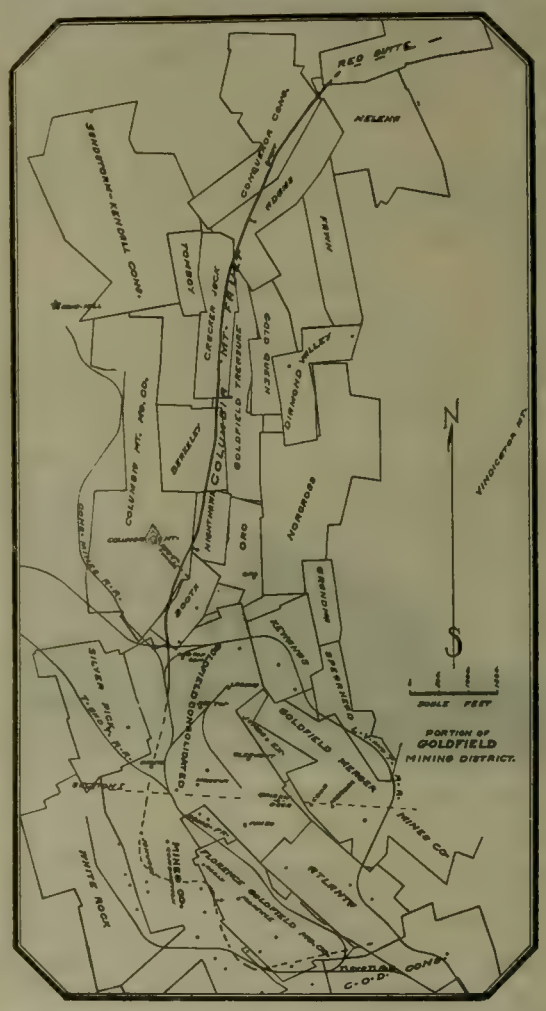
Elko County

Since June, the Dome Mining & Reduction Co., at Bullion, has sent 1700 tons of lead-silver-copper ore, and lessees 500 tons additional, to Salt Lake smelters. Auto-trucks haul the ore to the Eureka and Palisade railway. Ralph M. Kellogg is superintendent of the property, which is 30 miles south of Elko.

Esmeralda County

The Jumbo Extension company has declared a dividend of 5c. per share, equal to $62,500, making a total of $159,616 to date. The last distribution was made in July 1911, when the Vinagarone Fraction claim was sold to the Goldfield Consolidated. The present amount is from ore recently extracted. During September, 776 tons was sent to the Consolidated mill, assaying $15.51 per ton, and 930 tons of $56.30 ore was sold to the Western Ore Purchasing Co. The net profit on all ore was $35,153. Development totaled 532 ft. at $6.28 per foot. Mining cost $2.75, and all costs totaled $4.46 per ton. Ore blocked out on two or more sides is valued at $400,000. Cash and ore in transit on October 31 totaled about $100,500. October profits are estimated at $75,000.

The Goldfield Merger Mines Co., with A. I. D'Arcy in charge, has issued a report covering the term October 1911 to October 1914. When starting in the former year, it was decided to sink a large 3-compartment shaft. A complete surface and



mine equipment was installed. At 650 ft., the St. Ives shaft met with water, so pumps were started. In August 1912 the shaft was 1325 ft. deep, and 1475 ft. of work was done in a latite-shale contact, and connection made with the Grizzly Bear claim of the Goldfield Consolidated. No commercial ore was proved. In June 1913 the shaft was down 1772 ft., and at 1725 ft. a cross-cut was driven to the Atlanta property. The Atlanta Mines Co. advanced $35,000 toward sinking the shaft under certain conditions, of mutual benefit. The Atlanta extended the Merger cross-cut at 1725 ft. into its own ground, with encouraging results. A heavy flow of water stopped further work, and new pumps should be ready for work in a few days. When the water is drained, the Atlanta will open the vein found, by driving toward the contact. This development promises well for the Merger company. To develop the latter's Velvet claim, an agreement was made in

December 1912 with the Jumbo Extension company to use its shaft. A low-grade ore-shoot was opened. The Extension offered to buy the claim, and a deal was made for $85,000 and 150,000 shares. At present a drift is being driven in the contact from No. 7 level of the Grizzly Bear claim of the Consolidated. The work being done by the Atlanta company will help considerably the future of the Merger mine.

The Goldfield Consolidated company's estimated output in October was as follows: Ore treated, 28,660 tons; recovery, $334,000; and net realization, $149,000.

Lyon County

Thirty-two men are working on the site for the Nevada-Douglas leaching plant. All material has been ordered, and it is hoped to start treatment early in 1915. The plant is designed to treat 50 tons of sulphide ore in 24 hours, and the acid derived from this ore will be enough to treat about 200 tons of oxidized ore per day, so that the daily capacity will be about 250 tons.

Nye County

At Manhattan, work in the Mushett-Wittenberg 10-stamp mill on White Caps oxidized ore is better than expected. Ore worth $10 per ton gives a residue of 40 to 60c. Mining costs $1 per ton, and will be reduced. Reserves of oxidized ore are 4000 tons assaying $10 per ton.——Grading for the new Mushett-Wittenberg mill at the Big Pine is under way, and the machinery should soon be on the ground. The daily capacity is to be 200 tons.——Sub-lessees in the Manhattan Dexter are opening rich ore at 325 ft. The Union shaft supplies water for the Mushett-Wittenberg mill.

The output of eight mines at Tonopah last week totaled 10,835 tons, worth $210,990.——Tonopah has had another fire, and two blocks of residences, worth $20,000, were destroyed, on October 30. The West End mine plant was in the area, and houses were dynamited and the shaft closed.

Seventeen different stopes in the Belmont mine are supplying ore for the mill.——During the quarter ended August 31, 1914, the Tonopah Mining Co. produced bullion worth $552,116. Net earnings were $218,783. A dividend of $250,000 was paid on July 31, and another on October 21. Including cash $293,310, the surplus on August 31 was $1,680,194.——An electric haulage plant has been arranged at 950 ft. in the Extension, between the incline and vertical shafts. A Nordberg double-drum electric hoist has been ordered for the new shaft. Sinking from the 1170-ft. level is to be started soon. Sixteen stopes are supplying ore for the mill.——Development in the Montana last week totaled 165 ft.——No. 1 shaft of the Buckeye-Belmont is nearly retimbered. The vein at 1200 ft. is then to be opened.——Work at Tonogold is still quite encouraging.

White Pine County

A large blast was set off at the Liberty pit of the Nevada Consolidated on October 26. Twelve holes, from 65 to 125 ft. deep, were drilled, and loaded with 58,050 lb., or 29 tons, of powder. It is estimated that 200,000 cu. yd. of ground was moved. It dropped about 30 ft. in all.

NEW MEXICO

The value of the mineral products of New Mexico, according to the U. S. Geological Survey, increased from $14,391,355 in 1912 to $17,862,369 in 1913. The figures for 1913 are more than double those of two years ago, the increase being due principally to activity in the production of copper.

The New Mexico School of Mines, at Socorro, has opened with a registration 20% higher than that of last year, and numbers 50 students in all. This is in spite of the fact that the Texas School of Mines and Metallurgy has been opened at El Paso, a short distance south. The faculty has also been enlarged. The school is making a most creditable showing and is closely allied with the mining industry.

OREGON

Baker County

Installation of plant at the Cornucopia Mines Co.'s Last Chance mine, which is leased to the Baker Gold Mines Co., is finished.——The Flagstaff mine is being reopened by J. G. Cleary and associates of Boston.——The Eastern Oregon Light & Power Co. is suing the Highland Gold Mines Co. for $4185, for power and machinery supplied.——Liens for labor and supplies, amounting to over $1500, have been filed against the Mammoth Mining Co., near Baker.——A new 10-stamp mill is under construction at the Golden Gate mine, in the Greenhorn district.

UTAH

Emery County

With Theodore Garvin in charge, the Duchene Assessment Association of Pennsylvania is drilling for oil at Temple Wash in the San Rafael desert. Holes are drilled to about 600 ft. Water has been encountered in large quantities between 500 and 600 ft. Coal costs $25 per ton in this district. Several crews, 8 to 10 men in each, are employed.

Juab County

East Tintic properties are to be consolidated by the Tintic Coalition Mines Co., which absorbs the East Tintic Development Co., Provo Mining Co., Eureka Lilly Mining Co., Little Silver King claim, Little Silver King Sideline extension, and eight other fractional claims containing about 100 acres. The Company is capitalized at $500,000, with shares of a par value of 50c. each. Of the 1,000,000 shares, 400,000 will be issued, and 600,000 placed in the treasury for development purposes. S. S. Arntz is president, H. G. Snyder vice-president and treasurer, J. E. Galigher secretary, and J. B. Jenson and Henry I. Moore, additional directors. The properties have some equipment, and have produced lead and zinc ores.——The Iron Blossom and other Knight mines will continue to produce lead-silver ore in spite of the low prices of these metals, and the higher-grade ore will be shipped, according to Frank Birch, assistant manager of the properties.

Salt Lake County

Messrs. Grove, McCormick, and Lark have been appointed trustees for the Ohio Copper Co. No move will be made to resume mining and milling until copper is higher.——At the Cardiff, in the south fork of Big Cottonwood, the vein has been opened for 65 ft., and now shows 9 ft. of ore. It was cut in the adit at 2600 ft., in a contact of quartzite and lime. A shipment is to be made to the smelter at Murray.

Utah County

About 100,000 tons of zinc ore has been opened in an adit of the Santaquin King mine, 80 miles south of Salt Lake City, yet the main orebody has not been reached. This development is expected at any time.

WASHINGTON

Ferry County

Republic is showing considerable activity, and there are few empty houses in the town.——The Ben Hur Leasing Co. has sunk its shaft to 700 ft., and is employing 30 men in ore-breaking.——The Western Union Mines is also getting started at the mines it has recently acquired.

CANADA

British Columbia

At Windfall cañon, the Exploration Syndicate of New York has suspended work for the season. Under the supervision of T. W. Beam, of Denver, over 6000 ft. of diamond-drilling was done, holes varying from 700 to 1800 ft. deep.——At the Jewel mine, near Greenwood, the 500-ft. level is being opened. The mill is yielding good returns. C. A. Banks is in charge.

——Construction of surface plant at the Surf Inlet mine of the Tonopah Belmont company of Nevada has been finished and development has been commenced on ore in the old lower adit. A cross-cut is being driven to cut the vein below the adit.

ONTARIO

Eight claims for damages for injuries against various mining companies in the north are being heard in the courts.——At Cobalt, La Rose company proposes to sink a new shaft in unprospected ground on La Rose Extension, remove overburden on the east of the main La Rose claim, and look for surface veins, discontinue work in the Princess claim when the present ore is extracted, cross-cut in the south part of the Lawson claim under the diabase, and close down the Fisher Eplett claim. The Company paid its regular quarterly dividend of 2½% last week, amounting to $187,000. This was from accumulated profits. The surplus on October 1 was $1,396,620.——The annual meeting of the Temiskaming & Hudson Bay Mining Co. was held on October 25. Work was stopped at No. 1 mine in June, as the ore was all extracted. Prospects in No. 2 are encouraging. Silver production was 393,360 oz., worth $196,436, and a total to date of 5,604,168 oz., with a net value of $2,965,423. The profit for the year was $52,561. Four 300% dividends were paid. The Company has entered the Porcupine field and holds 540,000 out of 940,312 shares in the Dome Lake Mining & Milling Co. The Temiskaming mill was stopped on August 1, but it is to be restarted in the near future. At 750 ft. in the mine there is showing 4 to 6 in. of 2500-oz. ore.——Work in the bottom of Kerr lake is opening good ore. All of the mud will not be out this year.——A station has been cut at 900 ft. in the Beaver, and sinking is to be continued to 1000 feet.

At Porcupine, the Hollinger has paid its regular monthly dividend of $90,000, making 81% since 1912, equal to $2,430,000, on a capital of 600,000 shares of $5 each par value.——F. W. Schumacher, of Columbus, Ohio, owner of the Schumacher property, is having plans drawn for a 100-ton mill. ——The McIntyre mill is treating 275 tons of $9.50 ore per day. Underground work is quite satisfactory.——At the Jupiter, under option to the McKinley-Darragh-Savage company, the 400 and 475-ft. levels are being developed by 40 men and four drills. Good ore is opened at both depths.

YUKON

The Canadian Klondyke dredges recovered 1646, 2273, and 1967 oz. gold respectively during the weeks ended October 3, 10, and 17.

COLOMBIA

The Pato dredge treated 77,600 cu. yd., yielding gold worth $10,850, during the week ended October 13. The London office stated that probably a large part of this material was old tailing which had to be dug through in moving the boat to its new position.

MEXICO

NUEVO LEON

Operations of the American Smelting & Refining Co., Fundicion de Fierro y de Acero de Monterey, and the Monterey Tramways Co., at Monterey, are considerably interfered with by strikes. No compromise is in sight.——There are about 700 smelter laborers who demand an 8-hour day and more pay with Sunday off, instead of the 12-hour shifts they are working. The steel works and tramways have the same trouble.

TAMAULIPAS

Oil exports from Tampico, from October 15 to 20 inclusive, totaled 449,618 bbl. on 16 steamers and barges. During the second 10 days of the month the exports were 76,140 bbl. more than in the same period of September.

PERSONAL

FRED SEARLES is in Mexico.

G. W. STARR was in town Wednesday.

W. H. KNOWLES is down from Sonora.

G. W. METCALFE was in San Francisco.

J. PARKE CHANNING has returned to New York.

CHARLES S. SPRAGUE has returned to Goldfield after a vacation spent in San Francisco.

E. H. CLARK, president of the Homestake Mining Co., was recently at Lead, and has gone back to New York.

J. F. CALLBREATH is at Battle Creek, Michigan, where he has gone to recuperate after a severe nervous breakdown.

J. W. HUTCHINSON, of the Goldfield Consolidated, left the Adler Sanatorium, San Francisco, recently for Colorado.

RALPH C. NICHOLS, of Gilmore, Idaho, has been at Salt Lake City to arrange contracts for ore from the Latest Out mine.

MORTON WEBBER was recently engaged in examination work in the southeast Missouri lead belt on behalf of Eastern interests.

FREDERICK BRADSHAW has returned to Tonopah, Nevada, from a visit to the Belmont company's mine at Surf Inlet, British Columbia.

W. F. NEWMAN sailed from New York on the *Adriatic*, on his way to London from Peking, where he has been representing British Manufacturers, Ltd.

H. A. J. WILKENS, president, and W. B. DEVEREUX, JR., general manager, of the Mines Management Co., are now in California examining properties in the state with a view to commencing operations.

Following is the personnel of the management of the Tom Reed Gold Mines Co.: CHARLES GRIMES, president and treasurer; CHARLES MUSHRUSH, vice-president; W. J. LAWRENCE, secretary; S. S. JONES, general manager; B. L. LUNCEFORD, assistant manager and superintendent of mill; S. R. REEVES, assistant superintendent and auditor; WILLIAM H. FLANNIGAN, mine superintendent; J. D. SPERR, mining engineer; and J. S. WITHERS, bookkeeper.

Obituary

CHARLES J. BANDMANN, mining engineer and son of the late Julius Bandmann, died on November 1 of heart failure. Mr. Bandmann was about 50 years of age and was a resident of California. His death will be regretted by his many friends.

ANTON J. JACOBSON, familiarly and pleasantly known to his friends as 'Tony,' died at Salt Lake City, October 29. He was prominent in Utah mining, having operated in Pioche, Stockton, Deer Lodge, Stillwater, and other districts and was especially well known for his work in reviving activity at Alta.

DAVID JOHN KELLY, who died at Salt Lake City, October 10, at the age of 37, was a native of Utah, educated in the Salt Lake City schools, receiving the degree of M.E. from the University of Utah. In 1898-9 he was working under George Moore, as assayer, for the Salt Lake branch of the Consolidated Kansas City Smelting & Refining Co. In 1901 he was again with George Moore at Sunshine, Utah, where the Moore filter was born, and at which time he conceived the idea of the Kelly filter press. It was not until 1905, however, that he built his first working model and demonstrated the soundness of his theory. With faith, courage, and perseverance, through financial vicissitudes, mechanical and other difficulties, he struggled on, until the Kelly filter press achieved its present position in the metallurgical and manufacturing world. He was a man of winning personality and leaves many devoted friends, as well as a widow and two young sons.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, November 5

Antimony	15	15¾
Electrolytic copper	13	13¼
Pig lead	3.75—	4.70
Quicksilver (flask)	$55	
Tin	36 —	37½
Spelter	6½	6¾
Zinc dust, 100-kg zinc-lined cases		10

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, November 5.—The situation today is as follows: copper is slightly higher than the 11.20c. price of a few days ago, there being more domestic inquiries; lead is firmer at 3.50c., and spelter is quiet at 4.90c. per pound.

The board of managers of the New York Metal Exchange, at a meeting held October 30, passed the following resolutions: "Whereas, the London Metal Exchange will open for business November 9, be it resolved, that the New York Metal Exchange be opened November 9 for trading in tin, in accordance with the recommendations of the pig tin committee. Call will be held at noon."

On the following page will be found a discussion of the metal markets in October. Copper and antimony are also discussed in the New York letter of this issue.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The falling tendency has been arrested somewhat, the lowest recorded being 48⅛c. New York, and 22.19d. London. On November 5 these prices improved to 49⅛c. and 22.70d. respectively. At Salt Lake City, the U. S. Assay Office is now paying only 48c. for silver contained in gold received. The government of Peru is receiving silver for coinage at the mint at Lima under certain conditions. Imports of metal into England to the end of September totaled 72,600,000 oz., compared with 89,600,000 and 98,300,000 oz. respectively during that period of 1913 and 1912. Samuel Montagu & Co. states that one important factor connected with the recent increase of supplies was the fall in value of the Mexican 'peso,' which operated as a bounty to the mining interests of that country. This firm cannot regard the immediate future of silver with optimism. Inquiry from the Far East, or large coinage orders would affect prices. Pixley and Abell's circular shows that to October 15, exports of silver from London to the East were £4,625,500, against £8,847,000 in the same period of 1913, equal to a decrease of about 40,000,000 ounces.

COPPER

Prices of electrolytic in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

The copper situation is discussed elsewhere in this issue. Prices have been from 11.15 to 11.30c. per pound. No average for October is possible so far. The Granby company's Anyox, B. C., smelter produced 1,800,000 lb. in October; Kyshtim, Russia, 1,242,400 lb. in period ended October 10; and Braden, Chile, 3,130,000 lb. in September from 81,777 tons of 2.06% ore, with 76.91% recovery.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Oct.	29 3.50	Sept.	16 [illegible]
"	30 3.50	"	23 [illegible]
"	31 3.50	"	30 [illegible]
Nov.	1 Sunday	Oct.	14 [illegible]
"	2 3.50	"	21 3.50
"	3 3.50	"	28 3.50
"	4 3.50	Nov.	4 3.50

Monthly averages.

	1913.	1914.		1913	1914
Jan.	4.28	4 11	July	4 35	3 80
Feb.	4.33	4.02	Aug.	4.69	3 86
Mch.	4.32	3.94	Sept.	4 70	3 82
Apr.	4.36	3.86	Oct.	4 37	3 60
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	...

Lead is firm at St. Louis at 3.35 to 3.37½c. per pound. At Joplin, Missouri, lead ore is unchanged at $40 per ton.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
Oct. 8	55.00	Oct. 22	50.00
" 15	55.00	" 29	50.00
		Nov. 5	55.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mch.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	53.00
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

Quicksilver is stronger, and a cable from London to local dealers states that there has been an advance from the average of £7 per flask in September, and the rise to £9 early in October, to £11 on November 4, showing that the British government is controlling supplies, which are apparently low.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Oct.	29 4.90	Sept.	16 5.25
"	30 4.90	"	23 5.00
"	31 4.90	"	30 4.88
Nov.	1 Sunday	Oct.	14 4.55
"	2 4.90	"	21 4.73
"	3 4.90	"	28 4.90
"	4 4.90	Nov.	4 4.90

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	4.75
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	...

Spelter is dull at St. Louis at 4.90c. per pound. At Joplin, Missouri, there has been an advance of $5 per ton for ore of 60% metal content, prices being $42 to $46 per ton.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36.10	Oct.	40.61	30 40
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

The average in October was 30.40c. per pound. The market at present is somewhat sensitive. Futures are neglected, although there are sellers for December and January at 30⅛c. Supplies due are small.

New York Metal Review

The European war affected the metal market considerably in October. Copper, the price of which went as low as 11.12½c., was seized en route to Mediterranean ports by the British authorities in their campaign to keep the metal out of the hands of the Germans. After several vessels had been held up, the leading American producers lodged a formal protest with the United States government. A pleasing feature was a buying movement, in which domestic consumers took hold. The price of lead was reduced twice in the month, which, with a curtailment in production, started buying. Spelter again was sustained by heavy exports, especially to Russia. Tin quotations, which touched the lowest level in years, started upward on receipt of the news that the German man-o'-war *Emden* had sunk an English vessel carrying 850 tons of the metal; then declined again. Antimony has been exported heavily, Russia taking large quantities for war purposes, and its price is high as a result of the depletion of spot stocks. In aluminum, little or no interest has been shown. The action of the Secretary of the Treasury in ordering customs collectors to withhold for 30 days all statistics as to exports will greatly retard the completion of metal export figures.

COPPER

The last part of October brought some developments of a most unusual character to the copper market. As mentioned in the last review, England had not only placed the metal on its list of conditional contraband, but had seized stocks stored in Holland, and also some vessels bound for that country with copper among their cargoes. Later, ships bound for Mediterranean ports were held up for the same reason. A formal protest was telegraphed to Washington on October 28 by the leading copper-selling agencies, namely, the American Smelting & Refining Co., American Metal Co., Ltd., United Metals Selling Co., and Consolidated Metals Co. These firms represent nearly 90% of the copper export trade of the United States. Following the sending of the protest, an intimation came from Washington that England probably would release the vessels, in view of Italy having placed an embargo on the exportation of copper from that country, and would guard against its reshipment to Germany. The last named country is known to be short of copper.

A second feature of the month was a comparatively good buying movement, in which action was taken by both foreign and domestic consumers. The net loss in quotations between the first and the end of the month was about ½c., the price for electrolytic on October 1 being 11.75c., cash, New York, while on October 30 it was 11.25c. At the end of the first week, 11.50c. was the quotation; 11.25c. was reached October 19. Three days later the quotation dropped to 11.12½c., cash, but it stayed there only a couple of days, then returned to 11.25c. In the first half of the month the buying was light, and the market in every way monotonous. With the beginning of the last half of the month, some buying was reported, on the part of France in particular, but the aggregate was only fair at best. About October 23, both American and foreign consumers took hold in a lively way, and the total of orders booked was the largest of many weeks. Not a little of the metal sold for export was intended for Germany, shipment to be made through neutral countries. It was understood that the shippers were proceeding on the basis that if Germany received the metal she would pay a large premium, while if England seized it she would, according to her promise, pay for it. Some dissatisfaction was heard, however, as to the basis on which England was willing to settle. The exports of the month up to the 30th totaled 23,414 tons. Lake copper was in some demand from the ammunition makers, who were willing to pay fancy prices for high grades. Quotations for Lake dropped from 12c. to 11.50c. The Waterbury average for September was 12.87½c. Hot rolled sheet copper was reduced ½c., October 1, to 17c. base, and again ½c., October 22, to 16½c. base.

LEAD

The chief features of the lead market in October were two reductions in price and extreme dullness, followed by a good buying movement. The first reduction was made on October 5, when the American Smelting & Refining Co. reduced its New York price from 3.70 to 3.60c. per pound, and the second on October 7, when there was a cut to 3.50c. Both reductions resulted from the zeal with which independent producers went after business. The St. Louis price dropped to 3.35c. Shortly after the middle of October, the announcement was made that some leading producers in Missouri and elsewhere had curtailed their output about 25%, and this, together with the realization that the metal was extremely cheap, caused consumers to enter the market, and in some cases to buy more heavily than their actual needs warranted. October 30, quotations stood at 3.50c. New York, and 3.35c. St. Louis.

SPELTER

In October large quantities of spelter were again shipped to Europe, especially Russia. The month opened with the market on the decline, the heavy exports of September, estimated at 17,000 tons, having subsided, while domestic conditions were dull. The New York price, October 2, was 5c.; October 9, 4.85c.; and October 16, 4.75c. Then came new inquiries from abroad, with some from domestic sources also. These, coupled with reports that there had been a curtailment of production, caused the market to take an upward turn. The quotation October 23 was 5.10 to 5.15c., and on October 30, 5.05 to 5.10c. The last export movement involved a good tonnage, the quantity exported, October 1 to 30, being 6175 tons, making a total of over 23,000 tons since the war started. The steamer *Czar* for Archangel, Russia, from New York, carried 300 tons.

TIN

Just after the war started, as will be remembered, the price of tin soared to 68c. per lb., yet on October 15 the price was down to 28.40c., the lowest in many years. A dull market and ample supply was the cause of the slump. In London, early in the month, trading in prompt shipments and deliveries to be made within 14 days was allowed on the metal exchange there, and this caused such deliveries to decline, as it had the effect of forcing settlements on commitments falling due. It also was announced that trading in all positions would be resumed early in November on the London Metal Exchange, which caused uneasiness both in London and New York. Imports became a little lighter toward the latter part of October, which strengthened the market and caused sellers to hold off in quoting for a time, as they anticipated higher prices. October 21, considerable excitement was caused by the news that the German cruiser *Emden* had sunk the steamer *Trolius*, shortly after the latter ship had left Singapore with 850 tons of tin aboard. On that day, the market advanced from 29 to 30.50c. A good business was done, and more could have been done had not sellers withdrawn from the market, some of them, in fact, becoming buyers. The market on October 22 was active, about 300 tons being traded in. The course of prices in the month is indicated by the following: October 1, 31.05c.; October 6, 30.87½c.; October 13, 29.75c.; October 15, 28.40c.; October 20, 29c.; October 22, 31.50c.; October 27, 30.75c.; and October 30, 30.25c. In Holland, on September 30, there was stored 4437 tons of Banca tin, as compared with 173 tons on the same date in 1913. Domestic deliveries in September are estimated at 2800 tons, which would leave stocks at about 1000 tons. October 30, there was afloat 2145 tons, and arrivals to that date totaled 2043 tons. At Rotterdam, November 10, 850 tons of Banca tin will be sold at public auction.

Current Prices for Oils and Candles

(Corrected monthly by Standard Oil Co., California.)

All prices are f.o.b. San Francisco except where otherwise specified, and are subject to change without notice.

Granite Mining Candles	Per set, cents	Granite Mining Candles	Per set, cents
6s-12 oz.-40s	8¾	6s-14 oz.-20s	9½
6s-12 oz.-20s	9	6s-16 oz.-40s	10
6s-14 oz.-40s	9¼	6s-16 oz.-20s	10¼

Extra hard 1c. per set higher than the above.

The following prices are for oils (Calol) in wood barrels; cases (2-5 gal.) 3c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Compressor oil	40	Light gas engine oil	28
Amber gas engine oil	40	Red compressor oil	26
Castor machine oil	20	Red engine oil	17
Dynamo and motor oil	24	Turbine oil	35
Engine oil	24	Turbine oil, heavy	35
Gas engine oil	26	Diesel engine oil	40
Heavy gas engine oil	45	Cylinder oil	37
Heavy red engine oil	19	High-pressure cylinder oil	50
Heavy red journal oil	21	Low-pressure cylinder oil	37
Ice machine oil	28	Valve oil	50

The following prices are for oils in iron barrels, cases (2-5 gal.) 7c. per gallon higher, except on Eocene, which is 8c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Pearl oil	9	Engine distillate	7
Headlight oil	10	Aroturps	23
Eocene oil	11	V. M. and P. naptha	11½
Red Crown gasoline	13½		

	Per bbl.
Star fuel oil, f.o.b. Richmond Refinery	$0 85

	Per ton.
Petrolastic cement X	$13.00
Petrolastic cement XX	12.00
Asphaltum	$5.50 to 12.50

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, per ton	$19.00	$21.00
Arsenic, white, refined, per lb	0.05	0.06
Arsenic, red, refined, per lb	0.12	0.15
Asbestos, chrysotile	100.00	350.00
Asbestos, amphibole	5.00	10.00
Asphaltum, refined, per ton	11.50	20.00
Barium chloride, commercial, per ton	50.00	60.00
Barium sulphate (barytes), prepared, per ton	20.00	30.00
Bismuth ore, 15%, per ton	*250.00	upward
China clay, English, levigated, per ton	15.00	20.00
Chrome ore, according to quality, per ton	7.50	10.00
Cobalt metal, refined, f. o. b. London, per lb.	2.50	....
Coke, foundry, per 2240 lb	12.00	15.00
Diamonds (according to size and quality):		
Borts, per carat	2.00	15.00
Carbons, per carat	55.00	80.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Silica, per M	50.00	55.00
Snowball, per M	40.00	45.00
Flint pebbles for tube-mills, Danish, per 2240 lb	24.00	28.00
Fluorspar, per ton	10.00	15.00
Fuller's earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	40.00
Graphite:		
Amorphous, per lb	0.01½	0.02½
Crystalline, per lb	0.04	0.13
Gypsum, per ton	7.50	10.00
Infusorial earth, per ton	10.00	15.00
Iridium	55.00	....
Magnesite, crude, per ton	5.00	7.50
Magnesite, dead calcined, per ton	20.00	25.00
Manganese ore, oxide, crude, per ton	10.00	15.00
Manganese, prepared according to quality, per ton	30.00	75.00
Mica, according to size and quality, per lb	0.05	1.00
Molybdenite (Cal., MoS$_2$, per ton	1000.00	1500.00
Monazite sand (5% thorium), per ton	150.00	200.00
Nickel metal, refined, per lb	0.45	0.60
Ochre, extra strength, levigated, per 100 lb	2.00	7.00
Osmiridium, per oz	30.00	40.00
Platinum, native, crude, per oz	30.00	45.00
Silex lining for tube-mills, per 2240 lb	35.00	45.00
Sulphur, crude, per ton	25.00	30.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	425.00	450.00
Tungsten ore, 65%	400.00	425.00
Uranium ore, 10% min	25.00	per unit
Vanadium ore, 15% V_2O_5, per ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are f.o.b. San Francisco and subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, per 100 lb.	$ 0.80	$ 1.10
Acid, sulphuric, com'l, 66°, carboy, per 100 lb.	1.25	2.00
Acid, sulphuric, C. P., 9-lb. bottle, bbl., per lb.	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, per lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, per 100 lb.	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., per lb.	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, per lb.	0.10½	0.15
Acid, nitric, com'l, carboy, per 100 lb.	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., per lb.	0.16	0.22
Acid, nitric, C. P., bulk, carboy, per lb*	0.12½	0.15
Argols, ground, bbl., per lb.	0.10	0.20
Borax, cryst. and conc., bags, per 100 lb.	3.00	4.35
Borax, powdered, bbl., per 100 lb.	8.38	4.50
Borax glass, gd. 30 mesh, cases, tin lined, per 100 lb.	10.50	14.00
Bone ash, 60 to 80 mesh, bbl., per 100 lb.	0.50	6.50
Bromine, 1-lb. bottle, per lb.	0.55	0.65
Clay, domestic fire, sack, per 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, per lb.	No quotes	
Cyanide, 98 to 100%, 200-lb. case, per lb.	"	"
Cyanide, 129%, 100-lb. case, per lb.	"	"
Cyanide, 129%, 200-lb. case, per lb.	"	"
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white broken, casks, per 100 lb.	10.50	10.75
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white, crystals, per 100 lb.	12.50	13.25
Lead, C. P., test., gran., per 100 lb.	13.00	15.00
Lead, C. P., sheet, per 100 lb.	15.00	18.00
Litharge, C. P., silver free, per 100 lb.	11.50	13.50
Litharge, com'l, per 100 lb.	8.00	9.50
Manganese ox., blk., dom. in bags, per ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, per ton (85% MnO_2—¾% Fe)	85.00	140.00
Nitre, double ref'd., small cryst., bbl., per 100 lb.	10.75	12.00
Nitre, double ref'd., granular, bbl., per 100 lb.	9.75	11.75
Nitre, double ref'd., powdered, bbl., per 100 lb.	11.00	13.00
Potassium bicarbonate, cryst., per 100 lb.	14.00	16.00
Potassium carbonate, calcined, per 100 lb.	18.00	30.00
Potassium permanganate, drum, per lb.	0.30	5.50
Silica, powdered, bags, per lb.	0.03	0.05
	Min.	Max.
Soda, carbonate (ash), bbl., per 100 lb.	1.45	1.75
Soda, bicarbonate, bbl., per 100 lb.	2.00	2.50
Soda, caustic, ground, 98%, bbl., per 100 lb.	2.75	3.25
Soda, caustic, solid, 98%, drums, per 100 lb.	2.50	2.75
Zinc shavings, 850 fine, bbl., per 100 lb.	15.00	16.00
Zinc sheet, No. 9—18 by 84, drum, per 100 lb.	No quotes	

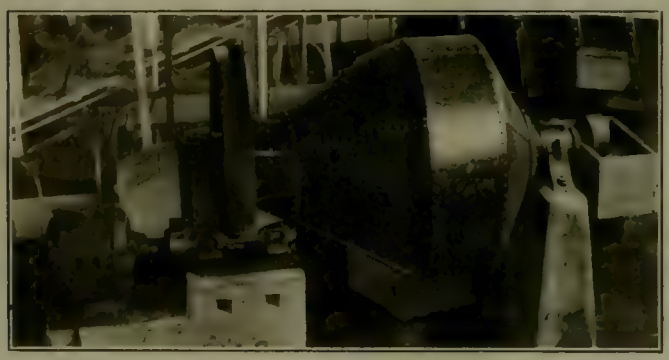
*Extra charge for packing nitric acid for shipment to conform to regulations.

Manganese ore to be used on the Pacific Coast, according to Atkins, Kroll & Co., of San Francisco, would have to contain 90 to 95% MnO_2, and not more than ¾ of 1% of iron. The principal market for this ore is at Atlantic Coast ports.

New Machines and Devices

Motors for Driving Hardinge Mills

When the Hardinge mill regrinding plant of the Calumet & Hecla Mining Co., at Lake Linden, was constructed it was decided to use 75-hp. squirrel-cage motors, equipped with starting-boxes, for driving the mills. Tests on the duty of the motors showed that they actually required about 52 hp. during regular running, the extra capacity of the motors only being required in starting. When the use of 8-ft. Hardinge mills was decided upon for the Baltic mill of the Copper Range Consolidated Mining Co., the management desired to find some more economical arrangement than the use of 75-hp. motors for the handling of 52-hp. loads, and secured the cooperation of the Westinghouse Electric & Manufacturing Co., which offered to develop a special high-efficiency 50-hp. motor built on new all steel frames, which would be capable of carrying these mills successfully, and which would have sufficient torque to start the mill if the motor were thrown directly on the line without the use of a starting-box. This made such a large saving that despite the special features of the motor, it could be furnished at a very much less figure than the standard 75-hp. motor with a starting-box, and the same equipment was ordered for the Champion mill. The point of particular interest about these motors is the rugged frame construction. The frame itself, instead of being of cast iron, is of a rolled open-hearth steel billet forged into a circle by means of a special upsetting machine and butt welded. To these are bolted steel end-brackets. The motor feet are of heavy pressed steel, stamped with a special die and welded to the motor frame. This gives an extremely rugged construction. In fact, the frames on these 50-hp. motors are stronger mechanically than the cast iron frames on the ordinary 75-hp. motors. The construction used makes the motor particularly suitable for strains of the heavy starting duty and for the vibrations incident to direct-connected gear drive.



MOTOR DRIVE FOR HARDINGE MILL.

Since the motors have been installed they have been remarkably successful, and the Westinghouse company has advocated the same type of motor for numerous other Hardinge mill installations. The entire efficiency is very good, and, due to the motors being well loaded, their power factor is high. The cost of the installation is said to have been 70% of what it would have been with 75-hp. motors and starting-boxes.

Commercial Paragraphs

MARK MANUFACTURING CO., Evanston, Illinois, is distributing a folder announcement regarding the cold drawn steel union. Many advantages are claimed for this type of union.

W. S. ROCKWELL CO., New York City, has for distribution a heavy cardboard hanger containing a comparative Fahrenheit and Centigrade scale, temperature conversion factors, hardening heats, and tempering heats.

THE PITOMETER CO., New York City. A folder descriptive of the Cole pitometer, which is claimed accurately records the flow of water through pipes. Its pen draws an ink record on a chart with ordinates directly proportional to the flow.

The 'October Reminder' of the ROBINS CONVEYING BELT CO., New York, contains a short description, with illustrations, of a recent unloading, storing, and reclaiming system constructed by this Company.

E. LEITZ, New York City. Catalogue No. 43-B, devoted to petrological and metallographic microscopes. Catalogue is fully illustrated and contains prices of various instruments manufactured.

GOODSELL PACKING CO., Chicago, Illinois, is distributing an announcement regarding the packing specialties manufactured by this Company. The list contains 14 products for a wide variety of purposes.

HAVANA MANUFACTURING CO., Havana, Illinois. The 'Havana' double grip friction clutch pulley for gas, gasoline, and oil engines embodies several interesting features which are described in a bulletin on this subject.

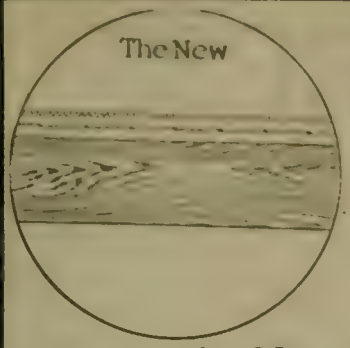
E. H. MOYLE ENGINEERING & EQUIPMENT CO., Los Angeles. An announcement regarding the prospectors' portable rapid-drop mill. The stamp involves many novel features, and is particularly adapted to the use of the small operator.

The UNITED METAL HOSE CO., of 510-512 West 24th St., New York City, is offering to send engineers a length of its 'dreadnaught' hose, complete with fittings, on a trial basis. If the hose is not satisfactory, it may be returned at the expense of the Company.

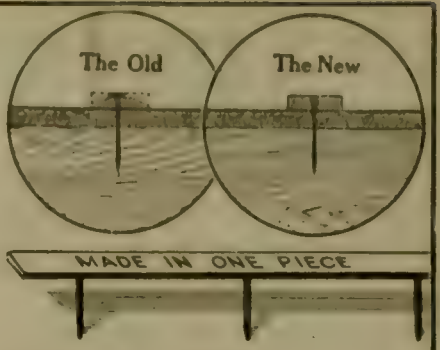
NATIONAL TUBE CO., Pittsburgh. Bulletin No. 7-D, devoted to N. T. C. regrinding valves. The regrinding is one of the conspicuous features; the ease and speed with which this work can be done is most commendable. On a test machine under pressure of 125 lb., one of these valves was opened and closed 3,046,280 times.

The LINK-BELT CO., Chicago, Illinois, has recently published a new edition of 'Steel Chains' or Book Number 124. This book is of interest and value to the user of chains, containing a large amount of data on chain construction and use. Sprocket wheels are also included in the catalogue. The Company is also distributing a folder descriptive of the 'Type K' link-belt loader.

MULCONROY CO., INC., Philadelphia, Pennsylvania, has recently taken over the all-metal hose business of the Schoen-Jackson company of Pennsylvania, acquiring all the patent rights, stock, and machinery, and is now manufacturing the products of that Company. A recent bulletin of the Company is devoted to the all-metal hose, connections, couplings, etc., manufactured by this Company.



Two New G-O Products



A Glass Top For Concentrating Tables

A sheet of wire reinforced glass ¾" thick, having 480 riffles instead of 45—the present practice. This glass table surface is the result of years of experiment and development. It is easily attached to any table and possesses unusual capacity, but the saving effected is its chief virtue.

The catalog gives the whole story—an interesting one. Send for it.

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Willey Table with G-O Surface	% Cu.	Standard Willey Table	% Cu.
Feed	2.03	Feed	1.48
Tails	.38	Tails	.78
Concentrate	10.14	Concentrate	9.30
Recovery	84.7	Recovery	48.3

The G-O almost doubled the extraction in this case.

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If you have not already investigated this new riffle, do so **now**. It is made of monel metal—(monel metal is as hard as steel, but non-corrosive).

G-O riffles come in varying sizes to suit all conditions. They save money by actually giving a better extraction and concentrate—incidentally they save the millman much trouble.

G-O riffles possess many advantages which are set forth in detail in the catalog, together with facts and figures. Send for it.

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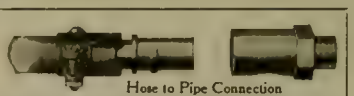
% % % %=% % % %=% % % %=% % % %

The Per Centum of Cost Reduction

—if throughout your operations **that** could be fixed **anywhere near** the 15 to 25% saved to you in drilling costs by

Cleveland Drills



you would greatly rejoice. It's because there are some operations where you **can't** save that you have greater reason to save where you **can**.

The savings accomplished by CLEVELAND DRILLS result from

Less trouble, less air,
Less help and less repair.

And these, in turn, result from the way the CLEVELAND is built, as told in Catalog 8.

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EDITORIAL

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ANTIMONY, as shown in our editorial of this week, is marketed more by brand than quality. This suggests that a local smelter might develop a good business by 'establishing a brand.' This requires capital, energy, and time, but a good selling brand of any standard product is well worth effort.

COMMUNICATIONS regarding the California Metal Producers Association may be addressed to 1022 Crocker building, San Francisco, for the present. It is expected that permanent headquarters will be established in a short time. We print this week the by-laws of the new association which are of interest not only locally but, being based upon experience in Nevada and elsewhere, as offering a model for similar organizations in other states.

GOLD RESERVES of the Bank of England and the Bank of Germany continue to increase, in spite of the war. Those of the former institution amount to £69,500,000, against £38,131,544 on July 30. It is probable that part of the present holding is in its branch at Ottawa, Canada. The sum of $8,000,000 left New York for the bank at Ottawa on November 9. The Bank of Germany has now M.1,826,094,000 in gold, about M.480,000,000 above the reserve of July 25. Of this increase, M.200,000,000 is from the war chest in Spandau Castle, having been recently removed to the Reichsbank.

GRANTING, by the United States Supreme Court, of the petition of Minerals Separation, Limited, for a writ of certiorari directed to the Ninth Circuit Court of Appeals, announced last week, has the welcome effect of bringing flotation litigation directly before the final court. It may be true as has been jokingly stated that "the supremeness of the Supreme Court consists mainly in the lastness of its guess," but at least its decision does settle things. So far as the mining and metallurgical profession is concerned, that is the thing chiefly desired as regards rights to flotation processes. In view of the conflicting decisions that have been given it would be idle to speculate as to the possible result of the new hearing, but even getting the matter before the court is a notable triumph for the counsel for Minerals Separation, since we believe that only about two per cent of such petitions receive favorable consideration.

AMERICANS doing business in other parts of the world are often at a disadvantage owing to the absence of American banking institutions, and this has been particularly true of South America. The formal opening of a branch of the National City Bank in Buenos Aires under charter of the government of Argentine on the tenth of this month will, therefore, be welcomed by many American manufacturers who have been trading with our Latin-American neighbors.

SINALOA and the west coast of Mexico are showing signs of a reawakening of the mining industry and a general feeling of optimism prevails among the mine operators. While there is no general boom, there is a feeling among those who have weathered the storm, that quiet waters are not far off. It may seem strange to many on this side of the Rio Grande, but it is true, that the west coast country, as do central and northern Mexico, looks to Francisco Villa as the best solution of the peace problem and believes that a *Constitucionalist* candidate with Villa's support is the logical hope of the people. This uncouth peon of Chihuahua, as he has been represented to the American people, holds the confidence of a large percentage of the Mexican people, and with the *Ejercito Constitucionalista* supporting his cause, is believed by many to be the best able to bring about a national peace. The west coast country with its numerous *minerales* has by no means been in a state of innocuous desuetude, and a limited production has been maintained throughout the recent years of revolution. Handicapped by lack of railway transportation, by bandits, by revolution, and by the general state of unrest, there, nevertheless, have been a few who have stuck to their work, and to these and others who are making efforts to recoup their losses, we extend our best wishes for a speedy return of peace and the blessings which go with it. It is gratifying to note that the west coast country is not suffering from a shortage of labor, as in the north and central part of Mexico, where Villa's call to arms has greatly depleted the ranks of the miners. While exchange rates have gone down, there has not been a corresponding increase in the cost of commodities and labor, and it is a consolation to the operators who have been able to continue at the mines to see this reflected in the mining costs. Lower costs prevail at the present time, when considered in terms of gold currency, than during the days of peace

and plenty. The present delicate political situation was heavily discounted in advance, and it is hoped that it will soon give way to the establishment of a government which will be representative of the majority, and then the long-looked-for prosperity may become a reality.

MINE OWNERS AND THE CALIFORNIA INDUSTRIAL ACCIDENT COMMISSION

Discussing the situation in California as regards mine owners and workmen's compensation indemnity insurance in January, we pointed out various reasons for believing that the rates charged for such insurance were entirely too high. Following this, we circularized our friends in the state and obtained important data regarding the volume of business and the rates actually paid, which we printed July 11. It was shown that the actual rate, while lower than the open rate, was still materially above the amounts paid elsewhere, and, admitting the inadequacy of existing records, far above the probable real cost. Since we first investigated the subject, relief, in part, has come through the organization of the Mine Owners' Casualty Indemnity Exchange, a coöperative institution designed to afford insurance to its members at approximate cost. We are glad to be able to say that the Exchange has found substantial support and shows every probability of affording real help to its members. Many California mine owners, however, take the ground that the state, having got them into the difficulty, should find for them a way out. This feeling is all the more keen since through the State Compensation Insurance Fund, other industries are given protection at cost, and the further fact that miners, while facing increased costs of both labor and supplies, cannot add to the price of their principal product, gold. We have conferred frequently with the Industrial Accident Commission, and have found its members and employees alive to the difficulties of the situation and willing and anxious to lend any aid that may prove feasible. As a first step a conference with mine owners was held last week at which the whole situation was informally but thoroughly discussed. The attendance, while not large, was especially representative, and the purpose to coöperate in finding a way out found expression in the appointment of a committee to formulate a plan which the Commission may consider for recommendation to the legislature. This committee consists of Messrs. George W. Starr, of the North Star Mines Company; Newton Cleaveland, of the Yuba Construction Company; D. E. Hayden, of the Wisconsin North Fork gravel mine; C. W. Fellows, manager of the Insurance Department, Industrial Accident Commission; and Chris. M. Bradley, attorney for the Commission. It is hoped that this committee may be able to formulate a plan whereby the Commission may organize and manage a mine owners' mutual. It was brought out at the conference that the cost for salaries and expenses amounted to but 9.37 per cent of the premiums received by the State Insurance Fund in the first nine months of its existence, and that a refund averaging 15 per cent would be allowed policy holders. Against this, private companies load compensation insurance 40 per cent to cover the cost of doing business. Mr. Cleaveland announced that an insurance exchange maintained by the metal trades, had resulted in a saving of 50 per cent in premiums. Mr. Starr stated that at the Empire mines, applying the present law to the accident record of 30 years, it was estimated that the cost would be about 2½ per cent. The amounts paid this year have been materially less. Experience from other mines was also given, and Mr. Albert Burch spoke most informingly upon the operation of the Nevada law.

In Nevada the largest single industry is cattle raising, but the largest employers of labor are the mines. Of the premiums paid for workmen's compensation insurance, 90 per cent is paid by the mining companies, and more than 86 per cent by members of the Nevada Mine Owners' Association. The executive committee of the latter has therefore followed the conduct of the business with great care. Starting without capital and with an average rate of 2.2 per cent (the Nevada Consolidated company as the largest employer being allowed a special rate of 2 per cent), the fund has paid all adjusted claims, set aside money for those not yet adjudicated and for future payments on claims allowed, kept expenses down to 10.6 per cent, and is building up a surplus. Allowing for the difference in compensation provided in the two states, and for medical attendance at the Nevada cost, Mr. Burch estimated that insurance in California ought not to cost more than 4 per cent, average rate, as against the 7.86 per cent asked. Mr. Fellows questioned this estimate, the main difference being in regard to cost of medical attendance. In Nevada the mines are so grouped that central hospitals are largely possible. The men are charged $1 per month, which covers hospital and medical attendance for both themselves and their families. This amounts to about one per cent of the pay roll. In California, medical attendance is required under the law, and the mines being scattered, central hospitals are rare. While only a part of the men injured receive compensation, they all receive medical attention, and evidently the individual fees amount to more than the whole hospital expense in Nevada. Indeed, the Commission pointed out that even in the general industries insured by the state, more money was paid out for medical attendance than for compensation. The Commission takes the ground that the best possible compensation to an injured worker is to put him back into the same condition, or as nearly the same as may be possible, as he occupied before the accident. This is a stand that will be approved by all, but the difference in cost as between Nevada and California raises the question whether economy is not possible in this particular in the latter state. This and other questions are receiving earnest attention from the committee that has been appointed to formulate a plan of action, and there is every prospect that acceptable recommendations will result.

ANTIMONY

To be of much use in industry a metal must be tenacious; in other words, strong and ductile. This is well illustrated in the case of iron, the most useful of all metals, although it is so easily attacked by atmospheric agencies that special means have to be taken to protect it from corrosion. Other qualities are of great importance also, and give to the other metals their special fields of usefulness. But antimony is the ugly duckling of the metallic family, and its qualities are such that, although it occurs in abundance in nature, it is used but little in industry. It is brittle, and though harder (and presumably stronger) than copper it is of no use for engineering purposes in the metallic state, since objects could only be made from it with difficulty and would break at the slightest blow. It is not affected by exposure to the atmosphere or by sulphuric acid, while hydrochloric acid attacks it but little. It has a pleasing color, and many other good qualities, but its lack of toughness is its fatal defect.

Antimony may be regarded as a recent metal, for although its minerals were known to the ancients, the metal itself seems to have attracted but little attention, as is indicated in the historical note on the metallurgy of antimony, by Mr. H. C. Hoover, in 'De Re Metallica.' Indeed, until a demand for a hardening addition to lead was created by the discovery of the art of printing from movable type, it may be said that there was little use for antimony, though it was used to some extent in the making of the alloys from which common grade household utensils of the Middle Ages were cast. The empirical metallurgists of those days soon found that when various other metals were added to tin the resulting mixture was easier to fuse, ran better in the molds, and was harder and more tenacious when cold. Of recent years it has been learned that such mixtures of metals produce eutectics and intermetallic compounds, but the earlier workers obtained the desired results by the less scientific but effective methods of empirical experiment. In the early days of the nineteenth century a clever American mechanic and inventor, Isaac Babbitt, who like others had struggled with the difficulty of placing the bearings of a rotating shaft in a straight line, conceived the idea of using a recessed support and casting the bearing around the shaft to a perfect fit. For this purpose he used pewter, which contains about 7 per cent antimony and nearly 90 per cent tin. Further experiment showed that for fast-running shafts an alloy of tin, lead, and antimony is more satisfactory. The tremendous development of the art of machinery construction, during the past half century, has created a large demand for such bearing alloys, and their properties and composition have been carefully studied by mechanical engineers and metallurgists. The use of pewter and similar alloys in domestic economy has greatly declined, having been successively supplanted by tinware, enameled ironware, and aluminum, and the making of fittings for coffins is the only considerable purpose for which they are now employed. But in some foreign countries, notably Japan, such alloys are still extensively used.

It is thus seen that while antimony has a number of uses (several minor ones not being here enumerated) the quantity required is not great, the total consumption in this country during 1913 having been less than 13,000 tons. This may be compared with the nearly 500,000 tons of lead consumed in the same period. The average selling price of antimony is about double that of lead, though it probably occurs quite as abundantly in nature as does lead, and its metallurgical recovery offers no especial difficulties. The comparatively small and rather fluctuating demand restricts most of the producers to a rather small scale of operations, and so makes operating costs higher. In addition, the selling of antimony is on a different basis from the selling of lead. This may be indicated by comparing them to the selling of flour and pepper. Flour is needed and sold in enormous quantities, standards of quality are well established, and competition in selling is chiefly in prices, while pepper is sold in small packages, competition being chiefly in presenting the product to consumers in attractive form. The baker who uses flour by the ton is tremendously interested in a possible saving of a quarter of a cent per pound; the householder who uses a few ounces of pepper per month cares nothing for a cent or two per pound, considering only whether it exactly suits his requirements. Thus, for example, Cookson's antimony sells for about $30 more per ton than Chinese brands, a margin for which the copper or lead producers would willingly go to almost any lengths of refining.

For the reasons which have been indicated, the production of antimony is not very profitable unless it is associated with some other metal. Since the antimony is not used by itself, but is commonly alloyed with lead, the frequent occurrence of antimony in lead ores is a decided convenience. Some of the antimony is doubtless lost in fume in smelting the lead, but much of it goes into the base bullion. Before the base bullion is subjected to desilverization, it is 'softened' in a reverberatory furnace, and the antimony, together with lead, is removed in the form of antimony skimmings, which are put aside for periodic reduction to antimonial or hard lead in an ordinary lead-smelting furnace. This method of procedure is subject to the disadvantage that arsenic also occurs in base bullion, and while much of it is removed as arsenic skimmings before the antimony skimmings rise, the separation is incomplete and the antimonial lead contains some arsenic. This is no drawback for many uses, but the makers of bearing metal and the type founders prefer to buy pure metals and alloy them, thus obtaining exactly the product desired and also making less dross in their operations. For this reason, more than half our antimony consumption is of pure metal, which is all imported, and the (supposedly) purer grades of the metal command higher prices. Cookson's brands are more in demand than Hal-

lett's, and both command better prices than the Hungarian or Chinese antimony. The average New York prices for the past seven years have been as follows, in cents per pound:

	1907.	1908.	1909.	1910.	1911.	1912.	1913.
Cookson's	17.03	8.57	8.27	8.24	8.58	8.54	8.52
Hallett's	15.39	8.37	7.98	8.00	8.16	8.19	8.07
Hungarian	14.68	7.80	7.35	7.27	7.48	7.63	7.43

The average price of Chinese brands is not available, but is usually about 1½ cents less than Cookson's. It is an interesting feature of this situation that careful analyses recently published by Mr. W. A. Cowan in the *Transactions* of the American Institute of Metals, show that although Cookson's antimony is purer than Hallett's, the Chinese Hwachang antimony is purer than either. Recently Hallett's antimony has been most in demand, and the inference seems inevitable that antimony is sold on the basis of its trade-mark rather than its quality. Antimony crystallizes in the hexagonal system, and if allowed to cool slowly from the molten state the surface of the metal is covered with large 'stars' which are popularly supposed to indicate that the metal is pure. This appearance actually indicates only that the metal was slowly cooled, since the least pure of commercial grades can be easily made to produce 'stars' by proper treatment. Nevertheless, only the 'star' antimony is accepted in the market as pure.

There are many other contradictory things in the metallurgy of antimony, and not the least is the peculiar use of terms. Stibnite, Sb_2S_3, is the mineral from which antimony is obtained, and as this is easily fusible the first operation is the liquation of the ore, usually in pots, the fused stibnite being allowed to run off from the gangue. It is collected and cooled, and is then known as 'crude antimony,' instead of antimony matte, which would be the logical name for it. The next step is the elimination of the sulphur. This is done by roasting to oxide and then reducing, with charcoal, by fusing with scrap iron, or by electrolyzing a solution of the 'crude antimony' in fused sodium sulphide. The metal thus produced is known as 'antimony regulus,' a most confusing term to the ordinary metallurgist, who seldom uses the term regulus, which he regards as synonymous with matte. Regulus was the name given to antimony by the medieval alchemists because it alloys readily with gold, which they regarded as the king of metals. By extension, the term was applied to any metallic mass which separates from slag in smelting operations, and finally to the matte produced in smelting. The term has long since outlived its usefulness.

As already remarked, there are plenty of antimony deposits in the world. The largest and most cheaply worked are those in China, occurring throughout the large area south of the Yangtze river, but especially in Hunan and Kuangtung provinces. In the past decade a number of smelting plants have been established, and the output of China has increased from an insignificant fraction of the world's output to about 60 per cent of the annual production. In spite of this, so far as can be learned, none of the operating companies in China have made much money, and most of the hundred or more Chinese companies are generally in financial difficulties. The best known of all the antimony mines is La Lucette, in France, which proved to contain gold in its deeper workings and made good profits. This mine is now practically worked out. There are numerous other antimony deposits throughout the world, and in this country they occur in Nevada, Arkansas, Idaho, Washington, California, Utah, and Oregon. None of these deposits can be as cheaply worked as those in China, and as the freight rate from Shanghai to New York is only $8.75 per ton, it is easily seen that mines in the Rocky Mountain states could scarcely hope to compete for the New York market, more especially as there are no antimony smelters now in operation in this country.

The outbreak of the European war caused antimony to take a sharp upward rise, as the war interfered with shipments and gave rise to a greatly increased demand, since considerable quantities of antimony are used for alloying with lead to make bullets for shrapnel. Shrapnel, as probably everyone knows, is a shell filled with bullets and provided with a bursting charge of explosive. At the proper point in its flight the shell explodes and the bullets are thrown out, spreading out so as to sweep an area of about 250 by 30 yards. These bullets should be brittle, so that they will break up to some extent and therefore sweep the area more effectively, and this brittleness is produced by alloying the lead with antimony. The rapid consumption of the stock of prepared ammunition makes it necessary for the European governments to manufacture more, while the recent agitation in Congress over our own military unpreparedness is likely to lead to increased manufacture in our own arsenals. Just before the war, prices here were about normal, although the stocks of the metal were only about one-third of what they had been a year before. For a time prices went to high figures and they still remain high; Chinese antimony having ranged from 9 cents per pound to 14 cents per pound during October, and averaging about 11½ cents. As long as the war continues, the demand for antimony will be greater than normal and prices will rule accordingly, but after the war they are likely to decline sharply, since the output of the Chinese mines can be, and doubtless is being, greatly increased. The increased production will come on the market at a time when the demand is slackening, so that the average price in the next few years is more likely to be under than over the average of recent years. It is clear, therefore, that there is nothing in the present situation to encourage the development of antimony mines in this country, since the present high prices are extremely likely to prove only temporary, and there is much danger that operating profits will not repay the investment necessary before prices decline to a point at which antimony production in this country is unremunerative.

Welfare Work Among Mine Workers

By L. F. S. HOLLAND

The provision of good board, lodging, medical treatment, and means of recreation for mine workers is no longer regarded by wise managers as philanthropy or paternalism, but as good business. The methods of attacking the problem of obtaining efficiency from the labor available differ in various localities, according to local conditions; but for good results, it may be accepted as essential that the workers be kept in good physical condition. The Michigan copper and iron miners get a larger proportion of their remuneration in the form of such betterments as cheap dwellings, sick and accident benefits, pensions, etc., than do workers in, say, the Butte, Montana, district, where the tendency seems to be to pay the highest wages that can reasonably be afforded directly to the men, and let them shift for themselves when their day's work is done. Some of the Butte companies, however, provide excellent change and wash houses at the mines.

However well a company may treat its men in welfare work, it will not necessarily be free from labor troubles, as witness the Calumet & Hecla company, which has always treated its men well, and the Colorado Fuel & Iron Co., which has spent many thousands of dollars every year in betterments. Besides the Lake Superior and Colorado districts, Butte also has had its grief. Where the Western Federation of Miners and its affiliations have shown strength, labor troubles have resulted, and with similar opportunities, similar results may be expected. Mother Jones does not draw $42 per day in times of peace. Generosity in expenditures for welfare work does not protect a company from professional agitators, but in any given district where wages are approximately the same at all the mines, the best accommodations naturally tend to attract the best men.

SMUGGLER UNION BOARDING-HOUSE AND SURROUNDINGS.

It happens frequently that by reason of the isolation of a mine, the operating company has to maintain a boarding-house to accommodate nearly all of its employees. Sometimes such accommodations are of the crudest description, and are found to consist of tiers of bunks built of rough lumber, frequently infested with vermin; dirty tin basins or wooden troughs to wash in; no baths; horrible back-houses; and an abundance of food poorly cooked. The best that can be said of such 'company' accommodations is that they are better than those tolerated by the men who 'batch,' or those provided by padrones.

A case in Colorado is on record where a padrone provided for 38 Italians a filthy bunk-house whose dimensions were 40 by 15 ft., with two small windows. The men slept in two shifts and they ate their meals in a small lean-to where the cooking was also done, by the padrone himself. Although they were getting $3 per day, the men were willing to tolerate all this, but the high percentage of sickness among them, and their unreliability and inefficiency, drew attention to their living conditions. The company then took steps to put the padrone out of business as a boarding-house keeper.

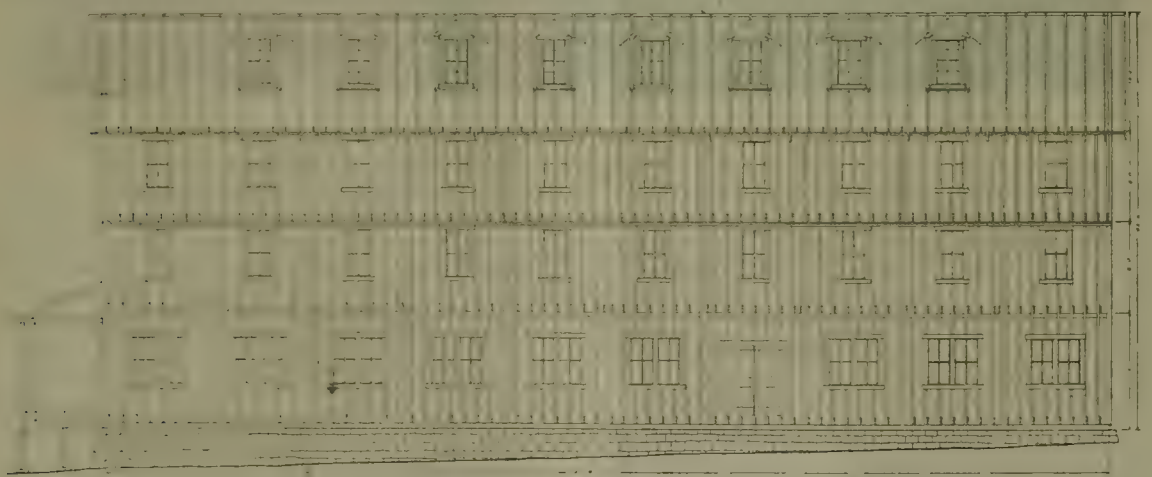
In his book, 'Across the San Juan Mountains,' T. A. Rickard says of the coffee supplied by the average mine cook: "It is a concoction out of keeping with the excellence of the remainder of the miner's fare and much better adapted for staining floors and removing boiler-scale." While the coffee served in the San Juan boarding-houses perhaps generally remains the same fearful and wonderful 'dope' found in most mining camps, there have been notable improvements in other respects at some of the larger mine boarding-houses, such as the Tomboy, Liberty Bell, and Smuggler Union mines, near Telluride, Colorado.

In consequence of a fire which wiped out all the old boarding and bunk-houses at the Bullion Tunnel workings of the Smuggler Union mines, I was called upon to design and erect a new house to accommodate a maximum of 200 men. The house had to be built in the depth of winter at a time when the railroad and county roads were under repair after a disastrous flood. Some necessary supplies were unobtainable within hundreds of miles. The truss-rods, for example, were delivered several weeks after the house had been built, on posts. As for carpenters, with the exception of a good boss carpenter and an able assistant, few of the men in the neighborhood who were hired as carpenters could saw a board straight. The total cost of the house was approximately $30,000. In summer time and with normal conditions as to deliveries and labor it could be duplicated for one-third less.

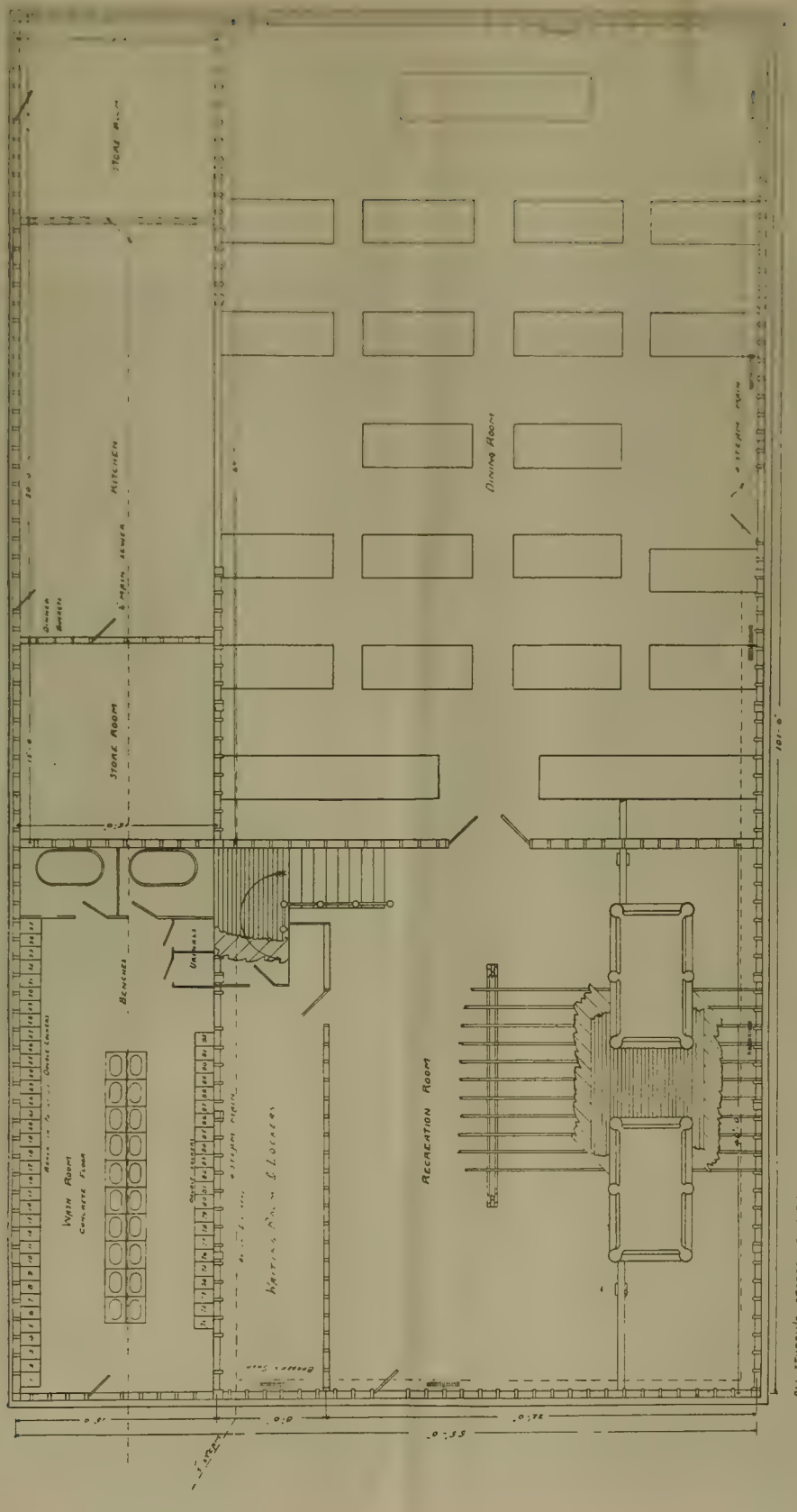
END ELEVATION.

In designing this house, advantage was taken of information gained in many mining camps, and especially of our good neighbors' experience with their new houses. The Smuggler house has now been operated long enough to demonstrate its general success. In these notes, with plans and photographs, I will endeavor to indicate wherein innovations have been successful and where unsuccessful in attempts to better the conditions of mine workers.

It is important to consider the type of men for whom betterments are provided, and what are their opportunities. 'Labor' in a mine nowadays usually means the man from Europe. The happy days are gone when a Western mine crew consisted mainly of 'Cousin Jacks,' 'Mickeys,' 'Bobtails,' and 'Bluenoses.' Many of the best of them have been driven out by the methods of the unions which have done their utmost to discourage efficiency. The following is the percentage of nationalities making up a typical crew I had working under me last year at the Smuggler Union while I was superintendent of mines: Italians and Italian-speaking Austrians, 30%; Swedes and Finlanders, 21%; Greeks (mostly



SIDE ELEVATION OF BOARDING-HOUSE.



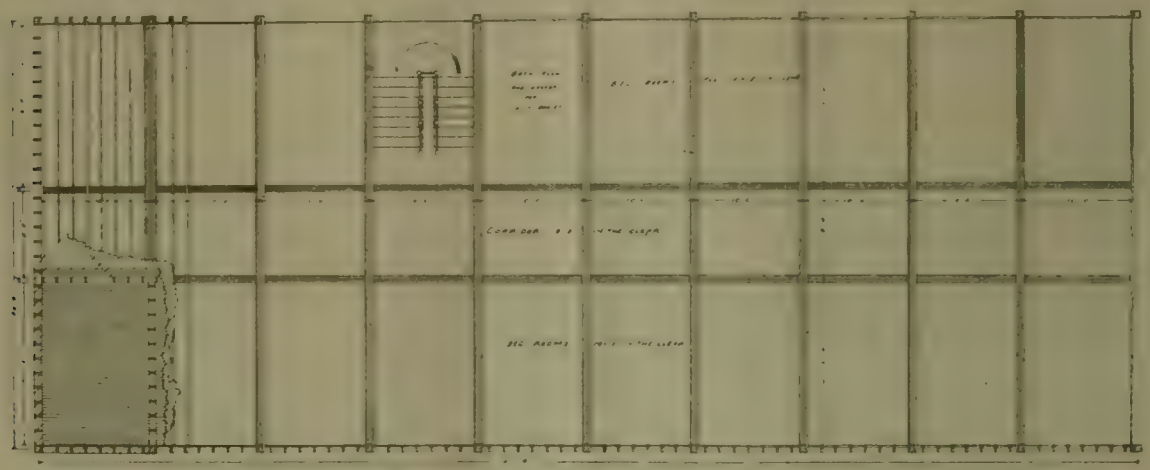
FLOOR PLAN, SHOWING KITCHEN, STORE ROOM, DINING-ROOM, WASH- ROOM, AND RECREATION ROOM, WITH STRUCTURAL DETAILS.

from Crete, 16%; Americans, 13%; British (mostly Cornishmen), 10%; various nationalities, chiefly Slavs, 10%. Only a small proportion of the foreigners will ever become American citizens. Other than shift-bosses, few trained miners were found among the Americans, who generally favored 'outside' jobs, nor did the Americans generally set a shining example to the foreigners in sobriety, efficiency, or recreations. The lowest rate of pay in the district is $3 for eight hours' work. Machine men and good timbermen usually get $4, and shift-bosses $5. The charge for board and lodging in the companies' houses is uniformly $1 per day, and a small fixed monthly charge is made for medical and hospital treatment.

The high rate of wages and steady operation of the larger mines naturally attract many efficient men to the district, but they also encourage unskilled and ignorant employees to undertake duties and risks for which they are not fitted. An employment agent has sent me men for underground work who could speak no English and had never worked in a mine. When the choice lies between an anarchist who can break ground besides taking care of himself, and a perfectly well behaved young man whose true calling is the shoe-shining parlor or the peanut stand, a mine superintendent with both eyes on the cost of production, and perhaps struggling to make a losing property profitable, will commonly prefer to take a chance on the anarchist.

The elevation of the mines, 11,000 to 12,000 feet above the sea, is not conducive to overexertion, especially out of working hours. The mine workers often seek entertainment at the local 'boot leggers' or 'blind pigs.' Except as a result of a stabbing affray or other serious trouble, the county authorities, in my experience, can rarely be persuaded to prosecute illicit liquor sellers. Amusement is also sought, especially after pay-days, in the town of Telluride, four or five miles down hill. The round trip by saddle-horse costs $2. The town is 'wide open:' that is, an abundance of saloons, brothels, and professional gamblers invite the visitors at every turn to waste their money so long as they have any to spend. A conscientious sheriff has been known to seize some of the public roulette and faro layouts, but he got little assistance from the legal authorities, nor was he nominated for reëlection. About the only rational entertainment provided in the town for the mine worker is the moving-picture show and an occasional baseball match.

In spite of the illegalities, the crowd, on the whole, is comparatively well behaved, and requires only a small police force to keep it in order. It is a matter of perspective. In a community where a self-confessed assassin can murder a mine manager by shooting him in the back, and then be acquitted by a jury of his peers; and another mine manager who has done great public service and would be a credit to any community,



PLAN OF A BEDROOM FLOOR WITH STRUCTURAL DETAILS.

is dynamited in bed, without any penalty to the would-be murderer, the operation of a roulette wheel or faro bank seems a very unimportant infraction of good conduct.

The president and directors of the Smuggler Union Mining Co. are men who have ever shown a lively sense of responsibility toward their employees. That it is not entirely a matter of commercialism is indicated by the fact that they have generously treated their men in the matter of the new boarding-house and other betterments although the expectation of life of the mine was only a few years. Bearing in mind the local conditions as to entertainment above mentioned, a large 'recreation room' was provided in the new house, with pool tables, card tables, reading tables, and a big open fireplace for cheerfulness. At the elevation of the house, about 11,000 ft. above the sea, snow may fly any day in the year, so steam radiators were provided besides the fireplace. The steam-heating plant is outside the house, and is an old one not destroyed by the fire which razed the other buildings.

The Company maintains a fine library at its mills at Pandora, and issues printed catalogues. Books are freely loaned to any of the employees applying for them,

either at the mine or mill, but few of the miners, even the English-speaking ones, avail themselves of the privilege. A few foreign newspapers are provided by the Company, and these seem to be more appreciated than the books.

A few years ago, the Young Men's Christian Association attempted some welfare work at the Tomboy and Smuggler Union mines, to which the mine managements, besides the men, gave generous financial support. The Companies provided suitable buildings, bowling alleys, and other means of recreation, besides a monthly, cash contribution. Among other educational aims, it was hoped to teach some of the foreigners English. The intentions were good enough, but after some months' trial, the whole scheme seemed to fall into disrepute and to lose the support of the men, chiefly, I believe, because the particular representatives of the Association who were sent to take charge of the work happened to be poor selections, and were unsuitable for the job. The Smuggler equipment was burned in the fire; in fact, that is where the fire started. In the new house, bowling alleys were not provided, as it was found that the men generally very much preferred pocket billiards. If desired, however, bowling alleys might be placed in the basement without danger of annoyance to occupants of the bedrooms in the upper floors.

The accompanying photograph of the Smuggler Union dining-room shows that tables and chairs for eight men each have been substituted for the usual long tables and benches. Besides adding to the comfort of the men and to the appearance of the room, the change has been found to facilitate service and cleanliness. The wooden chairs used all over the house were strengthened by wiring, but the breakages have been many. Suitable metal chairs, which should be more durable, can now be bought in Chicago for $1.50 each retail.

BILLIARD ROOM, DINING-ROOM, BEDROOM, AND LOCKER ROOM, SMUGGLER UNION BOARDING-HOUSE.

Serving tables are conveniently placed between the kitchen and dining-room, and gangways are arranged so that the 'flunkeys' can get around easily and quickly. The kitchen is provided with such labor-saving appliances as a steam-table, tea and coffee urns such as are used at railroad lunch counters, and motor-driven coffee grinder and meat mincer. A track behind the kitchen from the head of the aerial tramway, over which supplies are brought from the railroad, allows coal, groceries, and meats to be unloaded from trucks at the proper places. A half-door at the back of the kitchen allows the men to hand in their dinner buckets as they come out of the mine without having to pass through clean rooms in muddy boots and clothes.

After handing in their dinner buckets, the men can pass directly to the wash-room, in which are provided

20 white enameled stationary wash-basins with hot and cold water and self-closing faucets. Around the room, which has a concrete floor and drains, are ranged double-deck steel and wire lockers, as shown in the illustration. Steam pipes under the lockers dry the clothes left in them between shifts, but as the mine is not very wet except underfoot, no great amount of heat is required for the purpose. At very wet mines, the method sometimes employed for drying and storing clothes by suspending them from the roof of the 'dry' room may be adopted with advantage. A galvanized iron chain having at its end a hook on which hang the clothes, towel, soap-box, etc., passes over a pulley in the roof, and the chain is secured by a padlock, so that the men cannot tamper with each other's clothes.

The space between the wash-room and the recreation room is occupied by additional lockers which could not be accommodated in the wash-room. This space is also used as a waiting-room for men in their 'digging' clothes, about to go on shift, and it also accommodates a barber-shop. Among the dining-room staff is usually found a licensed barber who is given free use of the shop in consideration of the convenience to the men. Otherwise a barber from town makes periodical visits.

Experience with the old house which was burned showed that, for some unexplained reason, the men did not take kindly to the eight shower-baths provided there, but that the one bath-tub was well patronized. In the new house, three bath-tubs and two showers, each with hot and cold water, were provided, but the showers are much less used than the tubs. A private bath and toilet room, with enough lockers, are provided for the shift-bosses on the second floor, as is a private sitting-room for them. It may be that an elaborate equipment of shower-baths in white glazed tile cubicles, such as Messrs. Brunner, Mond & Co. have provided at their works in Cheshire, England, might cause the shower-bath to become fashionable at Smuggler, but evidently it is not so at present. Showers are much more economical with water than are bath-tubs, and at many mines clean water is scarce enough to be an important consideration.

Connected by covered way behind the wash-room, but entirely separate from the main building, are housed the closets, which are flushed automatically from the seats. The floor is of concrete and the janitor can quickly wash out the whole place with a hose. For thrifty men who do their own washing, enameled iron laundry trays are provided in this separate building. Urinals are provided on every floor of the main building, as are slop sinks with hot and cold water to enable the janitor to take care of the cuspidors. It may be noted that one janitor takes care of the whole house and keeps it clean.

In all mine boarding-houses preparations should be made to drive out the unwelcome but ubiquitous visitor called various names, but never anything complimentary, such as *cimex lectularius*, Norfolk Howard, or (adjectival) bedbug. The female of the species deposits eggs at the beginning of summer in crevices of wood and other retired situations, and it is said that new frame buildings which have never been lived in by human beings are sometimes infested with the pests. In one large mine boarding-house with which I am acquainted, whose bedrooms had been nicely finished with beaded ceiling, the inhabitants in the beading became so prolific and unmanageable that it finally became necessary to cover the partitions, etc., with canvas and calsomine the canvas. A mixture of two gallons of coal oil, one gallon of turpentine, and four ounces of pennyroyal, applied with a gardener's spray, will generally drive out the pests. In the new Smuggler house the material chosen for all inside wall and ceiling covering was 'Beaver Board,' which presents a smooth surface in large sheets, and takes a good coat of paint. The only lodgment which insects can find is between the sheets, and these cracks are usually covered with strips of wood. In spite of a thorough drying in hot rooms, the sheets were found, after being applied to the walls of the bedrooms, to shrink and to pull away from the nails, leaving unsightly gaps, and affording good lodgment for insects behind the one-inch strips of wood. The difficulty was finally overcome by taking off the wooden strips shown in the illustration of the bedroom and gluing strips of thick cotton sheeting over the joints between the sheets of Beaver Board. In the dining-room and recreation room downstairs, where no protection from the pests was found to be necessary, the walls and ceilings were attractively paneled by nailing 3 and 4-in. strips of wood over the joints and decorating wood and Beaver Board in harmonious colors.

For adequately supporting the sheets of Beaver Board a large amount of 2 by 4-in. 'cripples' was found necessary in addition to the studding. Where extra warmth is desired, it might be well first to cover the inside walls with rough one-inch boards and nail the Beaver Board to them. In damp situations, the sheets were found to warp badly. There are other similar compositions, such as 'Bishopric Board' and 'Sackett Board,' which might be less subject to this warping, and at the same time be more fire resistant, but they usually come in smaller sheets and are more expensive.

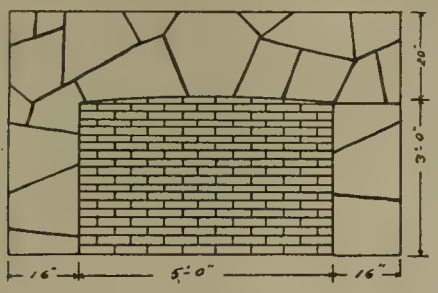
The type of bedstead adopted was a white enameled iron double-decker. There being two bedsteads in a room, each of four men has his own single bed. Mattresses are provided by the Company, and the men at the mine provide their own blankets, which are fumigated with formaldehyde before being allowed in the house. At the mill boarding-house at Pandora, the Company also provides blankets and bed linen. There is no logical reason for the discrimination except that such has always been the custom.

Each bedroom in the Smuggler house is provided with a steam radiator of suitable size, but during the first season it was found that steam heat in the bedrooms led to epidemics of colds. Except on very cold and stormy nights, the bedroom radiators are now kept cold, with better results to the men. The great danger at the high altitudes is pneumonia, epidemics of which

sometimes become very virulent. It happens that nearly every fatal case I have known occurred immediately after the victim had been on a 'spree' in town, when perhaps his vitality and powers of resistance were lowered.

A small temporary detention hospital, with a resident physician, occupies a separate building next to the boarding-house. Serious cases of sickness or accident are transferred, as soon as convenient, by horse ambulance, or by stretcher over the aerial tramway, to a larger hospital in town, to which nearly all the mines send their sick and injured. Sometimes better medical service can be obtained at a mine by having a resident skilled trained nurse who can obtain the attendance of a skilled physician at short notice, rather than by having to rely entirely on a young physician, perhaps a recent graduate, of the kind likely to be found at an isolated mine, where there is no opportunity for building up a profitable practice. It is, however, difficult to get a skilled trained nurse to stay at an isolated mine unless she happens to be married and her husband has employment at the mine.

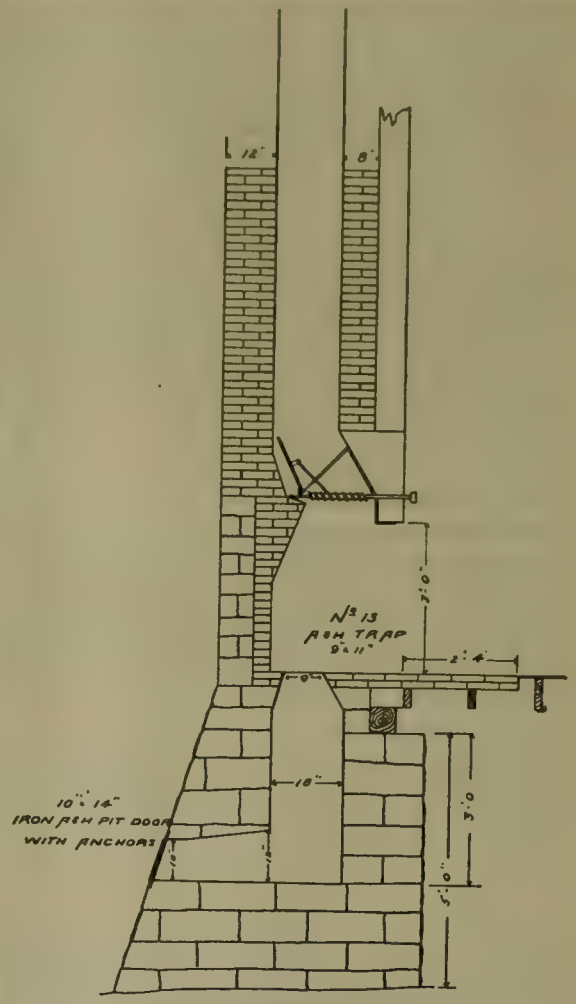
The rules forbid the bringing of liquor into the Smuggler boarding-house. Those who desire it, however, can generally get more than is good for them at one of the 'blind pigs' in the immediate neighborhood, or at the many saloons in town, as already described. In some mining camps, efforts have been made to regulate the sale of liquor with some success. Prohibition has always failed, I believe, but the 'restricted club' idea,



THE FIREPLACE

such as John C. Osgood worked out at the Coalbasin and Redstone Clubs for employees of the Colorado Fuel & Iron Co., is worthy of trial in localities where conditions are suitable. The essentials for success seem to be that the club should have a monopoly of the sale of liquor in the camp; no treating to be allowed; no drinks to be sold to a man who shows signs of intoxication; and all charges to be paid for at the time they are incurred. A club with a similar system has been in operation at the Cactus copper mine, near Milford, Utah. At my last visit, Mr. Heidenreich, the mine manager, informed me that the club was very successfully fulfilling its mission. At all these clubs, cases of drunkenness are said to be rare, and an offender is not given the opportunity of repeating the offense in the club.

These are the humane aspects of betterment work as well as commercial considerations. It has been said that a corporation has no soul, but if it acts with fairness and justice to its men, and gives them opportunities for health and recreation while earning fair wages, it may be credited with an excellent substitute for a soul. There is not much encouragement for sentiment in dealing with a crowd of foreigners whose principal object is to quit as soon as they have saved enough money for their purpose, which is generally to go back to Europe. Welfare work costs money, but it is doubtful if any company was ever a loser in the end by spending money for such a purpose.



CROSS-SECTION OF CHIMNEY AND FIREPLACE.

WOLFRAM produced in Siam totaled 309 tons in 1912-13. On the east coast the Chinese had separated this mineral from tin and left it in heaps as valueless. The surface workings are nearly exhausted, and capital is required for the deeper formations.

THE MINERAL PRODUCTION of Indiana was valued at over $80,000,000 in 1913.

Spelter—Manufacture and Properties

By GEORGE C. STONE

*The chemical properties of zinc are unique and render its extraction from an ore impossible by the methods used for the other common metals. The temperature at which oxide of zinc is reduced by carbon is considerably higher than the volatilizing point of the metal, so that it is always produced as a vapor. In order to obtain the metal in a commercially useful form it must be condensed at a temperature above its melting point, because if suddenly cooled to a solid it condenses as a powder, which oxidizes very readily and cannot be remelted and cast to form a solid. In ordinary metallurgical practice the oxide of a metal is heated with carbon or in an atmosphere of CO, either of which reduces the oxide to metal under the conditions which are maintained in the furnace. The reaction is

$$2RO + C = 2R + CO_2$$

or

$$RO + CO = R + CO_2$$

The furnace atmosphere is essentially a mixture of nitrogen, carbon dioxide, and carbon monoxide, and for all metals but zinc the presence of a considerable amount of carbon dioxide is not harmful. For zinc the case is different, as the presence of even a fraction of a per cent of carbon dioxide causes the action to reverse, and we have

$$Zn + CO_2 = ZnO + CO$$

It is therefore necessary always to have an excess of carbon present in order to produce metallic zinc, and the reaction is either

$$ZnO + C = Zn + CO$$

or

$$ZnO + CO + C = Zn + 2CO$$

These reactions were not known, and zinc as a metal by itself was not known, until early in the nineteenth century. Zinc as a constituent of brass was known for centuries before this. The old method of making brass was to heat the zinc ore with copper and charcoal. The zinc was reduced by the carbon and immediately alloyed with the copper and was thereby prevented from volatilizing completely, as it would if the copper were not present. The percentage of zinc in the resulting brass was naturally very uncertain and the quality of the product varied greatly. I have, myself, made brass in this way, maintaining as uniform conditions as possible, and the brass from the different runs contained from 8 to 25% of zinc.

There are two main classes of ores, the sulphides, blende, and the oxidized ores, carbonates, and silicates. The sulphides must be roasted to oxides before smelting. The oxidized ores require no preliminary treatment.

*Read before the American Institute of Metals and revised and extended by the author.

Blende is the most abundant ore of zinc and is mined in Virginia, Kentucky, Tennessee, Missouri, Wisconsin, and all of the Rocky Mountain states. It is usually associated with galena (sulphide of lead) and pyrite (sulphide of iron), and therefore usually requires mechanical concentration to separate it from these minerals.

The oxidized ores are found in the same localities as blende, and also in New Jersey, which contains the largest deposits of oxidized zinc ores in the world at Franklin Furnace. In most cases oxidized ores are associated with lead, which is removed as completely as possible by mechanical concentration.

All zinc ores contain iron, usually in considerable quantity. Most of them also contain cadmium in much smaller quantity. The effect of these impurities will be discussed later. The peculiar chemical properties of zinc limit the possible types of furnace to be employed, and, as a matter of fact, all of the successful zinc furnaces have been of the same general type.

The Spelter Furnace

A spelter furnace consists of a chamber with a solid roof and solid walls on three sides. The fourth side is an open frame of firebrick. Retorts closed at one end are placed in this chamber, resting on the open front frame and on projections from the opposite wall. The open ends of the retorts project slightly from the furnace, and the space around them is luted tightly with clay or a mixture of clay and coal. The furnaces are heated either by direct fires or by gas. When the furnace is sufficiently hot the charge, consisting of a mixture of crushed ore and coal, is thrown into the retorts with considerable force so as to pack it tightly. A small rod is then pushed through the charge near the top of the retort to make a vent for the gases formed. This operation is called 'spiesing,' in the East.

The condensers, short clay cones, are then fitted into the open ends of the retorts and luted with coal. The large ends of the condensers are placed in the retorts and the outer ends are supported on pieces of brick resting on the shelves in front of the furnace, or on movable iron rests called grasshoppers. The mouths of the condensers are partly stopped with coal to prevent the entrance of air and loss of heat. The heat in the furnace is gradually increased and the condensers watched to make sure they do not get stopped up, which would result in an explosion of the gas confined in the retort. The gas at the end of the condenser is lighted and burns at first with a clear red, yellow, or blue flame. In a short time this becomes smoky and tinged with green, showing that the zinc is beginning to come off.

In about six or eight hours enough zinc has been distilled to make it necessary to draw it. This is done by scraping the liquid zinc and oxide in each condenser

into a ladle held below it. When the ladle is full the oxide is skimmed off and the metal poured into molds. The operation of drawing requires considerable skill, as all of the material in the condenser should be removed quickly and none of the charge from the retort dragged with it. It is also important that none of the metal in the condenser should be pushed back into the retort, as, if it is, it will immediately be volatilized, will burn, and be lost.

As soon as the condensers are drawn a helper again stops their mouths with coal. The heat is gradually increased, and in another six hours or so a second draw is made. After the second draw the heat is increased as much as possible and maintained to the end of the charge. When the charge is worked off a third draw is made, the condensers being cleaned as thoroughly as possible. The condensers are then taken out and the material in the retorts removed either by scrapers or by blowing out with steam or water. The latter operation sounds rather barbarous, but is not as bad as it sounds. It is performed by pushing a pipe through the material in the retort to the back end and turning on steam or water for an instant. If water is used it is immediately converted into steam and acts like an explosion, blowing the material out of the retort. When steam is used, it is usually very wet, owing to condensation in the long pipes necessary.

Any used up retorts are then removed and replaced by new ones, which are brought red-hot from the kilns, which should be close to the furnaces. The furnace is then recharged and the operation goes on as before. It requires twenty-four hours to work off a charge. The ladle skimmings, condenser scrapings, chips from old retorts, and any metal spilled, are carefully collected and added to the next charge.

The success of the operation depends on the proper mixing and proportioning of the charge, the regulation of the heat, and the care and skill of the workmen.

Organization of the Crew

Up to 20 years ago the furnaces were very small and were all fired directly with coal. A furnace crew then consisted of a charger and a long-shift man, both of whom worked 24 hours, and a short-shift man who worked 12 hours. They wheeled and mixed the charge, fired and worked the furnace, drew the metal, replaced retorts, and took the metal made to the storehouse. The charger was responsible for the firing of the furnace, and the success or failure of the work depended almost entirely on him. It was never easy to get sufficiently intelligent, careful, and skillful men who were willing to work 24-hour shifts, and it became increasingly difficult to do so as other lines of employment opened. The endeavors of the managers have therefore been to design furnaces and plants that do not depend so entirely on the skill of the workmen. In this they have been largely successful. The charges are now usually mixed by machinery, concrete mixers being frequently used. The furnaces are fired by gas, giving easy regulation. The spelter was formerly drawn off in hand-ladles holding about 40 lb. each. These had to be moved by hand from retort to retort, lifted up and down, and carried to the molds. While doing this work the men had to stand close to the furnace with no protection from the heat. At the present time much larger ladles, holding from 200 to 500 lb. are used. They are carried on cranes or cars provided with shields to protect the men from the heat of the furnace. When the ladle is full the car is run to the molds and the metal poured, the ladle being still carried on the crane, by which its height can be adjusted for convenient pouring.

Working Conditions

The ventilation of many of the old spelter furnace buildings was very defective and they were frequently full of smoke and gas. In strong winds this was particularly troublesome, as it was necessary to close all openings on the windward side of the buildings because drafts interfere with the working of a furnace. At the present time the furnaces are usually built with very large hoods and clear openings over them so that the ventilation of the rooms is practically perfect. At some works an air pipe is run near the roof and parallel to the front of the furnace with open branches pointing toward the floor at a point about two feet back of the position of the men when working at the furnace. By moving back one step the men can get the cool draft and do not have to stay in it long enough to get chilled. This has proved of great advantage in hot weather. The general health of spelter men is excellent and no occupational diseases due to zinc are known. In a few cases where ores high in lead are worked authentic cases of lead-poisoning have occurred. The so-called 'spelter shakes' are unknown in zinc works, proving that this trouble is certainly due to something other than zinc.

The work is so arranged that no men work more than twelve hours, and most of them only about six. The largest number are required when cleaning out and charging. As soon as this is completed, all but the metal drawers are free to go home. It is still hard, hot, dirty work, and the hours are inconvenient, as the cleaning out usually starts at 4 or 5 a.m. The men prefer this early start, as it is the coolest hour in summer.

There are several kinds of furnaces in use—the old direct-fired furnace with the fireplace below the retorts has practically disappeared in this country. None are now in operation, and those still in existence will probably never be started up again. The simplest of the gas furnaces is the Hegeler, invented by Edward C. Hegeler, one of the pioneers in zinc smelting in this country and one who has probably done more than anyone else to improve the practice. The Hegeler furnaces are very large, some containing as many as 1080 retorts. The gas is all admitted at one end, the producer being placed close to the furnace so as to utilize as much as possible of the sensible heat. The air is admitted at different points lengthwise of the furnace so as to burn the gas gradually.

The furnaces used in the natural gas field are similar except that both gas and air are taken in at intervals along the front. This type of furnace is cheap to build and easy to operate, but is not economical in fuel. To Mr. Hegeler this made no difference, as he had very cheap fuel and means for utilizing all of the waste heat.

Various modifications of the Siemens furnace are largely used. In these the retorts are faced two ways, the butts of all resting on projections from the centre wall, which does not come quite up to the roof. There are four regenerators under the furnace, and the gas and air coming from two of these enter ports under the lowest row on one side and pass over the centre wall through ports below the retorts on the opposite side to the other pair of regenerators. At regular intervals, usually of about half an hour, the gas and air are reversed in direction. In this way the retorts are kept at a fairly uniform temperature. This type of furnace is very economical in fuel, but requires considerable care and judgment to get and maintain a uniform distribution of heat. It is impossible to keep the regenerators clean, and they gradually lose their efficiency.

The Convers de Saulles furnaces are used by only one company. In these the gas is taken hot from the producers and the air is heated in continuous regenerators. Both air and gas enter both sides of the furnace under the lowest retorts and pass out through the hollow back wall. As the air alone is regenerated, this furnace is not as economical as the Siemens, but is much easier to operate. The regenerators are built with straight passes that can be kept clean so that the efficiency of the furnace can be maintained until the brickwork of the chamber gives way.

In Europe several other furnaces have been used with considerable success, but none of them have proved satisfactory when tried in this country.

A very important accessory operation is the manufacture of retorts. Formerly they were made entirely by hand, which was slow and required a skilled potter. At the present time they are made in tile machines, or more often in hydraulic presses. The latter makes much denser retorts than either of the other processes, and they can be made with much thinner walls and are therefore easier to heat. After pressing, the retorts are placed in drying rooms where they are kept for three months or longer. Each morning the pottery man finds out from the furnace men how many retorts will be required the next day, and places the proper number in the kilns, where they are burned with coal or gas for about 18 hours. The kilns are close to the spelter furnaces and the retorts are transferred while red hot.

Impurities in Spelter

The commonest impurities in spelter are lead, iron, and cadmium. Arsenic is also common, but very little attention is paid to it. All of these impurities are derived from the ore and will be found in the spelter if they occur in the ore. In other words, it is impossible to make pure spelter from impure ore. The extent to which the different impurities in the ore go to the spelter varies considerably.

When lead is present in the ore in very small proportion (about one of lead to a thousand of zinc), practically all of it will be found in the spelter. As the proportion of lead to zinc in the ore increases, the proportion of the total lead that goes to the spelter decreases. It is difficult to make a spelter containing much over 2% of lead, no matter how much the ore contains. Lead and zinc make fairly homogeneous alloys up to about 1% of lead. When more is present it segregates badly.

Iron behaves differently, and the amount of it found in the spelter depends mainly upon the way the smelting is conducted, and not on the amount in the ore. It is possible to make spelter from ore that contains 10 or 12% as free from iron as from ore that contains 0.1 to 0.2%. The two causes that mainly contribute to the presence of iron in the spelter are careless drawing, by which part of the charge is drawn into the condensers, and poor scrapers which wear off and introduce particles of iron.

Cadmium is much more volatile than zinc and a good deal of that contained in the ore escapes condensation, so that the spelter never contains as much cadmium as the composition of the ore would lead one to expect. The behavior of arsenic has not been much studied, but it is known that it is found in the spelter whenever it occurs in the ore. Aluminum and tin are never found in virgin spelter, that is, spelter made from ore. Tin never occurs with zinc, and aluminum is not reduced under the conditions occurring in a spelter furnace.

Commercial spelter is divided into four grades, defined as follows by the Amer. Soc. for Testing Materials:

(*a*) *High-grade.*—Shall not contain over 0.07% lead, 0.03% iron, 0.05% cadmium, and it shall be free from aluminum. The sum of the lead, iron, and cadmium shall not exceed 0.10 per cent.

(*b*) *Intermediate.*—Shall not contain over 0.20% lead, 0.03% iron, 0.50% cadmium, and it shall be free from aluminum. The sum of lead, iron, and cadmium shall not exceed 0.50 per cent.

(*c*) *Brass special.*—Shall not contain over 0.75% lead, 0.04% iron, 0.75% cadmium, and it shall be free from aluminum. The sum of the lead, iron, and cadmium shall not exceed 1.2 per cent.

(*d*) *Prime Western.*—Shall not contain over 1.50% lead and 0.08% iron.

The following table gives the analyses of typical samples of the various grades:

	Pb	Fe	Cd
High-grade	0.010	0.026	0.04
" "	0.041	0.014	None
" "	0.035	0.014	"
Intermediate	0.095	0.009	None
"	0.190	0.017	"
"	0.123	0.011	0.12
Brass special	0.343	0.026	None
" "	0.474	0.013	"
" "	0.680	0.010	0.274
Prime Western	0.870	0.062	0.023
" "	0.644	0.013	0.090
" "	1.270	0.011	0.079

Strength of Spelter

Spelter is a highly crystalline metal and its tensile and transverse strength depend entirely on the size of the crystals. The tensile strength varies from about 2 tons per square inch with coarsely crystalline specimens, to 7 tons with very fine grained ones. The composition does not appear to influence the strength greatly. The transverse strength also varies with the crystallization, being greater the finer the grain. The modulus of rupture varies from 4 to 11 tons per square inch with deflections of from 0.09 to 0.44 in. on a span of 12 in. There is no definite relation between the modulus of rupture and deflection. The purer the spelter the higher the deflection it will stand without cracking.

The compression test pieces were cylinders 1 inch in diameter and 2.6 in. long. The load necessary to compress these at 10 and 20% was determined:

Names.	10%	20%
High-Grade	16,500	23,095
Intermediate	16,065	23,095
Brass Special	18,310	26,000
Prime Western	20,570	28,620

The resistance to compression increases with increase of impurities. The effect of the different impurities varies greatly. Lead has but little influence. Iron has comparatively little influence. Cadmium increases the resistance to compression very greatly. A cadmium-free Brass Special spelter required 17,190 lb. to compress it 10%, while a Prime Western spelter with 0.32% cadmium and about the same quantities of lead and iron as the other required 27,340 lb. In another case a cadmium-free metal required 16,500 lb. for 10% compression, while the same metal to which 0.2% of cadmium had been added required 26,870 lb. For 20% compression the cadmium-free required 24,000 lb. and the metal with 0.2% cadmium 37,000 pounds.

Effect of Impurities

Lead.—Lead in moderate quantity tends to make spelter softer in rolling; in galvanizing it has a tendency to weaken the coating and make it more liable to peel when the coated metal is bent. Present in quantities of about 0.7% it tends to produce bad cracking in spelter castings. In brass it tends to make the alloy more brittle and liable to crack.

Iron.—Iron hardens spelter and makes it more brittle. This effect seems to follow through all of its uses. In galvanizing, excessive iron also tends to make more dross, the iron being present in the form of a solid alloy, gradually settles to the bottom of the pot; though this effect is slight, as much more iron is added to the bath by the containing vessel and the material being galvanized than can possibly be present in the spelter.

Cadmium.—The effect of cadmium is to harden spelter greatly and make it more brittle. In galvanizing, this is very important, as the brittleness due to the cadmium causes the coating to peel off. This is of particular importance in telephone and telegraph wires which are sharply bent in making splices. If the zinc contains appreciable quantities of cadmium the coating peels off at these points and the life of the line is much shortened. Cadmium has a strong tendency to make castings crack. In brass, cadmium tends to act like lead and is also said to make the metal more sensitive to heat treatment. Luckily for the brass makers a large part of the cadmium in the spelter they use is volatilized and lost, so that the amount in the resulting brass is rarely large enough to cause much trouble.

Arsenic.—In the ordinary uses of spelter, arsenic in the quantity in which it occurs does not appear to have much effect. When used for generating hydrogen to be used in lead burning, it does, however, have a very important influence, making it impossible to burn a strong seam.

In general, the purest spelter gives the best results, and very pure spelter can only be made from pure ores. There are several refining processes which reduce the amounts of some of the impurities and have little effect on others. In Europe it is customary to remelt all of the lower grade spelter corresponding to our Prime Western. This is done in large reverberatory furnaces holding as much as 15 or 20 tons of spelter, which is heated to a temperature just sufficient to keep the metal liquid. A considerable part of the lead and some of the iron settles to the bottom of the furnace, and the purer zinc is ladled from the top and cast for sale. The lead is reduced to about 1% and the iron to about 0.03%. Cadmium is very little affected, as it dissolves in the zinc in amount up to 1% and, therefore, cannot be separated by liquation. The main advantage is not so much in the reduction of the amount of impurities as in the production of a more uniform grade of metal.

In this country the so-called refining is usually the treatment of scrap and galvanizers' refuse in the production of what the government calls 'secondary' zinc. The product made is of uncertain quality and usually contains impurities, notably tin and aluminum, not found in spelter made direct from ore. While some of this material shows a fairly good chemical composition, it is usually hard and brittle, due to excessive cadmium, and will not produce the results for galvanizing, alloys, or castings that can be obtained from good virgin spelter.

Castings

Spelter is largely used for making ornamental castings, mainly what are known as 'slush' castings—that is, those in which the metal in the mold is poured back into the ladle as soon as a thin layer next the mold has set. These castings are made as thin and light as possible to economize metal, and a material that will not give light castings is therefore unsuitable. The castings must be sound, not merely for strength, but because they are all ornamental in character. A single crack (or even two or three), if not large enough to impair seriously the strength, is not fatal, as such cracks can be soldered and finished so as not to show. The most objectionable cracks are the very small ones that are not visible, because the plating solution gets into them and does not show until

the work is finished, when it comes to the surface producing stains that ruin it. The molds are usually made of bronze, and many of the shapes are such as to cause excessive strains. The castings are polished and plated or otherwise finished. It has long been known that such castings could only be made from pure metal, but I do not know of the effect of the different impurities having been studied.

Our first experiments were made with a very simple and easy casting, and indicated that iron up to 0.07% had no bad effect, and that both lead and cadmium greatly increased the tendency to crack when present in considerable quantity. We next made slush castings of a fairly difficult shape, starting with the pure, high-grade spelter, to determine the necessary conditions. We then made a series of alloys by adding lead directly to zinc at a temperature of 700° C. (1292° F.), the metal being kept well covered with charcoal and stirred for ten minutes with a rod of fused silica. The cadmium alloys were made by melting together pure spelter and an alloy containing 1% of cadmium. Each of the lead alloys was used as the base of a lead-cadmium series, the necessary amount of the 1% cadmium alloy being added.

The alloys were melted in 80-lb. lots in No. 45 Dixon graphite crucible, the alloy containing the least amount of impurities in each series, being made first, and the crucible carefully scraped and cleaned with sandpaper before being used again. The following method was adopted as the result of the experiments on pure spelter. The charge was melted, stirred, and brought to approximately the desired temperature, 435 to 460°C. (815 to 860°F.), and three castings were poured to heat the mold. These castings were set aside and melted later if it was necessary to cool the bath. The temperature of the bath was taken before each casting with a platinum-platinum iridium couple protected by a fused quartz tube. While each reading was being taken, the bath was stirred slowly and the galvanometer needle allowed to become stationary. The inside of the mold and ladle were kept well covered with soot from turpentine smoke. Between casts the ladle was kept uniformly warm by placing it directly over the crucible.

The results of these experiments are given in the accompanying table.

Effect of Impurities on Slush Castings

Desired composition. Pb	Cd	Analysis. Pb	Cd	Casting temperature. C.°	F.°	Total number of castings	Number of perfect castings	Number perfect weighing less than 850 gm.	Weight of lightest perfect casting, gm.	Average weight of all castings	Average weight of perfect castings	Percentage of acceptable castings
Pure spelter				439.6	823	23	20	19	637	743.9	751.1	82.6
0.1	..	0.141	..	452.2	846	10	8	6	662	....	790.1	60.0
0.2	..	0.236	..	446.5	836	8	1	1	595	673.0	595.0	12.5
0.2	..	0.247	..	446.6	836	15	4	3	647	770.3	766.0	20.0
0.3	..	0.349	..	445.3	834	12	7	4	674	797.1	810.0	33.5
0.4	..	0.453	..	448.4	839	16	6	1	615	858.4	926.9	6.2
0.4	..	0.453	..	439.0	822	11	4	1	650	785.5	843.5	9.1
0.5	..	0.547	..	453.4	848	16	9	1	840	881.1	919.8	6.2
..	0.1	0.045	0.10	446.8	836	10	..	..	...	889.6	....	...
..	0.2	0.045	0.25	436.4	818	10	..	..	...	812.4	....	...
..	0.3	0.045	0.32	434.0	813	10	..	..	...	848.6	....	...
..	0.5	0.045	0.47	424.8	797	10	..	..	...	928.8	....	...
..	0.7	0.045	0.65	439.1	822	10	..	..	...	1004.4	....	...
0.1	0.1	0.105	0.07	450.0	842	11	1	..	880	910.7	880.0	...
0.1	0.2	0.120	0.22	449.2	841	10	..	..	...	947.6	....	...
0.2	0.1	0.214	0.12	454.0	849	11	1	..	1010	951.7	1010.0	...
0.2	0.2	0.200	0.21	434.2	814	10	..	..	...	971.1	....	...
0.3	0.1	0.273	0.10	454.5	850	12	..	..	...	731.1	....	...
0.3	0.3	0.265	0.33	432.5	810	10	2	..	1099	962 8	1099.5	...
0.4	0.1	0.383	0.07	449.3	841	11	..	..	...	818.1	....	...
0.4	0.4	0.424	0.39	434.3	814	10	1	..	1132	825.4	1132.0	...
0.5	0.1	0.500	0.11	452.1	846	15	3	2	840	836.1	859.0	13.3
0.5	0.5	0.450	0.46	432.9	811	10	2	..	952	919.0	1003.5	...

The effect of lead alone when present in amount exceeding 0.1% is to cause cracking, and any attempt to reduce this by lowering the casting temperature results in the production of castings of excessive weight. Lead does not alloy with zinc at the casting temperature, but separates as small drops or films between the crystals. These form lines of weakness which cause cracks along the irregular lines where crystals meet. When the cracking is due to lead, there is usually only one large crack extending about half way around the casting and opening about one-thirty-second of an inch and quite frequently to one-sixteenth inch.

Cadmium forms hard and brittle solid solutions with zinc at all temperatures, and we only succeeded in getting 2 satisfactory castings out of 160, from metal containing 0.1% or over of cadmium. When the amount of cadmium does not exceed 0.2% the cracks are similar in appearance to those due to lead. With larger quantities of cadmium the cracking is of a much more objectionable form, as there are usually a large number of cracks scattered over the surface, some of which are so small that they are difficult to detect. As would be expected for theoretical reasons, cadmium very decidedly lowers the melting point, and we were able to pour castings from high cadmium alloys at a temperature of 10° C. (18° F.) below that at which pure spelter would flow.

The effect of the presence of both lead and cadmium about equals the cumulative effect of the two if present separately. Alloys containing large amounts of lead (0.4 to 0.5%) with 0.1% cadmium, however, will sometimes give sound castings, but only when their weight is excessive. It is possible that this is due to the soft lead segregated in the joints between the crystals acting as a lubricator and allowing them to slip enough to relieve the strain without cracking.

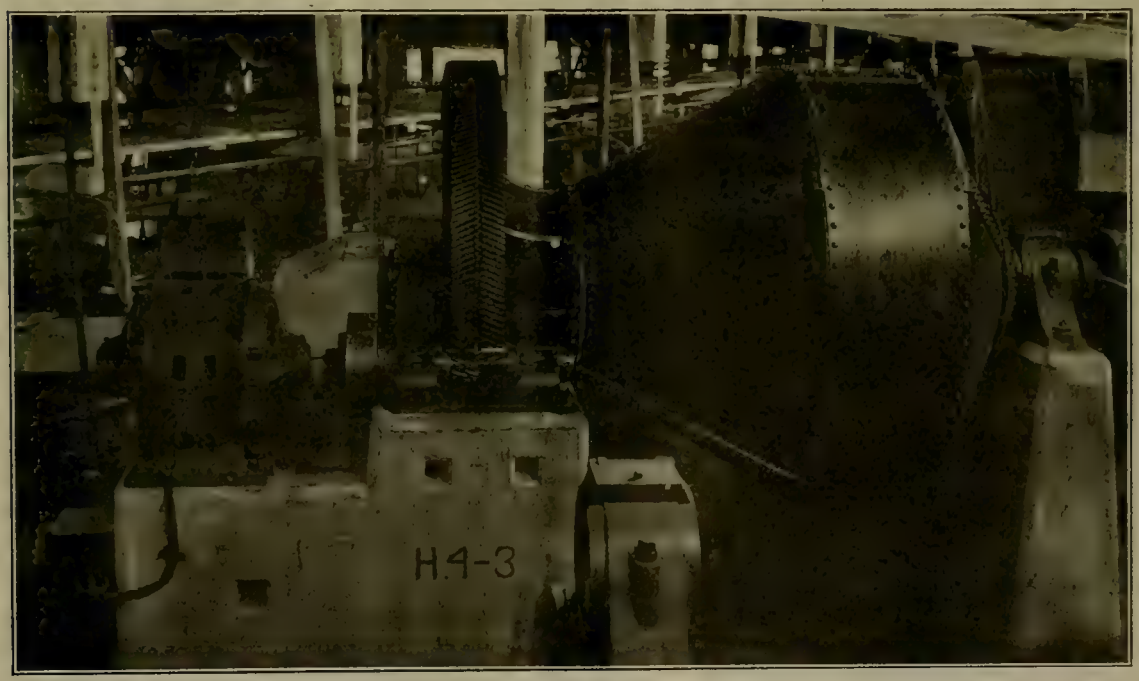
Conclusions

1. Both lead and cadmium are injurious in spelter to be used for slush castings.
2. The lead should not exceed 0.1 per cent.
3. The spelter should be free from cadmium.
4. It is possible to obtain sound castings from less pure metal, but can only be accomplished by making them excessively heavy.

In conclusion I wish to express my indebtedness to Henry E. Morse, who has carried out all of the experiments on castings, making the alloys, the castings, and doing the metallographic work in connection with them in the most satisfactory manner.

Use of Herringbone Gears to Drive Hardinge Mills

'Steam Stamps from the Gold Miner's Point of View' was discussed by Algernon Del Mar in the *Mining and Scientific Press* of October 3, 1914. The regrinding mill of the Calumet & Hecla company was discussed, mainly in connection with the Hardinge mills. Mr. Del Mar further states that probably he did not make the point clear that the saving of from 10 to 15% in power for driving the Hardinge mills was from the use of herringbone gears direct from the motor shaft to the cone, instead of the usual countershaft drive by belt or silent chain. The accompanying halftone shows a mill driven by motor with Wuest herringbone gears. If this saving can be made on a Hardinge, the natural question is why this style of drive gears has not been used for driving a cylindrical mill. The usual belt drive is not effective when the reduction in size of pulleys is greater than 6 to 1, while the herringbone gear is effective to a reduction of 20 to 1, or greater. By this means the loss



AN 8-FT. HARDINGE MILL WITH WUEST HERRINGBONE GEAR DRIVEN BY A 50-HP. WESTINGHOUSE MOTOR.

of power due to slipping belts, and the friction in at least two bearings, is dispensed with, irrespective of the gain in floor space, and the advantage of having the motor and tube-mill on one foundation. In a recent description of one of the large mills, the statement was made that the belt drive on the tube-mill was entirely satisfactory, which does not mean that it was satisfactory as to the power consumption, but that it gave no trouble in turning the mill. The tests made in the Lake Superior mills included belt-driven and ordinary straight gear-driven machines. The herringbone gear proved superior to all others.

Stabilization of the Copper Market

By C. S. BURTON

The abnormal conditions prevailing in the copper market since the outbreak of the war in Europe have been much like those in cotton. Like the chief product of the South, copper is turned out largely for foreign consumption, perhaps too largely so. In a larger sense, the foreign demand for copper has wrought a market condition that is bad from the point of conservation of our country's natural resources, particularly in such a source of wealth as copper, which cannot be replaced. The past decade and a half has seen copper production undergo a tremendous transformation, almost wholly by reason of advances in metallurgy. The primary result of such forward steps in the recovery of metal from low-grade orebodies has been the investment of huge sums in reduction works and the formation of great organizations, predicated upon the winning from the earth an amount of copper possible only by the handling of immense tonnages at a minimum of cost.

Necessity for Continued Production

The unfortunate feature of such development lies wholly in the fact that such huge plants must be kept going and the organizations must be held together. In other words, shut-downs and curtailments, common enough in mining ventures of the ordinary type are quite out of the question with the low-grade milling coppers. The advantages gained by the immense production are to be considered, to be sure, but the deplorable feature of the situation is that the lion's share of the profit, aside from that to the mining companies themselves, has been reaped not by our own consumers, but by foreigners.

The copper metal market has always been an attractive field for the man with both daring and money; it has been the scene of more than one big attempt to control the world's supply, and up to a few years ago, the price of copper was one of the most uncertain of earthly things. When it became plain that the huge output of copper could not be maintained without some stability of market, strong hands took control and by tacit understanding have since prevented the accumulation of any threatening surplus. Notwithstanding such efforts, however, there has existed and still exists an economic weakness in the copper situation in that the huge units of production, each seeking to make the most of its own opportunity by carrying a peak load all the time, cutting down its interest charges, and extracting and marketing its product in the least possible time, have kept the world's demand supplied constantly to a point just short of saturation. This condition has redounded to the advantage of the foreign buyer much more than it has to the domestic consumer. Put another way: the home manufacturer has come in on rising prices for metal, the foreign buyer when the market was declining.

There have recently been unprecedented conditions in the market for raw cotton. Prices were such that the spinner could afford to stock up for months to come, and yet the great cash crop of the South has been begging for buyers. The spinner was without a 'contract' or 'future' market in which he could hedge or insure himself against fluctuation, consequently to stock up with cotton meant that he must buy outright and warehouse his purchase, bearing the entire weight of the outlay and without means of limiting or fending against possible loss. Anyone familiar with the course of business in commodities must realize how necessary it is for the cotton spinner to have a contract market in which he can hedge against whatever position he finds it necessary to take.

No Machinery for Copper Trading

In copper, there exists no such machinery, at least not on this side of the water. There is nothing to which the manufacturer can turn to protect himself, there is nothing to take up any lost motion. Domestic consumers have therefore adopted a hand-to-mouth attitude, and have evidently adopted it permanently; on the theory that it will be possible at all times to buy copper, and, in the long run it will be better business to buy, as their needs dictate, and make the price of their product accordingly, than to attempt to pick out any soft spots in the metal market, when they have to take the entire gamble upon their own shoulders. It is by no means for the domestic consumer alone, that an open speculative market in copper metal would prove attractive. As matters now stand, there is no method by which the general public can participate in any movement in copper. Purchases by the outside public would be a great stabilizing factor, when the metal threatens to reach or break through its cost of production, just as sales would act contrariwise when a threatened copper famine begins to drive prices abnormally high.

Had there been some such machinery in action during the two and a half years preceding the outbreak of hos-

tilities, it is safe to say that the copper which went abroad during that period would have cost the English and German armament makers materially more than it did. Following the panic year of 1907, there was a period during which accumulated stocks of metal assumed threatening proportions and domestic consumers felt justified in the stand that there was no necessity for buying ahead so long as the producers had to carry the burden in any event. It was not until 1911 that the producers managed to put into effect a policy of curtailment of production that was effective enough to bring our manufacturers into the field on a rising market. The year 1912 saw price conditions better than they had been in five years, and many students of the situation voiced the opinion that there would be no return to the days of cheap copper. In view of the increased shipments abroad this position was probably justified. In 1912 exports accounted for 47.5% of our production; in 1913 we sent overseas 53.1% of our output and during the first half of 1914 and up to the time when the Copper Producers' Association ceased to give out the regular monthly figures, the percentage was still increasing, averaging for the six months 59.7% of the total consumption. The weakness of the situation lies in the fact that these record-breaking shipments abroad were made on a falling market. In January of 1914, copper was around 14½c. per pound; in spite of the foreign demand the price had eased to less than 14c. in July. If there were open trading in copper, this demand for overseas trade would have had a clear meaning to some market followers, and whether it would have foretold the outbreak of the war or not, it would have told of conditions that would have justified speculative buying, such as would have marked the price up. Even today, when copper exports are increasing and millions of pounds are known to have been destroyed, there is no way for the public to participate in the legitimate movement of one of the greatest of our natural resources, a resource which bids fair to be exhausted all too soon.

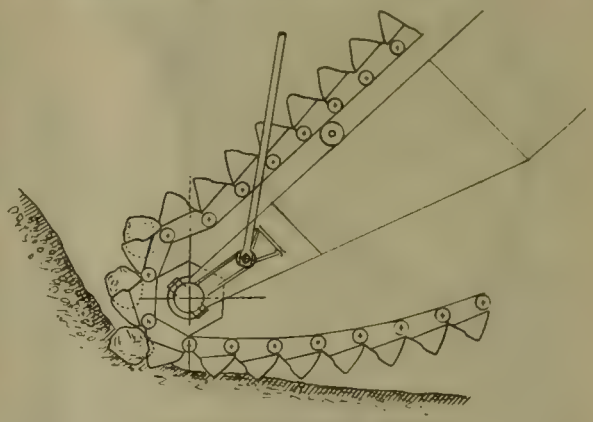
The situation in this particular regard is not unlike that of the German potash deposits, which were promptly protected by government action when it appeared that in order to keep the works going it would be necessary to make a low price and increase shipments to the United States. The ownership of copper properties is too diverse, and natural competition too strong, to permit of imagining any such emergency measure, but an open market in the metal would cause some study of copper costs, some knowledge of the actual average cost of a pound of copper would become prevalent, and a new kind of home consumption might intervene to prevent the cheapest of our metal from going abroad, and instead to force the payment of a better price; not only would the public have a chance to participate in profits in a new way in addition to holding shares in mines, to which it is at present limited, but the domestic manufacturer would have a much enlarged opportunity to become a market factor and could buy with much greater advantage, both for himself and the producer.

Handling Boulders at Andrada

By L. C. de La MARLIERE

The handling of boulders in alluvial deposits has always been considered by experts one of the most difficult obstacles in dredging, and many placers have been condemned because of the great quantity of big boulders found thereon. When the boulder is too big to be lifted by the buckets, according to size of the latter, it is usual to pass over it, or to push it in deep water. A clever winchman can accomplish this, but when it is necessary too often, dredging is not a success because of loss of time. For good dredging, all the boulders contained in the ground should be lifted, especially when they are near the bedrock, where the most gold generally is found.

Let us consider the best way in which boulders can be lifted by the buckets and be cast out. Suppose the composition of the ground to be dredged has been well tested by prospecting shafts. Drilling with Keystone or simi-



BUCKET-LINE PICKING UP BOULDERS.

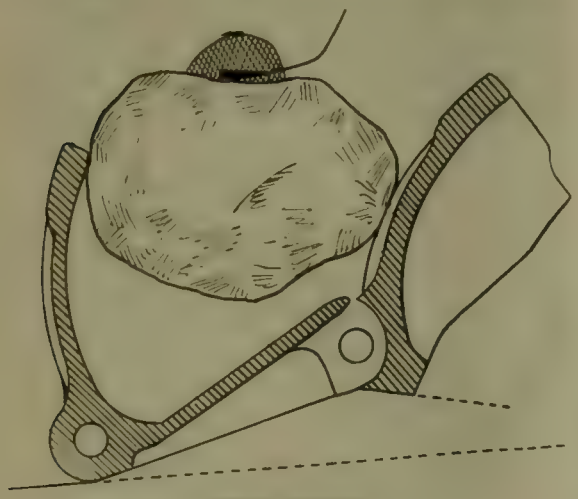
lar machines, while quite adequate in certain ground, is not accurate enough in deposits containing big stones and boulders. The size of the buckets should be decided according to the average size of the boulders. If these are correctly designed, a close-connected chain will easily lift boulders and without damage to the buckets. This statement must be insisted upon, as the partisans of the open-connected chain have long contended that the close-connected bucket-line would be a failure in ground containing many boulders. Their argument is based on the fact that if a big boulder be caught between two buckets (as they open while going around the under part of the lower tumbler) these buckets cannot close again as they reach the upper part without the bottom of the superior bucket being broken by the boulder being squeezed between this and the following one.

Contrary to what has been claimed, no damage can be done to the buckets if they are strongly built. The buckets take their place again after having gone around the lower tumbler. The boulder finds its place sometimes after having been crushed by the buckets. The worst that may happen is that the two buckets between

which the boulder is caught may open in going upward to let the boulder take its place. Furthermore the experience proves that the close-connected line is a help in that the buckets catch the boulders, acting on them exactly as a nut cracker.

In 4⅔ months, from February 10, 1914, to the end of June of the same year, the Alpha dredge of the Andrada Mines Ltd., a close-connected 7½-cu. ft. boat constructed by the Bucyrus company, and in the Portuguese territory of the Mozambique country near the Rhodesian border, has treated in a ground full of boulders, and of clay, 547,500 cu. yd. and has picked up 4400 boulders weighing on an average of over a ton each, without any serious damage to the buckets.

This argument of the partisans of the open-connected



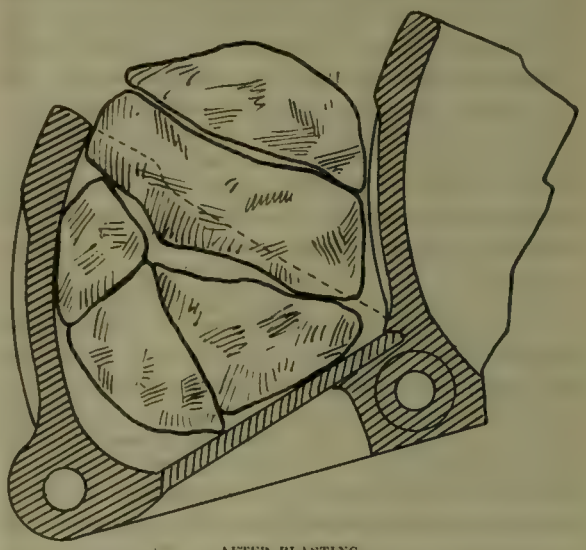
BEFORE BLASTING.

bucket, as well as all others, has therefore no real force in the actual state of perfection of the close-connected bucket-line.

Elimination of boulders from the buckets is the most delicate part of the work. The method in general use is to stop the bucket chain, and, after tying the boulder with slings, to raise it with chain blocks suspended to a moving crane, and to set it on the deck. When the boulder is very big and is squeezed in between two buckets, this operation requires at the least 10 minutes. By this method the Alpha dredge has pulled up over 200 boulders weighing an average of one ton, and the time lost has averaged just about 10 minutes per boulder. In February, however, the number of boulders found became so large that the removing of them by crane operated at first by hand and later by winch, caused such loss of time that the actual dredging fell to about 50% of the capacity of the boat. It was then that we decided to try to crack the boulders in the buckets by blasting them and to eliminate them in pieces through the screen and stacker. The method proved very successful.

A dynamite cartridge is placed on the boulder, covered with clay, and fired. The boulder is not broken in small pieces, many of which in flying might injure the dredge, but is only cracked and settled in the buckets. The action of the dynamite on the boulder is very effective, as the boulder is caught at its two extremities and not held in the middle. The force of the dynamite acts on the least resisting part, which is the middle of the boulder, and does not damage the buckets. There is no doubt that the success of this blasting is greatly due to the close-connected bucket-line and that it would not be so effective on a boulder simply laid on an open-connected line.

During March 1914 the Alpha dredge picked up 1510 boulders, fired 1544 dynamite cartridges, and lost by this method about 1800 minutes, say 60 per day or 1.2



AFTER BLASTING.

minutes per boulder. During this month the same dredge treated 131,000 cu. yd. in ground averaging 15 ft. deep. In four months the chain of 62 buckets has withstood 4600 blastings (nearly 72 blasts per bucket), and only 5 buckets were pierced in the hood. The holes, in these cases about 5 in. diameter only, were easily patched and did not interfere with the working of the line. Only 24 rivets were loosened; this, without any inconvenience to the buckets.

No accident happened to the framing, housing, or machinery of the dredge. The only drawback in blasting is that it is impossible to keep in good order the electric lamps lighting the bow of the dredge. An acetylene light should therefore be substituted for the electric light and equipped with very strong and well protected drums, or the bow of the dredge could be protected by covering the buckets, where the blasting is going on, with an iron cone easy to raise and to lower with a pulley from the winch room. The experiment of blasting boulders in buckets, which we believe has never been tried before, is very conclusive and can be undertaken without danger, providing that care be taken as to the quantity of dynamite and the best place to use it and that the work be done on buckets of sufficient strength.

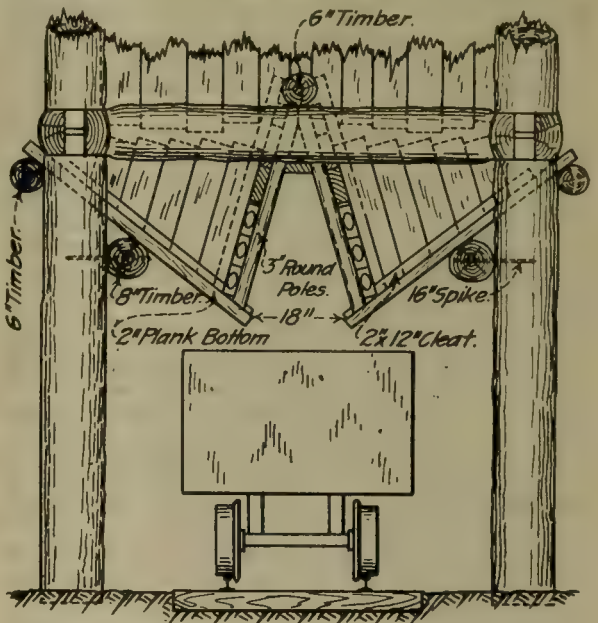
Efficiency in Michigan Copper Mines

Unlike the Lake Superior iron mines, where 'efficiency engineering' has received only fitful encouragement, the Lake Superior copper mines have given it careful and systematic attention for several years. In fact, the zeal of the copper companies for efficiency engineering became possibly a little too absorbing; for it is no secret that it was one of the indirect reasons for the long and costly Lake Superior strike. Two or three years ago, it was rumored around Lake Superior that the new efficiency campaign in progress with the Calumet & Hecla companies would save them half a million dollars or more per year. The cost of driving had been reduced 30 to 40%, and the cost of stoping 10 to 20%. At the same time, apart from the attitude of the miners who did not take kindly to the efficiency methods, the thorough tabulations of rock drilling and mining methods brought to light by the campaign were interesting. An outsider would be surprised at the detail with which the art of rock drilling was studied. For instance, the operation of cranking back a rock-drill on its feed-screw, performed three or four times for every hole drilled, was found to take a certain number of seconds under ordinary conditions. But when the crank handle was fitted with an iron ring or flywheel (like that on a large ice-cream freezer), 8 or 10 inches in diameter, it was found that cranking back took several seconds less each time. With such a flywheel, given a few swift turns, a well greased rock-drill would nearly screw itself back. In a small mine such a detail would, of course, not be worth bothering about, but with several thousand men of the Calumet & Hecla companies, it was considered worth while. In the experiments using compressed air of different pressures for running rock-drills, it did not always make a drill operate faster or hit harder to increase the air pressure. For instance, one drill of certain make and with a certain kind of valve, drilled faster with air at 70 lb. pressure than with air at 85 lb. Other rock-drills required the high pressures for best working. One drill could not stand too much air at once, and worked best with the air inlet cut down to ½ in. Water in the compressed air affected some rock-drill valves badly, and made them freeze; another type rarely froze. Rock-drills with a 'short-stroking' attachment were desired, not only for convenience in 'fitchered' holes, but for using drill-steels slightly too long for the full stroke, as often happens in changing steel, and for general desirability in starting holes. The attention given to setting up a column with its swinging arm and saddle, was also very close and several small mechanical appliances were invented to hasten that part of the miner's work. Another feature adopted by some companies is the use of ⅞-in. drill steel in place of 1⅛-in., which reduces the area of the drill holes so that with less rock to cut, the cutting goes faster, requiring, however, higher per cent dynamite in narrower sticks. On the South Range, where the Copper Range Con. mines use the 'dry-wall' method of stoping (the lodes are too flat for it at Calumet), tailing from the stamp mill is brought back in the ore cars and piped and blown by compressed air into the stopes for standing on to reach the back, in this way eking out the waste rock ordinarily used to stand on as a result of the sorting underground. It was formerly necessary to tap old stopes for additional waste or to blast it from the walls, which methods were expensive, especially the latter.

In 1909, when two-man drills were in use, the average driving per man per shift was 0.7 ft. for the Superior mine (as well as approximately for the entire copper country). In 1911, when the Calumet & Hecla had introduced one-man drills and efficiency methods in its Superior mine, where these innovations were first given trial, that mine raised this figure to 1.2 ft. per man per shift, and a little later to 1.5. Since then all the Calumet & Hecla companies have introduced the methods tried out in the Superior, as have most of the other operators also, and nearly as startling gains in efficiency have been made as was the case in the Superior.

Square-Set Ore Chute

The accompanying sketch is that of an underground ore chute on the Mesabi range. This chute has been widely adopted for the loading of cars underground and is proving most satisfactory largely because of the simplicity and ruggedness of construction. The ore is fine, soft, and sometimes wet, and is discharged from the chute



MICHIGAN SQUARE-SET CHUTE.

through the gates made of three round poles, as shown in the sketch. The timbering is of the 'round square-set' type and the construction as shown in the sketch. The chute was developed and has been adopted as standard in the mines of the United States Steel Corporation in this district.

California Metal Producers Association

The complete articles of association of the newly formed organization of California mine operators, are given below. All persons and concerns eligible to membership are invited to join.

Name.—The name of this Association is: California Metal Producers Association.

Purpose.—The purpose of this Association is to subserve, promote, and protect the interests of those engaged in mining for or the production of metals in this state and in that behalf to secure betterments in all branches of the industry; also to promote the health, safety, and welfare of miners and employees engaged therein, and to promote harmonious relations between employers and employees in said industry, and to prosecute any and all other lines of activity which may subserve the welfare of the industry and those engaged therein, as owners, operators, and employees.

Membership.—All persons, co-partnerships, and corporations of approved standing engaged in mining for or in the production of metals in this state may be admitted to membership, upon the terms, and under the conditions hereinafter set forth. Applicants for membership, upon the approval of their application and election to membership, shall become members upon signing these articles either in person or by authorized officer—or attorney in fact.

Fees and assessments.—There shall be a membership fee of $25 for those employing 25 men or more and $10 for those employing less than 25 men. Monthly dues shall be paid by the members upon the basis of the number of men employed in the mining or in the production of metals as shown by their monthly payrolls. Monthly dues shall be payable to the secretary-treasurer, at his office, on the twentieth day of each calendar month. In computing the number of men employed, the total number of shifts worked during the preceding month, as shown by each member's payroll, shall be divided by 30, and the result shall be defined as unit men; monthly dues shall be apportioned and payable on said basis of unit men.

Officers.—The officers of the Association shall be president, who shall also be chairman of the executive committee, two vice-presidents and secretary-treasurer. Said officers shall be selected annually by the executive committee immediately after the annual meeting of the Association on the fourth Wednesday of October, and the president and vice-presidents shall be members of the executive committee. The president, vice-presidents, and secretary-treasurer shall perform the duties and exercise the powers, usually required of, and conferred upon, such officers in deliberative and executive bodies.

Executive committee.—There shall be an executive committee of seven members, to be selected annually by the Association at its meeting on the fourth Wednesday of October.

Finance committee.—There shall be a finance committee of three members, to be selected annually by the Association at its meeting on the fourth Wednesday of October.

Principal office.—The Association will maintain its principal office at San Francisco, California, where the secretary-treasurer shall reside, and all records be maintained and all meetings be held.

Meetings.—The regular annual meeting of the Association shall be held at the office of the Association on the fourth Wednesday in October of each year. Special meetings of the Association may be called by the executive committee and shall be called by the secretary-treasurer upon the written request of ten or more members. Notice of the regular annual and special meetings shall be given in writing by the secretary at least two weeks before the date of the meeting. Fifty-one per cent of the membership shall be present or represented by approved proxies to constitute a quorum. The vote of a majority of those present or represented by approved proxies shall be necessary to a decision binding upon the Association. The Association may also vote and express its opinion or decision in the following manner; that is to say, after due and proper notice given by the secretary in writing, to each and all of the members of the Association, the members may cast their ballot by written United States mail vote. In that behalf it is prescribed that at least two weeks' written notice of such action shall be given by the secretary, provided that in emergency cases a less time may be prescribed by resolution of the executive committee. All mail votes shall be addressed to the secretary-treasurer, at the office of the Association. The voting power of members shall be, and is hereby prescribed to be in units, in the following manner; that is to say, each member employing 25 men or less shall be entitled to one vote; for each additional 25 employees, or fractional portion thereof over and above the initial 25 employees upon the payroll during the month preceding the date of any pending vote, or ballot, the member shall be entitled to one additional vote.

Powers and duties of the executive committee.—(a) At all times while the Association is not in session, the executive committee shall, and it is hereby authorized, empowered, and instructed, to exercise the whole power of the Association.

(b) A majority of the executive committee shall constitute a quorum. A majority of the quorum shall be necessary to form any decision, or pass upon any question, binding upon the Association. A written protest by two members of the executive committee upon any question, which said protest shall be lodged with the secretary-treasurer not later than three days after casting of the vote complained of, shall have the effect of suspending the operation of such action of the majority of the executive committee, until said action of the majority shall be ratified by the vote of a majority of the members of the Association. The vote of the members of the Association shall be cast by United States mail vote or by telegraph vote. The secretary-treasurer may prescribe whether said vote shall be by mail or telegram, and likewise shall prescribe the time allowed for casting such vote, provided that the time allowed for vote by mail shall not be less than seven days nor more than twenty-one days, and if by telegraph not less than three days nor more than six days.

(c) The executive committee shall select one of its own number to act as chairman in the absence of the president and vice-presidents.

(d) Sessions of the executive committee shall be attended by the secretary-treasurer, who shall keep a record of the proceedings of the committee and shall, quarterly, send an abstract of the executive committee's proceedings to all members of the Association, and at such other times as directed by the executive committee. In the absence of the secretary-treasurer, the executive committee shall select one of its own members as secretary pro-tem.

(e) The sessions of the executive committee may be held at San Francisco, California, or at any other place designated by the chairman of the executive committee. Such meetings may be held at any time upon ten days' written notice given by the secretary-treasurer, provided that a less time may be given in cases of emergency, either by the secretary-treasurer, or by the chairman of the executive committee. Notice shall be given either by letter, orally, or by telegram.

(f) The executive committee shall have power to fill any and all vacancies in its own body when the Association is not in session.

(g) The executive committee may be sub-divided into sub-committees. The executive committee shall determine the

number, the name, and the duties of such sub-committees and may create and abolish such sub-committees at will. The actions of the sub-committees shall not be binding upon the Association until ratified, approved, and adopted by the executive committee.

(h) The executive committee at large shall be and is hereby constituted a membership committee. As such membership committee it may prescribe the qualifications, not in conflict with article III hereof, and the credentials desirable and expedient for membership in this Association, and shall pass upon the applications for membership. No applicant shall be elected to membership until the name of said applicant has been mailed to each member of the Association and two weeks' time allowed for receipt of objections. An affirmative vote of four members of the executive committee shall be necessary to admit to membership.

(i) The executive committee is vested with full power and authority to prescribe and administer the finances of the Association. The executive committee shall determine the total aggregate of any and all regular assessments, necessary to be levied and assessed for the prosecution of the Association's business and purposes for any month, and may also levy, assess, and collect any and all special assessment whensoever any necessity or occasion may arise for such special assessment.

(j) The executive committee may act by United States mail vote in the same manner as hereinbefore prescribed for the action of the Association at large, providing that in cases of emergency the notice of the mail vote may be given upon such time as the chairman of the executive committee may prescribe, such notice to be given either by United States mail or orally, or by telegram. The executive committee may vote by telegram.

(k) The executive committee may from time to time amend these articles, and prescribe any and all further rules and regulations for the conduct and government of the Association and of the executive committee, as may, in the judgment of the executive committee, from time to time appear necessary, advisable, or expedient, all amendments being in force until disapproved by a meeting of the Association.

Delinquencies, expulsions, and withdrawals.—No member shall have a right to participate in the deliberations of the Association or vote on any matter while in arrears for dues for 30 days; any member may be expelled upon two-thirds vote of those voting thereon after a 30 days' notice by the secretary, and a vote thereon shall be by mail. A member may withdraw by resignation directed to the secretary, dues first being paid.

Amendments.—These articles of association may be amended by a two-thirds vote of those present in person or by proxy at any regular meeting of the Association or at a special meeting of the Association called for the purpose of making such amendment or amendments.

AN EXPLOSION in what is known as Ralph's mine of the Taupiri Coal Co., operating a coal mine near Auckland, New Zealand, entombed 59 men, in the second week of September. Of these, 19 escaped, but one has since died. The workings were quite free from gas, and naked lights were always used. The drifts and other workings are partly under the Waihato river.

THE CAM & MOTOR MINE, Rhodesia, produced 11,870 tons of ore yielding $80,200 in September. The recovery was 65.3 per cent.

STONE QUARRIED in the United States in 1913 was valued at $83,132,995, an increase of 7% over that of the previous year.

Artificial Respiration

The U. S. Bureau of Mines has been studying the various methods of inducing artificial respiration suitable for use in mines when men are overcome by electric shock or by gas. A committee consisting of Dr. W. B. Cannon, chairman, professor of physiology, Harvard University; Dr. George W. Crile, professor of surgery, Western Reserve University, Cleveland, Ohio; Dr. Joseph Erlanger, professor of physiology, Washington University, St. Louis; Dr. Yandell Henderson, professor of physiology, Yale University; and Dr. S. J. Meltzer, head of the department of physiology and pharmacology, Rockefeller Institute for Medical Research, has reported the following recommendations. As these not only apply to men who are overcome by electric shock or gases in mines, but also to persons suffering from the effects of illuminating-gas poisoning or from electric shock anywhere, they are of importance to many thousands of workmen.

In case of gas poisoning, remove the victim at once from the gaseous atmosphere. Carry him quickly to fresh air and immediately give manual artificial respiration. Do not stop to loosen clothing. Every moment of delay is serious.

In case of electric shock, break electric current instantly. Free the patient from the current with a single quick motion, using any dry non-conductor, such as clothing, rope, or board, to move patient or wire. Beware of using any metal or moist material. Meantime have every effort made to shut off current.

Attend instantly to the victim's breathing. If the victim is not breathing, he should be given manual artificial respiration at once. If the patient is breathing slowly and regularly, do not give artificial respiration, but let nature restore breathing unaided.

In gas cases, give oxygen. If the patient has been a victim of gas, give him pure oxygen, with manual artificial respiration. The oxygen may be given through a breathing bag from a cylinder having a reducing valve, with connecting tubes and face mask, and with an inspiratory and expiratory valve, of which the latter communicates directly with the atmosphere. No mechanical artificial resuscitating device should be used unless one operated by hand that has no suction effect on the lungs.

Use the Schaefer or prone pressure method of artificial respiration. Begin at once. A moment's delay is serious. Continue the artificial respiration. If necessary, continue two hours or longer without interruption until natural breathing is restored. If natural breathing stops after being restored, use artificial respiration again.

Do not give the patient any liquid until he is fully conscious. Give him fresh air, but keep his body warm. Send for the nearest doctor as soon as accident is discovered.

THE ST. JOHN DEL REY MINE, Brazil, produced $183,000 from 16,000 tons of ore in September.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Rand Banket

Reply by Mr. Horwood to J. W. Gregory's Discussion Dated Glasgow, May 5, 1914

In his cleverly worded discussion[1] Professor Gregory re-asserts the old arguments embodied in his paper read in London in 1907, before the Institution of Mining and Metallurgy on 'The Origin of the Gold in the Rand Banket.' This paper, as he admitted, was the result of his observations during a brief visit to the Rand in 1905, and of information and ideas obtained second-hand on that occasion. My difficulty in replying clearly and concisely lies in the fact that not only has he either not read my paper carefully, or he has purposely ignored much of the evidence there advanced, and consequently much of it has to be re-stated; but also he brings forward the same arguments that he used in his paper, quite regardless of the fact that many of them that he now uses were shown in the discussion at the time by admittedly competent authorities to be untenable. Further, his theory is what one might term a 're-solution theory.' That is, that while the gold was originally alluvial, it has since been subjected to solvent influences, and been re-distributed in the banket. Thus mere arguments against the alluvial theory and in favor of the infiltration theory can sometimes be fairly well answered by the re-solution theory. On the other hand, I think most of my readers will admit that the actual evidence points unmistakably to a lode origin. Destructive criticism in the form of expressions of personal opinion unsupported by scientific evidence helps no one, and Gregory brings forward no new evidence in support of his placer theory. Alluding to the infiltration theory, he ends his discussion by stating that it "introduces the gold from a hypothetical and improbable source, along solution channels of which we still have no evidence, and, according to Mr. Horwood's version, at a date long after the banket had received its gold." In his paper he made the statement that it is only when the ores can be traced to fissures through which the solutions have come, that the evidence for infiltration is accepted as conclusive; and that no such fissures are known on the Rand. In my treatise, one of the points upon which I lay great stress is that the auriferous bankets differ in no important essentials from ordinary gold-quartz lodes, the gold having been derived from the barysphere or deep region that is admittedly the primary source of the heavy metals. The numerous and extensive fault-planes and longitudinal dikes that intersect the bankets mark the site of fractures, communicating with great depths. When discussing Gregory's paper and his reference to verticals in the case of the silicious gold ores of South Dakota, W. McDermott pointed out that on the Rand the connection with deep-seated sources of gold was provided by the 'reefs' themselves, as with ordinary fissure veins. After marshaling my evidence, I expressed the opinion that the facts indicated that the genesis of the gold, of the pyrite, and of the carbon in the bankets of both Witwatersrand and Black Reef age in the Southern Transvaal, and also of the bedded quartz veins in the Black Reef and Dolomite formations of the Northern Transvaal, could be satisfactorily explained on the assumption of one period of mineralization, and that the gold was introduced after, or during, the time when the Dolomites were being laid down. Gregory ends his argument by the statement that this date was "long after the banket had received its gold." He does not attempt to prove this, it is merely his opinion based on his statement that "lumps of auriferous banket occur in the Black Reef conglomerates;" and this, he thinks, seems to contradict my conclusions.

The Black Reef conglomerate is in the Black Reef formation, which occurs at the base of the Dolomite formation. Formerly, in places, it was mined, as it sometimes carries gold, and may then be termed auriferous banket. However, I imagine Gregory (disregarding the Elsburg conglomerates that are placed by some in the Ventersdorp system and by others in the Witwatersrand system) refers to lumps of banket, stated to be auriferous and assumed to have been derived from the Witwatersrand banket, reported as occurring in the Ventersdorp series that underlies the Black Reef formation. I maintain that the evidence to date indicates that the Rand banket owes its gold directly or indirectly to the longitudinal dikes, and that the latter are genetically related to the Klipriversberg amygdaloidal diabase, which is of Ventersdorp age. If some of the Ventersdorp breccias or conglomerates (other than the Elsburg) do actually contain boulders of Witwatersrand banket that are auriferous, the gold in these boulders may represent fragments torn from the banket beds during the irruption of igneous rock, either after that phase of the Ventersdorp period when the main mineralization occurred, or, if before, their gold may be directly due to the Ventersdorp diabase; if it be maintained that they are water-worn, and if they are, then they may have been derived from the disintegration and denudation of

[1] My reply to Gregory's discussion dated May 5, 1914, has been unavoidably delayed owing to illness.

the Witwatersrand beds during some portion, later than the mineralization phase, of that long drawn out time of volcanic and eruptive activity that characterized the Ventersdorp period.

Gregory admitted that pyrite is so easily oxidized and so brittle that its occurrence in the form of pebbles in a placer deposit was highly improbable, and that he had not seen any in such a deposit; but, that when he was on the Rand, he realized that some of those in the banket seemed to owe their form to attrition, and from their shape he concluded that they were pseudomorphic after black iron sand, as he argued, that their arrangement agreed with that of the black iron sands in modern placers, and he instanced those of New Zealand, along the west coast of the South Island: These conclusions were dealt with in the discussion on his paper. S. H. Cox stated that he was acquainted with the auriferous black sands of New Zealand, and he failed to see any resemblance between the conditions there and those on the Rand. S. J. Speak pointed out that Gregory accounted for the conversion of black iron sand into pyrite by the agency of sulphuretted hydrogen from the decomposition of organic matter, and the precipitation of the gold and pyrite by the action of water containing oxygen on the pyrite, producing ferric sulphate that dissolved the gold, and the solution encountering fresh reducing matter. As he pithily said, Gregory summoned to the assistance of his theory sulphur and oxygen *ad lib.* and reducing and oxidizing agencies as he desired; and Speak showed that even if the organic matter contained as much as 4% of sulphur, the same thickness of organic matter as of banket would have been necessary, and aptly asked what had become of the carbonaceous matter, and the space once occupied by this organic matter; also, whence were the oxygenated waters derived? J. Malcolm Maclaren said that one of the cardinal features of Gregory's paper was his supposition that the pyritic seams associated with the banket represented original marine black sand, consisting presumably mainly of magnetite and ilmenite; but that as these minerals were extremely stable their direct replacement by pyrite was certainly highly problematical, and that such alteration would appear to be possible in nature only by way of an intermediate hematite stage. He also emphasized the fact that though Gregory advocated the alluvial theory, he also employed the impregnation theory to bring the gold again into solution, and consequently, to validate his assumptions, the alluvial gold must have been re-deposited in the same place from which it had been dissolved. R. Beck confessed that the hypothesis that all the iron ore had been changed into pyrite in the banket seemed very improbable, and, if it had, surely some portion of the beds could be found in which such gigantic pseudomorphic processes would not yet have taken place. David Wilkinson,[2] discussing the occurrence of gold in the pyritic quartzites, informed me that many years ago he examined these quartzites carefully in the Wolhuter mine and found that while often the pyrite occurred in layers parallel to the bedding, in many other cases it occurs irregularly across the bedding, and he considers it undoubtedly due to infiltration. He contends that it cannot be due to sedimentation on account of its form. Some of it, in places, yields from 10 to 15 dwt. gold per ton. G. F. Becker, in order to explain, on the placer theory, the presence of the pyrite in the Rand banket, suggests that the magnetite of the black sand may have been in part converted into pyrite by the sulphur-bearing solutions accompanying the intrusion of the dikes.[3] Since I have shown that the latter contain appreciable amounts of gold, pyrite, and carbon, and since the dikes communicate directly with those regions that are the original source of the metals, if one invokes their agency at all, is it not more reasonable to conclude that the gold, pyrite, and carbon at all events for the most part, are derived from them?

Most impartial critics will probably admit, as W. Lindgren and J. F. Kemp have done, that I clearly demonstrated that the pyrite had replaced quartz pebbles and quartzite pebbles, and also the matrix of the banket, and these can be found in all stages of replacement. At the same time I dealt fully with the question of the shape of the pyrite pebbles. Gregory speaks of some of the pyrite nodules as 'concretions.' I very fully discussed this point, in my paper, and showed that to state that they are concretions merely leaves the problem where it was before, and I proved that the so-called pyrite pebbles occur not only as metasomatic pseudomorphs, but also, be it noted, as metasomatic concretions.

The analogy that I drew between the pyrite and flint nodules was not one of genesis, but one merely to illustrate the influence of existing lines of least resistance in determining where the greatest deposition will occur. In the particular Crown Reef case under discussion the evidence indicated that deep seated solutions ascended through fractures and along lines of weakness, now marked by the intrusion of a dike, and spread out laterally through a conglomerate bed, that immediately overlaid an impervious shale band, and there deposited their mineral contents; while in the chalk the solutions (which in this case had derived their silica from organisms that already existed in the beds) have flowed along horizons coinciding with the bedding-planes, as these offered easy passages for maximum circulation, and they there precipitated their silica in the form of flint.

C. Baring Horwood.

London, September 22.

(To be Continued)

[2]In this reply to Gregory's discussion the various references to information given me by David Wilkinson are from a letter written by him to me from Johannesburg and dated July 24, 1914. He had read my treatise on the Rand banket, and this letter was written just after he had read Gregory's discussion on my paper. I take this opportunity of thanking him for placing at my disposal the valuable evidence he had carefully collected during a number of years spent on the Rand.

[3]U. S. Geol. Surv., Ann. Report, 1896-97, Part V, p. 174.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

LABOR EMPLOYED at Panama canal, including 4059 on the railroad, totaled 28,883 on August 26, compared with 32,437 on July 22.

COST OF SINKING a two-compartment shaft 595.3 ft. at the Rock Island Coal Mining Co.'s mine, Hartshorne, Oklahoma, totaled $15,264, or $27 per foot. The cost varied from $13.14 to $50.51 per foot. The country passed through was generally slate, and the two 6 ft. 2 in. by 8 ft. 6-in. hoistways were sunk in 199 days.

BRONZE FIVE-CENTAVO PIECES are now being coined in Mexico City by the Constitutionalist authorities. The composition of the coin is decreed as follows: copper, 95%; tin, 2.5%; and zinc, 2.5%, with an allowance of 1% in all these metals. The coin is 28 mm. diameter, and weighs nine grams. A nickel coin may also be executed.

CULM, or coal refuse, produced in mining anthracite, amounts to about 25% of the output of this coal. A large tonnage of good material has been recovered from the culm piles, while more has been flushed back into the mines for filling old workings. In 1913, the International Acheson Graphite Co., of Niagara Falls, produced about 7000 tons of graphite by the use of electricity on coal, 8750 tons of culm being consumed in the work.

CRANEMEN in foundries, when handling maximum loads, particularly ladles of molten metal, should test hoist brakes after a load has been lifted a few inches; if brakes do not hold, the load should be lowered at once and the brakes adjusted or repaired. If hoist brakes refuse to hold while the crane is handling molten metal, it may be necessary, in order not to interrupt the pouring operation, to sustain the load by short upward movements of the hoist, to counteract settling of load.

MANY MINERS are careless in handling explosives. The following 'don'ts' should be remembered: miners resting should not smoke in a place used as a powder magazine; crimping a 'cap' with the teeth is very dangerous; hatchets or cold chisels should not be used to open a box or keg; in carrying dynamite in a sack, a miner should not carry capped fuse in the other hand; do not punch a hole in a cartridge with a candlestick attached to a lighted carbide lamp; dynamite must not be thawed by placing sticks inside a shirt. In United States metal mines in 1912, 427 men were killed and injured by explosives.

THE COPPER PRODUCT of Michigan is largely native, and is considered for some purposes superior to electrolytic copper. 'Lake' copper, as the product of Michigan is generally known in the trade, sells generally at about a quarter of a cent per pound above other coppers. The mining of copper in Michigan is of prehistoric origin, the metal having been used by the North American Indians before the advent of the white man. The development of copper mining, however, began in 1845, and since that date to the close of 1913 the production has amounted to over 5,335,000,000 lb., or about 30% of the total output of the United States. The total output of Montana to the end of 1913 was about 6,200,000,000 pounds.

CURIOSITIES in the shape of old stamp-mills are still left standing in various parts of the world, and excite considerable attention. The accompanying halftone, from a photograph taken by O. F. Heizer, of the Argo Reduction & Ore Purchasing Co., shows an old dis-

OLD STAMP-MILL NEAR IDAHO SPRINGS, COLORADO.

mantled plant up Trail creek on the road to Freeland, about three miles from Idaho Springs, Colorado. Close inspection of the picture will reveal some peculiar features in the battery. It will be noticed that the order of drop of the stamps is 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and that the stems are upset and threaded, and the tappets screw onto them; also that the upper end of the stems show a thread which engages a similar thread in the boss-heads. Mr. Heizer cannot remember ever having seen or even heard of any similar arrangement, and thought it might be a matter of interest to readers of the *Press*. Tappets screwed on to the stems were very common in early Australian mills, in fact, numbers are still at work in certain old districts.

KLONDIKE RIVER, MAY 6, 1914, AND CANADIAN-KLONDYKE No. 4.

MINING IN THE FAR NORTH*

Operations of the Canadian-Klondyke Gold Mining Company, Ltd.

By EMIL EDWARD HURJA

One 71-ft. and three 16.1-ft. dredges are working on holdings of the Canadian-Klondyke Gold Mining Co., Ltd., in the Klondike, with prospects of two more 16.1-ft. boats to be added during the next two years.

Perhaps the most interesting development by the Company is its system of ditches, which last year permitted the dredges to operate until December 26, despite the cold weather. The boats kept on working because of the admirable power facilities which the Company developed at its plant on the north fork of the Klondike river. The ditches total 60 miles in length. Their width varies from a minimum of 30 to a maximum of 70 ft., and can carry 30,000 inches of water. The power-house is 30 miles from Dawson.

The particular method taken to permit operation of the hydro-electric plant the whole year round was conceived by J. W. Boyle. About the time when power plants in the

*[Previous articles in this series by Mr. Hurja on mining in Alaska and the Yukon have been 'Mining Revival in the Ketchikan District, Alaska,' July 4; 'Wrangell, Alaska,' special correspondence, July 11; 'Developments of the Alaska Gold Mines Co.,' July 18; 'Juneau, Alaska,' special correspondence, July 25; 'Cordova, Alaska,' special correspondence, August 8; 'Valdez and Prince William Sound,' August 15; 'Seward and the Kenai Peninsula,' August 29; 'The Koyukuk Mining District,' September 12; 'Operations of the Yukon Gold Company,' October 10. Mr. Hurja in subsequent letters will give full accounts of present conditions in each of the great producing districts of the Far North.—EDITOR.]

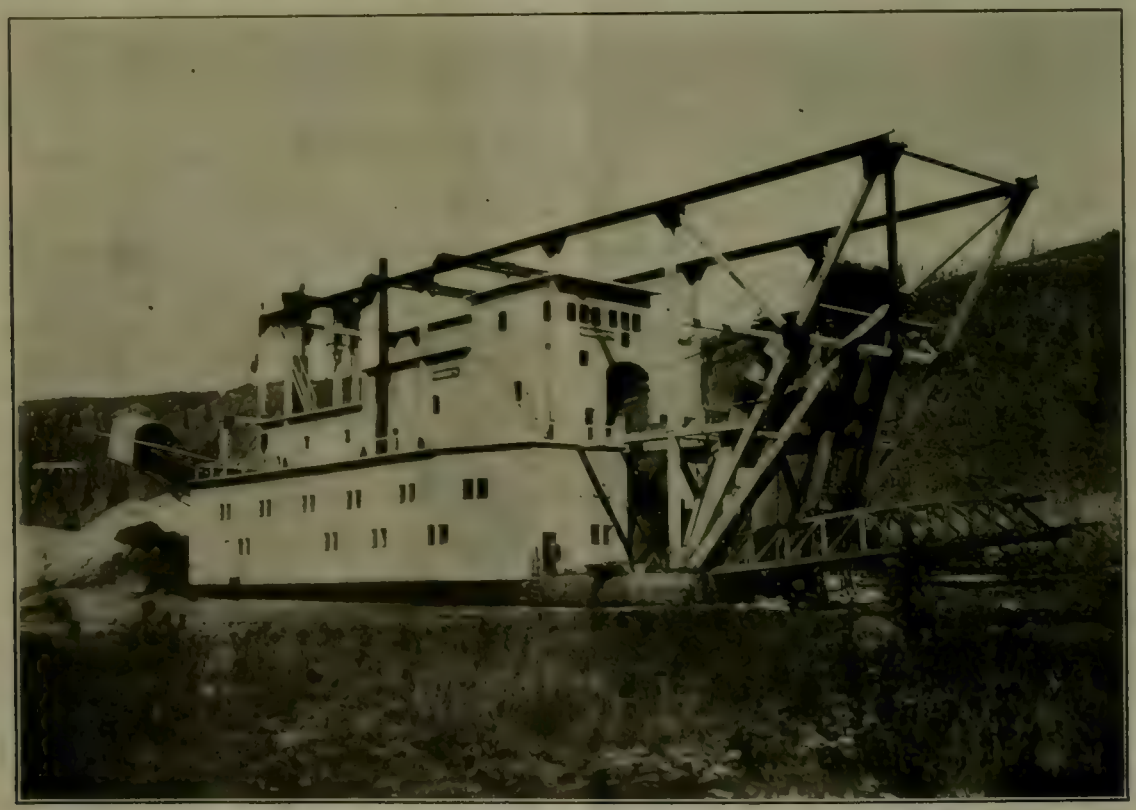
Klondike usually close, the ditch was flooded to its capacity for a few days. The cold weather caused a sheet of ice to form across the top of the ditch. Then, after the covering had attained sufficient thickness, the water was lowered to its normal level. Three electric heaters were placed at intervals in the ditch, and the water was kept sufficiently warm to prevent freezing. In addition to supplying the dredges with power, the town of Dawson draws its current from the Boyle plant. The maximum capacity of the plant is 10,000 hp. It was built in 1910. Power is supplied by the Canadian-Klondyke Power Co., 51% of the capital stock of which is owned by Mr. Boyle, 29% by the Granville mining company, and 20% of which is not issued.

During January 1913 the temperature for seven days did not rise above 68 F. below zero, and as the power-plant was not forced to suspend operation during that time, the success of the ditch-freezing scheme cannot be questioned.

At the mouth of Bonanza creek, a transformer plant with two 1875-kw. transformers and an electrical repair-shop have been built. From this plant, the electric truck used by the Company in its freighting work around the claims is charged.

The area owned by the Company is extensive. The principal holding is known as the Boyle concession, which takes in all of the valley of the Klondike river from summit to summit for a stretch of 6¾ miles, from the mouth of the Hunker to the mouth of Bonanza. Three miles of ground on the upper end of Eldorado creek, worked in the earlier days of the Klondike by crude methods, remains to be reworked by dredging. Partly by ownership and partly by agreement, the upper five miles of Hunker creek is being worked. The Company also owns five dredging leases, taking in the first 15 miles of the Klondike river as well as five miles up and five miles down the Yukon river from the mouth of the Klondike.

The 7½-ft. Marion dredge was the first built. As the result of the experience of this dredge, which started work



No. 4, A MARION, 16.1-CU. FT. BUCKET DREDGE.

August 14, 1905, now on upper Hunker. Joseph W. Boyle planned the 16.1 ft. dredge. The big dredges, which are among the largest in the world, were first conceived in 1909. Canadian No. 2, the first, began operation in November 1910.[1] Orders for No. 3 and No. 4 were placed in 1912, and they started work in May 1913. No. 1 is at present on upper Hunker, the others in the valley of the Klondike river, No. 2 below the mouth of Bear creek, No. 3 inside the city limits of Dawson one-half mile from the mouth of the Klondike, and No. 4 opposite the mouth of Bonanza creek, 1½ miles above No. 3. The machinery of the big dredges was built by the Marion Steam Shovel Co. The wearing parts of Nos. 2, 3, and 4 have been standardized, and parts are renewed to last through the 270-day working season.

Construction Details

The 16.1-ft. dredges have hulls 136 ft. long, 56 ft. 8 in. wide, with a deck overhang on each side of 6 ft. The depth at the bow is 14 ft. 6 in.; at the stern, 12 ft. Lumber used in construction of the hull totals 750,000 ft. Entire control of all dredge machinery is centred in the winch-room, which is connected with every other part of the dredge by an electric bell system. All wires run through conduits. A transformer reduces the current from 2200 to 110 volts and makes possible a complete electric lighting system. Two pumps are operated by General Electric induction motors of 150 hp. Motors operating other parts of the dredge machinery are as follows: Main drive, 300 hp.; ladder hoist, 200 hp.; screen drive, 150 hp.; stacker hoist, 50 hp.; stacker belt drive, 50 hp.; winch motor, 50 hp.; fire pump, 35 hp. All motors are 2200-volt, General Electric make. Oil switches are all encased in steel boxes, with steel pans under them large enough to contain all the oil from the switch.

A 20-ton traveling crane travels 16 ft. beyond the bow of the dredge, picks up machinery and parts for the dredge with ease from the bank. Hatches are in the roof, making it possible to lower machinery easily into the hull. The bucket-line has 68 buckets, each with a capacity of 16.1 cu. ft. The buckets weigh 4600 lb. each. They travel at the rate of 21½ per minute. Boulders weighing from 500 to 600 lb. are carried with ease.

The dump box has in it two 2-in. nozzles and one 3½-in. nozzle, opening into a revolving cylindrical screen weighing 80 tons, 50 ft. long and of 9 ft. 9 in. diameter. Thirty-five feet of the screen is perforated. Suspended through the cylinder is a 14-in. pipe, discharging water through two rows of 1-in. perforations. The water is supplied by a 14-in. high-duty Morse centrifugal pump.

Water for the sluice tables on both sides of the screen is supplied by a 16-in. Worthington centrifugal pump, discharged through pipes running along the heads of the tables. There are 15 tables on each side, inclined 1½ in. to the foot, each having a width of 30 in. and a length of 42 in. Saving of gold is effected by cocoanut mat and expanded metal riffles followed by angle iron riffles. The mats catch 95% of the gold. They are replaced with clean ones each morning when the dredge stops to permit of oiling the lower tumbler. The stacker is 120 ft. long, has a belt 48 in. wide, and travels at the rate of 180 ft. per minute. Waste from the screen is handled by two sluiceways, one on either side of the dredge.

Anchors are two in number, each 65 ft. long and weighing 32 tons. The ladder is lowered two feet at a time when digging is going on in the upper gravels until within three feet of bedrock, then one foot at a time to bedrock, then 6 in. at a time while in bedrock. Most of the gold occurs from three feet above bedrock to five or six feet in bedrock.

In order to keep the dredges free from ice during the cold weather, a canvas-covered square box compartment encloses the stacker belt. The compartment is heated with steam coils. A 60-hp. boiler is housed in a steel and asbestos-lined room forward in the hull, so arranged that it can be flooded with water in an instant in case of fire. One room has been provided on each dredge as a rest and lunch room, equipped with electric stoves and toasters, so that employees can have hot lunches without inconvenience. Mr. Boyle estimates the cost of each 16.1 ft. dredge at $175,000.

Life of the ground in sight for the dredges is estimated at 18 years, not counting holdings outside of the Boyle concession. The down-stream four miles of the concession has been thoroughly prospected. Holes have been put down at 100-ft. intervals up and down stream, and at 200-ft. intervals across the valley floor. Work of prospecting the upper 2¾ miles of the concession is in progress now. A No. 3 Keystone drill and shafts are used in prospecting. Crews in charge of the work put down three shafts at a time. Prospects shown up so far this year have been as good as the ground already proved. The four miles of ground prospected is estimated to contain 150,000,000 cu. yd. of gravel, with an average value of 22c. per cu. yd.. If present indications are borne out by further prospecting, orders for the machinery for one or two new boats will be placed this year, for shipment during the summer of 1915. These dredges will start digging in 1916.

Operation up to this time has shown a recovery of 25c. per yd. in Klondike valley, at a working cost of 6c. per yd. The major part of the cost comes in the stripping work, which is being carried on three years ahead of the actual operations. The sandy loam, layers of black 'muck,' and timber are stripped off by ground-sluicing and the use of a 1½-ft. Marion steam-shovel. In 1904 all the Klondike Valley gravels were frozen. The output of each of the three big dredges averages 10,000 yd. per 24-hour day. No. 2 dug 100,000 yd. in a single week, and recently established a record for a single day's work of 14,411 yd. This was under very favorable conditions.

On Hunker creek, steam thawing has been resorted to in order to keep the 7½-ft. dredge in ground. For several years past ground has been stripped ahead of it, and after next year no more steam thawing will be necessary.

At the mouth of Bonanza creek, a mess-house and bunk-house and other buildings for the crews of dredges No. 3 and 4 have been built. The crew of dredge No. 2 is housed at Bear creek, and of No. 1 at Hunker. Considerable *esprit de corps* has been developed among the Boyle employees. During the summer, the dredge crews form baseball teams and compete with each other, while curling clubs are formed in winter.

The Canadian-Klondyke Mining Co., Ltd., purchases all its supplies for the different mess-houses from Dawson merchants. Mr. Boyle says that excellent treatment is obtained and immediate redress is had where merchandise is unsatisfactory. The confidence and good will of Dawson people is due in a measure to this treatment by the Company.

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[1][No. 2 dredge of the Canadian-Klondyke company sank during the second week of October. It will be out of commission for the remainder of the season.—Editor.]

According to T. A. MacLean in his work, 'Lode Mining in Yukon,' published by the Department of Mines, Canada, the geology of the Dawson district is complicated, and rock formations are found ranging in age through the greater part of the geological scale, and exhibiting varied structure and composition. In many instances it is nearly impossible absolutely to classify certain formations, on account of gradual alteration of massive igneous rocks into schists, and clastic rocks into the appearance of igneous rocks. The Klondike and allied series are the most important, the principal rock being a light-green sericite schist. Practically all the gold-producing creeks occur within the area occupied by these schists, while the quartz veins, so far disclosed, lie generally along the slopes and ridges of the hills, which form the divide between the different water courses.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

NEW YORK

FURTHER NOTES ON THE EXPORT OF COPPER.—THE NICKEL INDUSTRY.—RUSSIAN COPPER MINES.—REOPENING THE YELLOW JACKET MINE, LEMHI COUNTY, IDAHO.—F. A. HEINZE.

The principal sellers of copper have been making strong protests at Washington, in an endeavor to get our government to take some official action in regard to the numerous cargoes of copper which have been held up by the British government. The cost of shipments to the Mediterranean ports is already more than double, and several of the lines will not accept shipments at any rates. If England maintains her present attitude, about the only markets left for the American producers will be those of France and England, both of which must be pretty well stocked by this time. The American Metal Co., American Smelting & Refining Co., United Metals Selling Co., and the Consolidated Metals Co. are taking united action, and it has been proposed to charter their own ship and make a strong effort to get the United States government to protect this from seizure. It is doubtful whether it will be possible to secure any very strong action on the part of the State Department. So far no definite assurance has been received. Meanwhile, exports of copper have remained at a fair figure.

The Russian copper companies have not decreased their output. The Kyshtim corporation reports that during the four weeks ended August 15, 734 long tons of refined copper was produced by the refinery. During the same period the smelters smelted 25,779 tons of ore yielding 538 tons of copper. The ore smelted averages about 2½ to 3½% copper.——The Spassky company produced 350 tons during the month ended October 13.——The Sissert output was 72 tons in the month ended August 13, 74 tons in September, and 50 tons during the month ended October 13. This copper was recovered in its leaching plant from ore averaging a little over 4% copper.

It is interesting to note that the Canadian government is attempting to prevent nickel from reaching Germany and Austria, and has prohibited the export of nickel from Canada to countries at war with Great Britain. It is not a very effective action to take, because none of the nickel is produced in Canada; the Mond company ships its matte to Wales for reduction, and the International Nickel Co. sends its matte to New Jersey for reduction to nickel. Of course, it is easy for the British government to control the shipments from the Mond plant, but the International company is a different matter. As a matter of fact, this Company has not sold any nickel to either Austria or Germany since the beginning of the war, and the sales to the allied countries have been smaller than reported. Thus the recently reported sale of 1000 tons of nickel to Russia is an exaggeration. The International is only operating its principal mine, having shut down the others and having reduced capacity at its smelter.

There has been a great deal of interest in the West of recent years over the successful reopening of old mines, notably the Plymouth Consolidated in California. Another old gold mine which has successfully come back is the Yellow Jacket, in the western part of Lemhi county, Idaho, not far from the old Leesburg gold diggings, which were the scene of excitement in 1859. The ore in the Yellow Jacket is free-milling quartz, occurring associated with a complex series of intruded igneous rocks in metamorphic schist. The mine produced a good deal of ore yielding from $8 to $10 per ton in the mill, but the orebody was badly faulted and was lost. More recently the Mandarin Mines Corporation, organized last July, and capitalized at $1,000,000, which has been financed by C. W. Pope and D. C. Catlin of New York, reopened the mine, and by well directed exploration has discovered the faulted portion of the orebodies. Recent developments are said to be very encouraging, and the management has strong hopes of making a good profit from the new work.

The death of F. A. Heinze last week called forth many reminiscences of his varied career. There has been much speculation as to how much is left of the $10,000,000 he is supposed to have brought to New York at the conclusion of his fight against the Butte companies. One by one since that time his holdings have slipped away, and the recent lawsuit in which Edwin Gould recovered a judgment for over $1,000,000 against him must have left him with very little in the way of cash assets. Heinze still retained an interest in the Ohio Copper Co., the Stewart Mining Co., and extensive land holdings in British Columbia, but by the time these are disposed of and the judgment paid, it is at least doubtful whether there will be much left for the three-year-old son who inherits the Heinze holdings.

HOUGHTON, MICHIGAN

SANITARY CONDITION OF THE COPPER COUNTRY.—LAKE NAVIGATION AND LOADING ORE.—TRAP-ROCK QUARRIES.—SHAFT-SINKING AT NEGAUNEE.

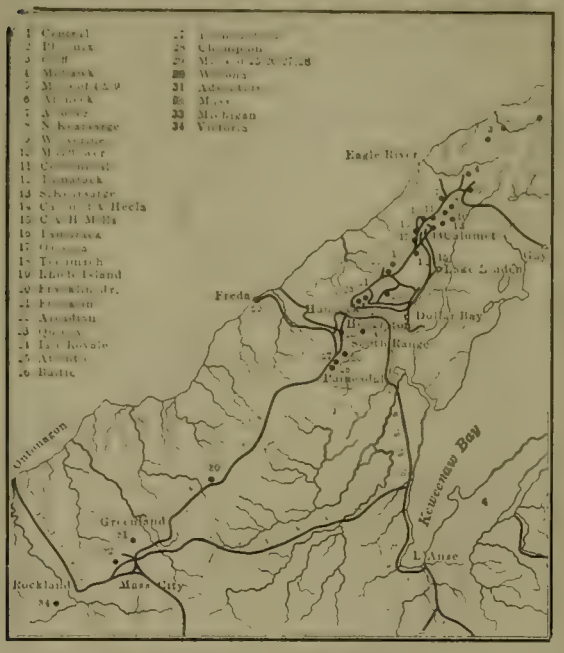
An inspection of the sanitary conditions of the communities of the copper country by Robert Olesen and Joseph Bolton, of the U. S. Public Health Service, has recently been completed. Almost perfect conditions were found in the mining centres of the district. There is no doubt that the living conditions are far better than in the average mining district. The doctors were considerably pleased with the assistance offered them by the municipal and mining officials.

The close of navigation on the upper Great Lakes is expected in a week or so. Only a few more coal boats are expected at the Marquette docks. Ore shipments have increased during the last month, but the total tonnage from the Lake Superior region will be the lowest since 1911. At some of the mines large stockpiles have been accumulated, but many other mines have little ore on hand. A tonnage record has been established for the new dock of the Lake Superior & Ishpeming railroad at Presque Isle, the upper Marquette harbor. One of the Cleveland-Cliffs Iron Co.'s steamers was loaded with 10,792 tons of ore. This deeper loading was made possible by the new Davis lock recently completed at Sault Ste. Marie.

The Marquette Trap Rock Co. has reopened its quarry at Harvey, and this property and that at the Blemhuber farm are now being worked at full capacity. These are the only two trap-rock quarries in the upper peninsula. The rock at the Blemhuber farm quarry is a massive diorite in the form of a dike. A great deal of the rock taken out at Harvey has been from Keewatin schist. The number of men has been increased at both quarries, and in order to supply the demand for the rock, a full force will be employed at the two quarries through the winter. The demand for the trap-rock from the lower peninsula and Wisconsin has been so great

that next season will probably be the busiest the Company has ever experienced.

The shaft of the Cleveland-Cliffs Iron Co.'s Athens mine, on the Harvey lots at Negaunee, is to be sunk to a depth of over 2000 ft., and is one of the largest projects ever undertaken by an iron-mining company. Joseph Thomas, of the Maas mine, has been placed in charge of the work. Sinking was commenced early in June, and has progressed on an average of about 60 ft. per month. It is expected that within a short time an additional 15 ft. per month can be sunk. Water at the bottom of the shaft has hindered the work, and a small pump has been necessary to keep it from being flooded. The ore on this property probably lies in a 'pitching trough' with a foot-wall of Siamo slate. The inside dimensions of the shaft will be about 17 ft. diameter, with a 3-ft. concrete wall. Three crews, of six men each, work



MAP OF COPPER COUNTRY, MICHIGAN.

on 8-hr. shifts. Thirty-six 5-ft. holes are drilled in the floor of the shaft before a charge of powder is set off. The rock is then hoisted to surface before drilling is again resumed. For one blast, 144 sticks of 80% giant powder are used. The concrete machine mixes and pours 30 cu. yd. of concrete per hour. This is to run into the shaft through a pipe system, and after it is placed in the forms it requires 48 hours to set. When the forms are removed, steel dividing sets for the skip, cage, pipe, and ladder-ways are put in place. It requires 8 hours' work by one crew to remove 10 ft. of forms.

LONDON

RIO TINTO COPPER MINE.—EL ORO MINING & RAILWAY CO.'S AFFAIRS.—TOMBOY MINE.—ZINC, TUNGSTEN, AND LEAD PLANTS.

Like most copper companies, the Rio Tinto of Spain has been hard hit by the war. Not only did Germany take a great deal of the copper, but also large amounts of pyrite, both cupriferous and otherwise. Spanish pyrite has long been the basis of chemical manufacture in Germany. The mines and smelters are at present working half time, and even now the output is slightly greater than the demand. Opportunity is being taken to do an extra amount of development work. No interim dividend is to be paid for the half-year ended June 30. The war is not the only worry to which the Company has been subjected recently. As no doubt readers of the *Press* will remember, the mines were closed during January and part of February owing to a strike, and interruptions from the same cause occurred in March and April. Affairs had been restored to normal, and the output had been raised to record figures when the war supervened.

The directors of the El Oro Mining & Railway Co. report that owing to the disturbed state of Mexico, no accounts have been received from the mine since the end of April. Nor has the manager, A. F. Main, been able to send the usual annual report due at this time. Mr. Main had to suspend all milling and surface work at the end of April, but development has been continued, and the plant and mine have been kept in good order. He reported on August 22 to the effect that the forces of the Constitutionalists entered El Oro on the 7th of that month, after the evacuation of the town by the Federal troops. A levy was made on the mines by the Constitutionalists, and this Company's share was $20,000. On September 9, Mr. Main cabled that owing to the difficulty of exporting and disposing of bullion, and to the general unsettled financial conditions in Mexico City, milling could not be resumed. On the 22nd of the same month, he cabled that in view of changed circumstances it would be advisable to resume milling to a limited extent early in October. It is probable that pressure was put on Mr. Main by the Constitutionalists in order to force him to adopt this course. The directors and shareholders of this Company have serious misgivings as to the future.

The Tomboy Gold Mines Co., operating in the Rocky Mountains above Telluride, continues to be a profitable undertaking. This Company has had a romantic and withal a highly creditable career. Formed in 1909 by the Exploration Company to purchase the Tomboy mine, the future appeared to be highly promising, but the orebody gave out two years later, and it was only the sagacity of the late John Herron, the manager, that saved the situation. He took, on his own responsibility, the time available being short, an option on the Argentine property. The purchase price, in cash, was provided during the currency of the option. For 10 years this mine enriched the coffers of the Company. Continuity of interest was then secured by the purchase of the Montana group of claims from the Revenue Tunnel Co., also in the same basin. The Company bought this property for £80,000 cash, all provided out of revenue. This has all been paid, and the dividends have resumed their old level. At the recent meeting of shareholders, Lord Arthur Butler described the present position clearly and concisely. The profit was £81,070, and £62,000 was distributed as dividend, being at the rate of 20%. The annual report appeared in the *Press* of October 31.

The scheme to erect a zinc smelter for the treatment of zinc concentrate from Broken Hill and Burma is likely to be carried out, for the manufacturers of galvanized iron are ready to back it financially. As they are large consumers of zinc, this assures a good market for the output of the smelter.——Another metallurgical scheme that looks healthy is the extraction of tungsten from wolfram concentrate, from the Shan states, Cornwall, Australia, and Bolivia. The plant is to be erected at Sheffield. In this case also the consumer plays a principal part, for tungsten is used in making tool-steel, and it is the tool manufacturers at Sheffield that are finding the capital for the enterprise.——The plan to erect a lead smelter for Broken Hill concentrate is still in the air, the enthusiasm on the subject having been chilled by the fact that the Port Pirie and Cockle Creek smelters in Australia are now working at full blast, and so are able to take care of the major portion of the Broken Hill output of lead concentrate.

JOPLIN, MISSOURI

Revival of Activities in the Porto Rico District.—Mill-Building Operations in Missouri-Oklahoma-Kansas Field.—Recent Drill Strikes.

Two large Texas pumps have been started by George A. Barnett, of Joplin, and Kansas City people on a 17-acre lease of the Van Dorser land at Porto Rico, eight miles northeast of Joplin. More than 3500 gal. of water per minute, pumped from the shaft, is rapidly draining the ground, and mining operations are expected to begin by the latter part of the month. The mine was opened several years ago when zinc ore prices declined suddenly, and before any extensive development could be undertaken, offerings for ore had dropped to such a low level that work could not be conducted at a profit. Following the closing of this property other important mines in the vicinity suspended operations, and for several years this portion of the district has been non-productive. The Vogey mine of the American Zinc, Lead & Smelting Co. is situated near the Barnett property and will probably be placed in operation soon. On another nearby lease, the Carmean & Squires Lead & Zinc Co. operated a 500-ton mill which was destroyed by fire several years ago. This Company has planned to reconstruct this mill, and begin mining operations again when ore prices justify it. The ore encountered in this district occurs in sheet formation, and will yield about 3% blende, and some lead. A formation about 20 ft. thick is encountered at a depth of 160 ft., extending down to 180 feet.

The Twin City Mining Co., a new corporation recently organized, plans to construct a mill of 250-ton daily capacity on a 15-acre lease of the Daugherty & Davey land at Carterville, Missouri, where some extensive prospecting work has been under way for some time. Interested in this Company are John Wingfield, George Moore, Weed Smith, Cleve Bird, William Burns, and Harry Hulett. The lease on which they are operating is near the S. Y. Ramage mine, one of the largest producers of sheet-ore in the district, but no deep mining has been undertaken prior to the operation of the Twin City company. The ore in this mine is not of sheet formation, but is found at a depth of 150 ft.; the ore face is 15 ft. high, and is estimated to yield 15% blende.

A new mill is being constructed by the Cornfield Mining Co. at Miami, Oklahoma. It is one of the few entirely new plants of the district. A number of mills have been constructed which have been made up largely from equipment taken from old plants, but a number of unusual ideas in concentration methods necessitated the use of new equipment throughout at the Cornfield property. The cost of the plant is $17,000. It is being constructed by Frickleton, Onstott & Marcum. The orebody has been opened in three drifts at a depth of 92 to 120 ft., and a second shaft is now being sunk southeast of the original shaft, and a drift is being driven to connect the two and afford better ventilation. A large 'crush-rock heap,' amounting to almost 4000 tons, has been gathering on the surface. The showing of this 'crush pile' is unusually good, both zinc and galena occurring in exceptional richness. The operators claim to have a large body of equally good ore blocked out in the drifts, and in several drill-holes on the lease.

The long drawn out period of low zinc-ore prices has resulted in some of the larger mines of the district being closed, and many men thrown out of employment. Considerable shallow prospecting on the part of idle wage earners has followed, and some good discoveries of shallow galena have been made in various parts of the district. In an area northeast of Duenweg, Missouri, where little work has been under way for several years, three different companies are now at work on the Bonni Patti land, and all are producing a good tonnage of galena from a depth of about 80 ft.——Another group of good lead prospects is being opened immediately south of Joplin.——A company on the Boruff land is making as high as 40,000 lb. of galena each week over hand-jigs, with only two men working in the ground.——Fay & Burnett are prospecting on the Paul estate, also south of Joplin, and have opened rich lead ore at a depth of 80 ft. In sinking three feet in a new shaft they took out 3000 lb. of galena.

Two Joplin newspaper men have recently done well from mines near this city. One is Ray Cochran, managing editor of the *Joplin Daily Globe*, who owns a half interest in the Flynn & Cochran mine on the Hornaday lease of the Connor land at Central City, west of Joplin. Good calamine and galena have been encountered. The partners went into an old shaft and spent less than $150 each in placing the mine on a productive basis. They are now clearing about $200 per week each, and the outlook for continued production is good. The other newspaper man is John Powers, proof reader on the *Globe*. He has taken over the old Little Jew mine, west of Joplin, has repaired the mill and opened a rich face at a depth of 150 ft. Scarcity of water at this mine caused former operators to suspend work. At one time water was obtained from another mine half a mile distant, but when work was suspended at the other property the water famine at the Little Jew was again in evidence. Powers has overcome this difficulty by laying 3000 ft. of pipe to connect with the city water mains.

CHIHUAHUA, MEXICO

Summary of Conditions in This District, Labor, Cyanide, and Smelters.—Rio Tinto, El Cristo, Cusi, Cusi Consolidated, El Potosi, and Justicia Companies.—Interests in Nicaragua.

In spite of difficulties in transportation, and higher prices of supplies, mining can be carried on here now cheaper than in normal times, owing to the fact that wages and freight rates have not advanced in proportion to the drop in the gold value of the current money.——It is generally thought that there is little danger of interference with business or movement of ores and supplies in the near future, on account of fighting between the different factions, no matter what may happen in other parts of the country. There is a great scarcity of labor for all purposes, chiefly owing to the continued recruiting of all available men into the army. It is expected that as soon as order is restored in the country there will be plenty of labor to operate the mines and smelters at normal capacity. There is no lack of ore, but not sufficient men to mine and smelt it, and a shortage of transportation facilities to move it to market. On the whole, the outlook for mining here, while not exactly bright, is more cheerful than for a long time.

The cyanide problem has not yet become acute, as most of the mines using it were well stocked when the war broke out, and can keep going for some time on their present supplies.

The Chihuahua plant of the American Smelting & Refining Co. is working steadily, but cannot secure sufficient men to operate all the furnaces, so only four are running at present. All shippers to the local smelter are restricted in their tonnage, and many are unable to ship at all, owing to the inability of the smelter to handle all the ore offered.

The smelter of the Cia. Metalurgica de Torreon, at Torreon, is again receiving ore, as is also the Azarco plant of the A. S. & R. company. The smelter of the Peñoles company, at Mapimi, Durango, is also reported to be about to resume. This will relieve the situation somewhat, and allow many mines to resume shipments.

The Rio Tinto Copper Co., at Terrazas, is sinking the main shaft to further develop the great body of ore in that part of the property. The smelter is idle, owing to lack of labor.

El Cristo Mining Co., working the property of that name at Santa Eulalia, is again shipping to the Chihuahua smelter. — J. T. McClammy and associates have secured an option on the Dolores mine in that district and are about to commence work under the supervision of W. A. Fritsche. This mine has a famous record as a producer, but has been idle for some years on account of litigation. — Schuyler Lawrence, leasing the San Antonio mine of the A. S. & R. company, has resumed shipments of lead ore to the smelter.

At Cusihuiriachic the Cusi Mining Co. is working with a reduced force, and shipping a restricted tonnage to the smelter. — The Cusi Consolidated Mining Co. is working chiefly at development, but is extracting some good-grade gold and silver ore in the course of that work.

Zinc mining is again showing signs of activity after lying dormant for a long time.——El Potosi Mining Co. has lately

MAP OF STATE OF CHIHUAHUA.

made a contract in the United States for a large tonnage of calamine ore, and other producers are expecting to ship soon.

A company under the management of S. G. Burn has taken an option and lease on the Justicia copper mine at Chorreros, east of this city, and will commence operations as soon as the Orient railway is repaired to Falonier, so that the ore can be moved to the smelter. The Justicia has been a large producer of high-grade ore and concentrate, and will doubtless again ship heavily as soon as conditions permit, as the ore-bodies are not yet fully opened.

A syndicate has been formed in Chihuahua to conduct mining exploration and development in Nicaragua, with R. H. Burrows in charge of its affairs in the field. He has already left for that country.

While conditions are not normal, there has been a decided improvement within the past six months, and the outlook for Chihuahua mines is a great deal brighter than it has been for some time. Peace has been established in the state and is being preserved by the Constitutionalist authorities; law and order are being kept and mining operations where being conducted are proceeding uninterruptedly.

SILVER CITY, NEW MEXICO

IRON ORE MINING IN GRANT COUNTY.—EMPIRE ZINC CO.'S OPERATIONS.—SIERRA COUNTY ACTIVITIES.

Practically all the iron ore produced in New Mexico during 1913 came from the Brockman and Penrose estates mines at Fierro, Grant county, there being only 16,583 long tons from other sources. Approximately 90,000 tons of magnetite was mined from the Snow Flake and 58,000 tons from the Jim Fair by the Colorado Fuel & Iron Co., and shipped to its works at Pueblo, Colorado. The state stands eleventh in rank with the other states, against seventh place for 1912. The shortage of 100,000 tons in 1913 was doubtless due to the curtailment of shipments to Colorado on account of the labor trouble there. Many new iron operators are in the field this year, and the output in 1914 will no doubt eclipse those of the preceding three years. The Yellow Jacket iron mines at White Oaks, Lincoln county, have been put in shape for the economic extraction of ore by Swoyer & Evans, and occasional shipments to Pueblo are being made. In the Hanover and Fierro districts, contracts are being let for magnetite of 50% and over, delivered on cars. The C. F. & I. company is at present extracting about 300 tons per day from the Snow Flake open-cut and immediate claims, the Jim Fair being held in reserve. Since Phelps, Dodge & Co. pulled pumps and abandoned its copper properties at Fierro, the Colorado people are the only active operators in the district.

Below Fierro, the Empire Zinc Co. is preparing for the development of its zinc sulphide claims on Thunderbolt hill, and a tramway is being constructed. Shipments of carbonate ore from the Company's workings known as the Nason tunnel, are being made over a new tramway. Shaft sinking is in progress at the mines. The Copper Queen mine, between Hanover and Fierro, has been purchased by the Company for its water supply, and will be used if a sufficient quantity of water cannot be found near the site of a proposed power-plant and concentrator. A one-mile pipe-line will deliver water from the Copper Queen to Empire Zinc workings.——In the same district, McKenna & Gerhardt are developing the Mountain Home mines in Humboldt mountain. They recently shipped a car of copper ore to El Paso taken from a small deposit or pocket.

Several new operators have entered the Pinos Altos field of Grant county, among whom are Holman and Hickman of Santa Rita, who purpose working the Young properties.——The Mountain Key, Jr., Mining Co. is being organized to take over several promising mines, and the Silver Hill operators are incorporating prior to commencing development in the upper levels.——La Fortuna mine is being worked by Norris and Spitzley, and driving has cut two rich veins, extensions from the main vein system of the area. The ore is rich in lead and silver. A custom mill is under consideration in the district.

In Sierra county, the Bi-Metallic company, at Sierra Blanca, has received a consignment of drills, an air-compressor, and other machinery.——The Amethyst mine at Kingston is being opened again. The Overlook mine in the same camp recently made a large shipment of silver ore.——Owen Bros., of Santa Rita, have taken over the Tom Casey properties in the Trujillo district, and are contemplating development.——The Ready Pay group at Hillsboro was examined a short time ago by a representative of Eastern investors.——Clyde M. Becker and associates have cut two promising veins in driving 60 ft. in a shallow shaft near Rincon. Property owners near by are consolidating claims and intend forming a company.——It is reported that a manganese mine will be developed owing to the demand for the mineral.

The old Jerry Boyle mine near Lordsburg, abandoned for 30 years, is being reopened by P. Wehner.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

'Mineral Resources of Alaska' is the title of *Bulletin* 592, by Alfred H. Brooks and others, published by the U. S. Geological Survey. It consists of 413 pages, with illustrations, maps, plans, and a bibliography on recent Survey publications on the territory. This volume is a report on progress of investigations in 1913. Contents are as follows: preface, administrative report, the mineral deposits of Alaska, the Chisana placer district, and the Alaska mining industry in 1913, by A. H. Brooks; lode mining in the Ketchikan region, by P. S. Smith; marble resources of the Juneau, Skagway, and Sitka districts, and a barite deposit near Wrangell, by E. F. Burchard; mineral deposits of the Yakataga district, by A. G. Maddren; preliminary report on a water-power reconnaissance in south-central Alaska, by C. E. Ellsworth and R. W. Davenport; the Port Wells gold-lode district, and mining on Prince William sound, by B. L. Johnson; gold lodes and placers of the Willow Creek district, by S. R. Capps; mineral resources of the upper Matanuska and Nelchina valleys, by G. C. Martin and J. B. Mertie, Jr.; preliminary report on the Broad Pass region, and mining in the Valdez Creek placer district, by F. H. Moffit; lode mining near Fairbanks, and placer mining in the Yukon-Tanana region, by Theodore Chapin; placer mining in the Ruby district, and mineral resources of the Yukon-Koyukuk region, by H. M. Eakin; and placer mining on Seward peninsula, and lode developments on Seward peninsula, by Theodore Chapin.

IDITAROD, ALASKA.

Cordova

According to A. J. Elliott, secretary, and Louis G. Hinckle, superintendent of the Hubbard-Elliott Copper Co., development at the mine in the Kukalina district is very satisfactory. In the 1000-ft. adit rich bornite and chalcopyrite were cut at a vertical depth of 150 ft., 300 ft. in from the portal. This has been opened for 170 ft. On October 17, at a depth of 400 ft., 30 ft. of chalcopyrite was also cut. A concentrator, electric power-plant, compressors, and possibly a nine-mile tramway connecting the Company's property with the C. R. & N. W. railway, at Mile 144 is proposed next season. Work will be resumed as early as possible, it being the intention of the Company to commence freighting in additional equipment and supplies early in January 1915. The head office is in Chicago.

Iditarod

An accumulation of mail, amounting to nearly 100 sacks, is lying at the Seward post-office for Iditarod.

Knik

Navigation to Knik is closed until next April.

ARIZONA

Gila County

The proposal to divide this county, and form another under the name of Miami county, which, though small, would include most of the mining centres, was defeated at the elections on November 3.

The Iron Cap Copper Co. closed its mine on November 1, on account of the copper market. The mine is dry, and there is about 400 ft. of good ore in the stopes. The plant is in good condition for resumption at any time.

A promising gold-bearing area is said to be in the Chemehuevis district, 14 miles south of Franconia, on the Santa Fe railroad. At the Yellow Jacket is 10 to 36 in. of $18 ore, 14 ft. of $37 to $40 ore in the Los Angeles, and 12 ft. of $18 to $20 ore in the Constitution. A zinc-lead-gold deposit is being worked by M. R. Ruiz.

Yavapai County

The Great Belcher mine and other claims are being reworked by El Paso people. A shaft was formerly sunk to 800 ft., and at 300 ft. a wide vein was cut. Lack of capital resulted in a shut-down. The Red Rock was opened to 300 ft. Dumps on these claims amount to about 25,000 tons of profitable gold ore. The Poland branch of the Bradshaw Mountain railroad runs across the property, and the Big Bug creek flows nearby. A 10-stamp mill is on the Red Rock, and will be used to crush ore. Under certain conditions the new owners are to pay $50,000 for the mines.——The Poland mill recently crushed 168 tons of ore from the Poorman mine. Good ore is being opened in the Bonanza or Harqua Hala mine.——The Stoddard Copper Co. is getting good results at its mine.——The Lynx Creek Mining Co. is preparing to work its placer ground.

CALIFORNIA

Butte County

The Supreme Court has upheld the previous decision of a judge and jury in a case wherein Lavinia Crabbe sued the Mammoth Channel Gold Mining Co. for damages for her husband's death. The verdict was for $20,000.

Two boats of the Oroville Dredging Co. recovered $4090 during the week ended October 1.

Modoc County

It is said that the Big Four mine at High Grade has been optioned to the Tonopah-Belmont company of Nevada, whose engineers have been examining it for some time.——Some rich ore has been opened in the Modoc mine, owned by the

Wrigley people of Chicago. Work will be continued during the winter.

Sacramento County

The Natomas Consolidated company has started the Union dredge in the Blue Ravine district, near Folsom. This boat was shut down over a year ago by the former owners.

Shasta County

Six feet of good ore is being opened in the American mine at French gulch. F. L. Sullivan is in charge.——Van Ness Bros. are prospecting at their Five Pines claim.——The Mammoth Copper Co.'s output in October was estimated at 1,200,000 pounds.

The Noble Electric Steel Co. will increase its capital from 100,000 $10 shares to 100,000 common at $10 and 50,000 preferred at $10 each. The latter stock will receive out of surplus profits a cumulative dividend at the rate of 8% per year, on the par value dating from the original issue. This stock will be non-assessable.

Sierra County

The Tightner mill is working steadily on good ore. Retimbering of parts of the mine is under way. The Red Star claim is being developed by a crosscut from the Tightner workings, and good results are expected.——The Red Ledge mine on Kansas creek, and operated by the Bank Mining & Promotion Co., of Buffalo, was recently inspected by W. H. Barnhardt. A good deal of new work is contemplated. John B. Moulton is superintendent.——As soon as the new pump is installed, sinking of the Telegraph shaft, near Downieville, will be continued.——At the Alhambra the Sears roller quartz mill is working 16 hours per day. A fair tonnage of ore is ready for crushing.—Development is under way at the Mount Alta, Gold Bluff-Oxford, Monte Cristo, City of Six, Mott tunnel, and Little North Fork properties.

Trinity County

At the Enterprise mine, near Helena, a large tonnage of $20 ore has been opened. Repairs are being made to the water-power plant and the 10-stamp mill. R. A. Skinner is manager.——A lower adit is being driven at the Oversight.——In the upper level some good ore has been exposed. A. H. Wolfe is managing owner.

COLORADO

The annual report of the Colorado Fuel & Iron Co. shows that gross earnings totaled $17,803,025, a decrease of $6,512,862 compared with 1912. Net earnings totaled $1,073,769, a reduction of $2,546,496. The decreases were due to labor troubles in the fuel, and general curtailment in the steel business. The Company operates iron mines in New Mexico and coal mines and iron works in Colorado.

Gold worth $25,000,000 was shipped from Denver to New York last week, the largest single consignment ever made in the country.

Gilpin County

Companies and lessees made a large number of shipments of milling and smelting ores from the Black Hawk district last week.——The Bates Leasing Co. shipped 12.5 and 13.2 tons of gold-silver concentrate, worth $24.62 and $38.34 per ton, respectively, from the Stroehle mill to the Globe smelter. Twenty tons of smelting ore averaged 2.62 oz. gold and 18.4 oz. silver per ton.——Lessees at the Lake mine, near the boundary of Gilpin and Clear Creek counties, produced over 1000 tons of concentrating and smelting ore in October. The property is worked through the Big Five adit, above Idaho Springs.

Lake County (Leadville)

The first shipment of zinc oxide has been made from the local zinc smelter.——As soon as the Colorado Power Co. has finished its line, the Penrose shaft will be overhauled.

Pitkin County

The fire in the lower workings of the Smuggler mine still baffles all efforts to put it out. No serious accidents have happened to the men employed. A rescue car has been at the property.

Teller County (Cripple Creek)

The committee in charge of work at the Roosevelt drainage tunnel reports that the flow of water is 432,000,000 gal. per month. In October the adit was extended 185 ft. with one shift drilling and one tramming. Two shifts are now to be employed.

The shaft house and other buildings, with all the machinery, at the El Paso mine, were destroyed by fire early on Novem-

SURFACE PLANT AT EL PASO MINE.

ber 5. The loss is estimated at $150,000. But for the heroic work of the engineer at the hoist, James Herring, and other men and officials, about 15 men would have been trapped in the mine. Work will be slightly curtailed, and the plant rebuilt.

Seven sets of sub-lessees are working and producing good ore from the Vindicator No. 2, under Potts and Starkweather. Martin & Co. sent out $27 ore last week.

IDAHO

Shoshone County

According to the state mine inspector, Robert N. Bell, the mining industry of northern Idaho is marking time at present, on account of the metal markets. The lead output is being made at a loss of 50c. per 100 lb., the silver contained making good this deficiency. The Bunker Hill & Sullivan company will continue at normal capacity as long as the smelters will receive the concentrate. New development, in the district covered by the recent trip of the inspector, shows a good increase in ore reserves in the deep levels of the principal mines at Burke.

In the Nine-Mile district, the Tamarack and Custer, Success, and Interstate-Callahan have made good, and are suffering from curtailment owing to a poor market for zinc, and small milling capacity.

The flotation process at the Interstate, devised by D. F. Haley and L. F. Fogel, is a complete success, and is recovering 90% of the lead and 70% of the zinc in the ore treated. The system is inexpensive. Losses have been mainly in slime at this mill. A small quantity of oil is added to the pulp before it enters the suction of a centrifugal pump, and the whole is well mixed. The discharge of the pump is through a ¾-in. pipe, and is delivered into a 6-in. pipe slightly above a V-shaped box 4 ft. long. A froth overflows, remaining on top of the solution in the box, and is then removed by overflow or scraping. The general mill extraction has been improved 10% by this simple device.

In the Kellogg-Wardner district, the Bunker Hill & Sullivan, Last Chance, Sierra Nevada, Ontario, and Stewart mines are

giving satisfactory returns, considering the conditions of the markets; while the Caledonia is making more money per man employed than any other mine ever did in the history of the county.

Experiments at the Bunker Hill & Sullivan, according to the president, F. W. Bradley, show that it may prove unnecessary to ship concentrate to smelters in the future. The Maim process, an electro-chemical one, is under development.

WALLACE, IDAHO.

MONTANA

Silverbow County

The North Butte Mining Co. reports as follows for the third quarter of 1914: Early in August the working force was reduced to 50% capacity, and the last week in that month, and three weeks in September, all mining was stopped for retimbering 325 ft. of the Speculator shaft. Late in September work was resumed on a 50% basis. The regular quarterly dividend was passed on account of the copper market.

Development amounted to 1775 ft., and ore reserves decreased slightly owing to the irregular size and value of the Edith may vein at 2200 and 2600 ft., also on account of the shut-down. Driving was done on the 2200, 2400, 2600, and 2800-ft. levels on this vein. At the latter depth the east drift shows 133 ft. of ore 6 ft. wide, assaying 4% copper and 2.5 oz. silver per ton. The west drift was extended 97 ft., of which 80 ft. was 4 ft. wide, containing 6% copper and 5 oz. silver. Some 'bunches' of high-grade ore were cut at 2600 ft. on the Jessie vein. Good ore was further opened at 2200, 2400, and 2600 ft. on the Snowball vein.

Ore treated amounted to 66,035 tons and 18½ tons of precipitates, yielding 3,337,023 lb. copper, 201,049 oz. silver, and 221 oz. gold. Assets include cash, $111,546; and copper and silver on hand, $1,077,868; liabilities include advances in metals, $685,327; and surplus, $2,883,149.

Eleven out of the twenty-two shafts of the Anaconda company are working, and the smelting operations at Anaconda are correspondingly curtailed. The plant at Great Falls is entirely closed down, including the refinery.

NEVADA

Clark County

(Special Correspondence.)—A 60-ton cyanide plant is to be supplied by the Stearns-Roger Manufacturing Co., of Denver, and erected by J. H. Alpenfels, at the Flagstaff group of mines, developed by the Nevada-Eldorado Mines Co. in Eldorado cañon. The mill will consist of stamps, a tube-mill, Dorr system of agitation and thickening, and an Oliver filter. The property is now owned by the Colorado-Nevada Mining & Milling Company.

Nelson, November 4.

Esmeralda County

The Goldfield Consolidated Mines Co. reports as follows for the quarter ended September 30:

Ore treated, tons	79,605
Gold recovered	$918,088
Expenditure	516,878
Net profit	401,210

Since the last report, the sum of $374,211 has been paid to complete purchase of control of the Aurora Consolidated Mines Co. Cash and bills receivable on October 31 totaled $697,000. No dividend will be paid for the third quarter.

The hoist-house, compressor building, blacksmith-shop, transformer plant, electric motors, and equipment worth $6000 was burned on November 4. The steel head-frame was uninjured. The plant is to be replaced at once. Charles D. Wilkinson is general manager.

Humboldt County

Seven feet of $50 ore has been cut in a rise from the 400-ft. level of the Big Four lease at Rochester. Foundations for the new mill are finished.——Fourteen men are working at the Nevada Packard mine. A carload of ore last week assayed 230 oz. silver and $2.50 gold per ton. Frank Margrave is superintendent.——The Kramer-Hampton lease produced 135 tons of $65 ore in October. These properties are improving steadily.

The Seven Troughs Coalition mine and mill were described in the *Review-Miner* of Lovelocks on October 30. Most of the underground work is being done on the rich ore at 1200 ft. The 10-stamp mill is now producing about $2000 per day.——The Mazuma Ore Reduction Co., in charge of F. R. Lockhardt, has acquired the Darby mill at Mazuma. It is a modern plant and will receive custom ore for treatment at a moderate charge.

Mineral County

There are about 100 men working in the mines and three mills of Rawhide. The principal producers are the Nevada New Mines Co., Rawhide Coalition, and Rawhide Queen, and the Black Eagle Mining & Milling Co.——There are 150 men employed at the Aurora mine and mill. A recent shipment of bullion was valued at $30,000.

Nye County

(Special Correspondence.)—A carload of gold-silver-lead ore is being shipped by J. Galligher from his lease in Camp cañon, near Blue Eagle ranch at Railroad Valley. The ore is said to assay $90 per ton.——It is reported that Irwin Bros. have sold their mine near Railroad Valley to Tonopah people for $50,000. A two-stamp Campbell & Kelly mill has been crushing ore with good results for some time.

Ely, White Pine county, November 2.

Tonopah mines produced 10,194 tons of ore, worth $199,434, last week.——In the Belmont, a rise above the 900-ft. level shows 2 ft. of rich ore. The final clean up for October resulted in 179,014 oz. bullion.

At Tonogold, the shaft at the Lone Hand lease No. 2 is down 41 ft., showing bunches of ore with free gold.——The Gingles shaft is down 51 ft., and will be continued to 100 ft.——Murphy and Co.'s shaft has followed good ore to 70 ft.——Twelve inches of 'sugar' quartz, with free gold, has been opened in the Wardle-Burnham lease.——The *Tonopah Miner* lease shaft has cut some stringers at 40 ft.——Other claims are being actively worked.

White Pine County

(Special Correspondence.)—Wherever possible, the Nevada Consolidated company is reducing costs. Good results are being obtained from the oil agitators which are made in the Company's foundry. It is said that they will be installed in one of the units of the mill.——A carload of gold-silver-lead ore was recently shipped by Rowley and Ferguson from their lease on the Hayes claim, near the old Coppermines claim, near Star Pointer. The ore netted about $20 per ton. F. Smith has secured a lease on part of the Hayes. Both parties are working oxidized ore near the surface.

Ely, November 2.

TEXAS

Burnet County

(Special Correspondence.)—What is said to be the only known deposit of ichthyol (a sulphonated hydrocarbon of syrupy consistence) in the United States underlays a tract of 500 acres of land near Burnet. The property has been purchased by a syndicate of New York men, headed by William Polatsik, an industrial chemist, who has arrived here for the purpose of mining the mineral on an extensive scale. Mr. Polatsik says that the world's supply of ichthyol has heretofore come from a certain district in the Austrian Tyrol, and that the shutting off of those mines by the war in Europe led to an investigation of the possibilities of the product being obtained somewhere in this country. It was found that the State Geological Survey of Texas gave an account of the existence of ichthyol near Burnet. Mr. Polatsik came here, and his explorations convinced him that the deposit is probably the largest and richest in the world. One of its peculiarities is that it is soluble in water, alcohol, or oil. It resembles carbolic acid in its effects, being a mild antiseptic. It is known also as ammonia ichtho sulphonate. It is used for a variety of purposes and commands a good price. Mr. Polatsik has awarded the contracts for the construction of the necessary plant to crush the rock and extract the substance. Mining will be started on an extensive scale in a short time.

Burnet, October 24.

UTAH

Beaver County

The Newton district shows considerable activity. Owners of the Sheep Rock property are going to test their ground thoroughly.——In the Star district, work has been curtailed at the Monitor, owing to the low price of lead and silver.

Juab County

The Utah Minerals Concentrating Co.'s 100-ton plant to treat ore from the Chief Consolidated dump is finished, being constructed in 60 days. It consists of a gyratory crusher, rolls, tube-mills, and concentrators.——The station at 1700 ft. in the Eagle & Blue Bell is practically finished. Weekly shipments of silver-lead ore from this mine total 15 cars.——Sixteen mines in the Tintic district sent out 134 cars last week.

Salt Lake County

The Utah Copper Co.'s third quarterly report shows the following results. Owing to the effect of the war on copper the mine was reduced to 50% capacity on August 6 and the Arthur mill was closed on the following day, since which time the Magna has treated the ore extracted.

Details of results.	Third quarter of 1914	1912
Overburden removed, cubic yards	1,408,224	1,824,697
Ore treated, tons	1,466,606	2,000,157
Average copper content, per cent.	1.4356	1.4573
Recovery, per cent	68.13	68.44
Metal production, pounds	28,686,672	40,017,562
Cost of production, cents per pound	7.760	7.539
Net profit from all sources	$1,312,738	$2,819,104
Dividends paid	$1,218,367	$1,291,710
Copper on hand, pounds	50,118,797	46,704,098

No income was derived from dividends of the Nevada Consolidated Copper Co., this being $375,187 in the previous quarter.

Lessees at the Wasatch mine at Alta have shipped 37 tons of ore assaying 0.012 oz. gold, 61.3 oz. silver, 6.7% lead, 11.65% copper, 10.7% zinc, and 14.5% iron. It returned $1346.

Summit County

The Snake Creek tunnel was driven 328 ft. in October, and is now in a total of 9764 ft. Low air pressure and hard ground interfered with a larger footage.

The Daly-Judge mine is in good condition, and in the mill the Callow flotation process is working well.——The dispute between the shareholders in the Silver King Consolidated and the president, Solon Spiro, is still being discussed.——A small Holt-Dern furnace is being tested at the Park City mills plant. A Christiernsen furnace is already at work. The Mines Operating Co. has a 10-ton Holt-Dern roaster giving good results.

WASHINGTON

Chelan County

The Wenatchee Gold Mining Co. held its annual meeting at Wenatchee recently. Charles F. Pleiffer is in charge of the property on the Ential river. An 800-ft. adit is to be started to cut the vein at a lower level. The output during the past two years has been $75,000, of which $14,000 was paid in dividends.

CANADA

Ontario

At Cobalt, the Temiskaming & Hudson Bay company paid a dividend of 300%, equal to $23,283, on November 10. The total since 1905 is 25,000%, or $1,940,250.——Hydraulicking on the surface of the Nipissing has exposed from 2 to 6 in. of rich ore for about 150 ft.——Another scheme for reorganizing the Bailey company is being prepared. Ore reserves are estimated to contain 400,000 oz. silver.——The Right of Way Mines Co. has declared a dividend of 1%, equal to $16,865, the first since 1911. The total to date is 78%, or $543,754, on a capital of $1,685,500.

At Porcupine, the second unit of the new compressor plant of the Hollinger is at work. It has a capacity of 45 drills. Twenty additional stamps are being erected, mainly to crush ore from the Acme mine. The plant is now treating 700 tons per day, but by next spring this will probably be about 1300 tons.

KOREA

The Seoul Mining Co., operating the Suan concession in Whang Hai province, reports the following results for October:

Stamps working	40
Time, days	28
Ore crushed, tons	6,126
Total recovery	$59,000

Operating expenses	25,000
Net earnings	34,000

The Oriental Consolidated Mining Co.'s October output was valued at $135,157. In September the mills and cyanide plants treated 25,633 tons of ore for $132,201. The Taracol plant made a recovery of 96%. The Kuk San Dong plant finished its dump on September 25, and is to be reërected at the Maibong mill to treat concentrate. The rainy season is over, the total for the year to date being 83 in. The Candlestick mine is short of men.

MEXICO

A decree was published last July fixing a tax of 60 *centavos* per ton on crude petroleum produced in the republic, and has again been published in *El Constitucionalista* by order of Venustiano Carranza.

Mexico City is in the throes of a milk and toothpick famine, while sugar and salt are at a high figure. The quality of the bread made is being complained of.

PUEBLA

Large forces of Constitutionalist troops are being mobilized in this state to attack ex-Federal generals and their troops.

NICARAGUA

The Panama Mining Co., of Philadelphia, Pennsylvania, has issued a circular in which it states that its property in Nicaragua has been optioned to the Tonopah Mining Co. of Nevada until January 31, 1915, for $50,000. Of this, $30,000 has been paid. If the deal is concluded, an additional sum of $45,000 will be paid to the Panama company, which has debts approximating $70,000. The permanent interest of Panama stockholders under this agreement will amount to 400,000 shares in a company incorporated for $1,000,000, par $1 per share, which will then be immediately exchangeable for Panama Mining Co. stock, in the ratio of 40 shares stock of the new company to be organized by the Tonopah Mining Co. for 100 shares of Panama stock.

PERU

Since the gold standard was put into effect in this country in 1898, the mint has coined £1,621,117 in gold. Imports and exports since that date are £3,916,787 and £367,144, respectively, leaving a net influx of £3,549,643, which, added to the amount coined, gives an approximate circulation of £5,170,760.

The Cerro de Pasco company's hydro-electric plant at Oroya is in full operation, supplying power for the mines and smelter.

PHILIPPINE ISLANDS

The third clean-up of the Gumaos Placer Co. has produced 537 oz. of gold, which together with previous yields of 604 and 867 oz. makes a total of 2008 oz. for August, valued at ₱73,284. The dredge worked for 517 hours and handled 82,000 cu. yd. of gravel.

The MACKAY SCHOOL OF MINES OF THE UNIVERSITY OF NEVADA, at Reno, which gives instruction to men for mines, mills, and smelters, etc., and makes assays free of charge for Nevada prospectors, has decided to start a four weeks' course in prospecting in February 1915. There will be no fee for instruction, only $5 to cover partly actual cost of supplies used during the period. There will be nine lectures on excavation of earth and rock, nine on prospecting, eight laboratory exercises on mineralogy, ten lectures on geology of mineral deposits, four on assaying, eight laboratory exercises on assaying, four on gas-engines, six laboratory exercises on first-aid to the injured, and four lectures on mining law.

The AMERICAN ROAD BUILDERS' ASSOCIATION will hold a congress in Chicago on December 14 to 18. A number of papers have already been received.

PERSONAL

C. M. WELD has gone to Cuba.

ALFRED HUNT is down from Juneau.

W. DEL. BENEDICT is on his way to California.

SUMNER S. SMITH has gone to Washington, D. C.

KARL E. EILERS was in San Francisco last week.

F. G. COTTRELL has gone to Salt Lake City and Butte.

F. SOMMER SCHMIDT is in charge at the American Flag mine, Park City, Utah.

CARR B. NEAL is in San Francisco, having come from New York by way of Panama.

F. W. BRADLEY reached San Francisco last week. He will go to New York November 23.

ROBERT H. RICHARDS will spend the month of November in Virginia on professional work.

F. LYNWOOD GARRISON sailed for San Domingo on November 5 and expects to return about Christmas time.

ELLARD W. CARSON, of Los Angeles, has been appointed general manager for the Cambria Quicksilver Company.

WALTER HARVEY WEED is spending a week in New York before leaving for an extended trip to Montana, Nevada, Idaho, and Arizona.

GEORGE E. ROBERTS will be assistant to the president of the National City bank and not president as erroneously announced last week.

W. R. INGALLS has declined reëlection as secretary of the Mining and Metallurgical Society after four years of distinguished and exacting service.

G. CLEVELAND TAYLOR, of Republic, Washington, has taken over the assay office formerly owned by F. W. BEWLEY and will conduct a custom assay office in connection with general engineering.

Obituary

F. AUGUSTUS HEINZE, who died at Saratoga, New York, November 4, was a man whose striking career in mining is widely known. Born in Brooklyn, New York, of German-American parents in 1869, he was educated at the Polytechnic Institute, Columbia School of Mines, and in Germany. When he went to Montana in 1889 he was possessed, not only of much natural ability and great energy, but the best technical knowledge then available. Unfortunately, he chose to use these advantages in a way that brought him into prompt and sharp controversy with fellow mining men and which ultimately led to his financial ruin. Heinze recognized quickly that the defects of the American mining law and the unsettled and somewhat crude condition of law enforcement in Montana at the time, left many weak points in the titles of his neighbors. Selecting claims for their strategic value, a maneuver which he was by no means the first or the last to adopt, he plunged Butte into a maze of litigation mixed with politics which became a reproach to the whole nation and industry. Heinze was by no means solely to blame for this—responsibility must be assessed widely—but when through the good offices of Thomas F. Cole and J. D. Ryan he was eliminated by purchase of his holdings, a welcome peace came to the war-weary district. From Butte, Heinze went to New York, where he lost in Wall street much of the money he had won at Butte, but in Ontario, Utah, Idaho, and elsewhere he retained important holdings to the time of his death. He was a hard fighter and he had to meet the same sort of fighting that he put up. His picturesque career leaves a feeling of regret that such energy and ability should have been used to so little good purpose.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, November 11.

Antimony	15	15½
Electrolytic copper	13	13¼
Pig lead	3.85	4.00
Quicksilver (flask)	$55	
Tin	36	37½
Spelter	6½	6¾
Zinc dust, 100-kg zinc-lined cases	10	

EASTERN METAL MARKET

The New York Metal Exchange reported the following prices on November 11: spot tin, easy, five-ton lots, 33.87½ to 34.25c., and 25-ton lots, 33.75 to 34.37½c.; lead, 3.50 to 3.60c.; spelter, 4.90 to 5c.; electrolytic copper, 11.37½ to 11.50c., and Lake, 11.50 to 11.75c. for 30 days. The demand for copper, especially from domestic consumers, is improving.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The upward movement shown at the end of last week has received a check, and prices are weaker, as follows: 49⅞, 49⅝, 49⅞, and 49c. at New York, and 23, 22⅝, 22⅜, and 22⅝d. per ounce in London. It is probable that now the German cruiser "Emden" is out of the way, more silver will be sent to India.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Oct.	29 3.50	Sept.	16 3.85
"	30 3.50	"	23 3.85
"	31 3.50	"	30 3.75
Nov.	1 Sunday	Oct.	7 3.75
"	2 3.50	"	14 3.50
"	3 3.50	"	21 3.50
"	4 3.50	"	28 3.50
		Nov.	4 3.50

Monthly averages.

	1913.	1914		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.26	3.86	Oct.	4.37	3.60
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

Curtailment of lead production in the United States is now about 35% of normal, against 25% three weeks ago. There has been a good export demand, especially by Russia. London prices are £18 per ton.

COPPER

Prices of electrolytic in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.16	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

Total exports in October were about 55,000,000 lb. Statistics of exports of copper are now withheld by the government for 30 days, so November figures will not be available until December. The visible supply in England, France, and afloat thereto was 29,671 tons on October 1, and increased 1772 tons during the month. Supplies at Rotterdam increased 200 tons. London quotations are £50 10s. per ton, and New York 11.25 to 11.50c. per pound. The Anaconda company's October output was 11,800,000 lb., against 12,400,000 lb. in September.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			Week ending	
Oct.	15 55.00	Oct.	29 50.00
"	22 50.00	Nov.	5 55.00
		"	12 55.00

Monthly averages.

	1913.	1914		1913	1914
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mar.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	53.00
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Oct.	29 4.90	Sept.	16 5.25
"	30 4.90	"	23 5.00
"	31 4.90	"	30 4.88
Nov.	1 Sunday	Oct.	14 4.55
"	2 4.90	"	21 4.73
"	3 4.90	"	28 4.90
"	4 4.90	Nov.	4 4.90

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	4.75
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

Prices for zinc in London are about £24 per ton, equal to 5.14c. per pound.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36.10	Oct.	40.61	30.40
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

Spot stocks of tin are scarce in New York, and prices have risen to 34.25c. per pound. Straits tin in London is £139 per ton.

CYANIDE

It is reported that the steamer 'Sun,' which was captured by the British authorities, and was to have brought a cargo of cyanide from Rotterdam, as mentioned in this Journal of October 31, has been released. It has been loaded with 1000 tons of cyanide and is on its way to New York from Rotterdam. Arrangements are being made for direct shipments of the salt from Copenhagen to San Francisco.

ALUMINUM

Throughout October there was little or no variance from the quotation of 18 to 18.50c. for 98 to 99% pure aluminum, in wholesale lots, smaller quantities commanding a premium as usual. About the middle of the month there was a slight spurt in demand, but it was not generally felt.

Gold and silver bullion received at the San Francisco mint in October amounted to 524,630.80 oz., and 82,649.63 oz., respectively, worth $6,755,637.69. Coinage executed amounted to $5,026,000. Coin, bullion, etc., on hand at the end of the month totaled $254,510,446. Transactions at the New York Assay Office were $7,342,042, compared with $4,162,009 in September.

COMPANY REPORTS

NORTH BROKEN HILL, LIMITED

This is one of the 'Barrier' companies of New South Wales, and the report covers the first half of 1914. A total of 156,020 tons of ore was concentrated, yielding 27,550 tons of concentrate assaying 70% lead and 23.6 oz. silver. There was sold to the Amalgamated company (flotation works) 73,691 tons of tailing. Working expenses totaled $4.28 per ton. The profit was $778,000 and surplus $1,010,000.

WAIHI-PAEROA GOLD EXTRACTION CO., LTD.

As mentioned before in this journal, this Company has a dredging plant, 22 tube-mills, Pachuca tanks, and vacuum-filters, recovering and treating tailing from the Ohinemuri river, New Zealand, washed down from the mills at Waihi, Waitekauri, and Karangahake. During the half-year ended June 30, 1914, the dredge had to work on shallow bars, due to a dry summer; but a new Priestman dredge is to be installed. The plant treated 70,200 tons of tailing yielding gold worth $89,000, against 71,200 tons and $108,000 in the previous half-year. The profit was $4300. Since early in 1912 the output was 304,400 tons for a profit of $60,000.

ROOIBERG MINERALS DEVELOPMENT CO., LTD.

This Company operates a tin mine in the Transvaal, and the report of E. J. Way covers the year ended June 30, 1914. Ore reserves are estimated as 20,097 tons, averaging 4.95% metallic tin. The 10-stamp mill crushed 29,181 tons, producing 1294 tons of concentrate assaying 68.51% metal. The recovery was 78.81%. An average of £174 per ton was received for the tin, against £218 in 1912-13. The revenue amounted to £152,889; profit, £55,805; amount from last year and interest, £73,888; dividends, £31,500; and carried forward, £22,787. Costs were reduced by $1.46 per ton of ore milled. While development at depth has not been up to expectations, the property is in a sound condition.

CAMP BIRD, LIMITED

The report of this well known Company covers the year ended June 30, 1914. In the directors' report, details are given of the Company's trouble with the failure of the Canadian Agency, Ltd., Chaplin, Milne, Grenfell & Co., and A. M. Grenfell, which was published in this journal of July 25. A technical committee was appointed, and with the change of offices in London there has been a saving of about £2000 per annum. The Company owns 1,122,901 shares of the total of £1,500,000 of Santa Gertrudis, Ltd., but on account of the revolution in Mexico no dividend was paid for the year. The Messina (Transvaal) Development Co., Ltd., was also mixed up with the Grenfell failure, and the Camp Bird company holds a considerable interest in it. On June 2, according to R. J. Frecheville, the Messina mine contained ore reserves, to No. 9 level, amounting to 247,000 tons of 9% copper. Further development has been good. The mine, mill, and smelter are in first-class condition. In the Central American Goldfields Syndicate, Ltd., the Camp Bird has invested £47,200 of the capital of 5000 £1 shares and £100,000 7% notes. Litigation will probably arise over the title to the properties acquired in Nicaragua, and operations are suspended for the present. Owing to the war, it is impossible to forecast what will be the ultimate liquidation of certain loans, etc., and the directors have written off considerable amounts in respect of losses. In the assets are shares in several companies valued at £905,184 net; cash, £30,916; stocks, £16,999; and sundry debtors, £55,371. Among the liabilities are sundry creditors, £18,159; outstanding dividends and debenture interest, £14,360; and balance forward to the current year, £5392.

The general manager, William J. Cox, reported as follows concerning work at the mine and mill: The general situation is no better than as advised in the report for 1913, but rather exaggerated with increasing depth and narrowing stoping widths in hard ground. Development totaled 3605 ft. Work is confined to the territory reached through No. 3 shaft, and a vein of increasing width, with depth, throughout a length of about 500 ft., lessened at each end to a width comparing with that in the upper levels, thus forming a lenticular 'bulge.' At between No. 4 and 5 levels it was 12 ft. wide, increasing to 30 ft. 400 ft. deeper, and for a short length on No. 8 it is 60 ft. wide. This forms the productive area of the mine. Quartz predominates in the vein filling, and only a small percentage is profitable. The profitable ore has hematite for its base, and is freakish, as it contains iron, zinc, and lead sulphides. It occurs in streaks, lengths being less persistent and narrower with depth, and less regular in its relation to the walls. The extreme west end of the mine is leased to the Argo Mining Co., and 1145 ft. of work failed to reveal profitable ore. Ore reserves are estimated at approximately 25,709 tons, which will yield a profit of $307,648. On June 30, 1914, there was 17,616 tons of ore broken in stopes.

The stamp-mill crushed 30,595 tons of ore yielding metals worth $801,079, against $675,630 last year. Details of mill work will be given in another issue of this journal. The year's profit was $337,000, of which $218,000 was paid to preference shareholders.

SANTA GERTRUDIS COMPANY, LTD.

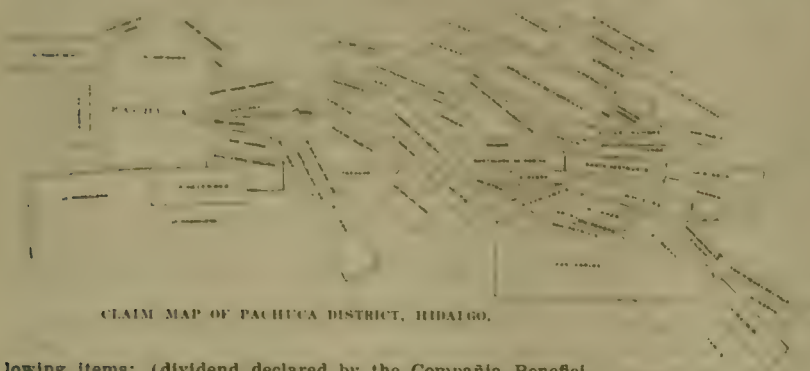
In many respects, the report of the directors of this Company for the year ended June 30, 1914, is similar to that of the Camp Bird, an abstract of which appears on this page. The report of the general manager, Hugh Rose, contains the following information:

No prospecting was undertaken. Development was continued vigorously, and amounted to 19,119 ft., of which 4853 ft. was charged to mining. The cost of development and mining was 56c. and $2.32 per ton, respectively. Deferred development written off was 8c., making a total underground cost of $2.96, against $4.28 for the preceding year. No. 20 level has been driven for 1400 ft. west of the east boundary. The vein is as strong as ever, with no material change in the andesite walls. Profitable ore exposed is limited to two shoots, 270 and 350 ft. long, respectively, with a stoping width of 5 ft. worth $5.52. Further work at depth is to be done through the interior shaft, now sunk 221 ft. below No. 20 level. It will be continued to 400 ft. Three large orebodies were found lying in the hanging wall of and near the North vein. So far as opened, one shoot, from No. 16 to 100 ft. below No. 19 level, is 370 ft. long, 110 ft. wide, and 470 ft. deep, estimated to contain 544,000 tons. Of this, 272,000 tons will average $7.04 per ton, the remainder unprofitable. The second shoot, on No. 17 level, is 230 ft. long and 20 ft. wide, and assays $12 per ton. And the third shoot, on No. 9, 11, 13, and 14 levels, is wedge shaped, 24 by 84 ft., worth $8.96 per ton. These discoveries show the importance of cross-cutting the hanging-wall area. Work in the Necesidad mine gave encouraging results. Ore reserves are estimated by the advisory engineer, William J. Cox, as 1,194,000 tons, which should yield a profit of $4,128,000, that is with silver at 59⅜c. per ounce, as in the last report [Silver is now 48½c.—EDITOR.]. Water pumped from the mine varied from 800 to 1200 gal. per minute, an increase over previous years.

Owing to the Mexican revolution, and occupation of Vera Cruz by United States troops on April 21, 1914, regular production was suspended, but by July 6 conditions allowed of a resumption to about 66% capacity. During the year the new mill treated 307,079 tons of ore, the March output being 32,849 tons with 60 stamps. Bullion recovered amounted

to 16,587 oz. gold and 3,182,341 oz. silver, worth $2,223,000. The recovery was 92.78%. From the Guadalupe mill was recovered 233 flasks of quicksilver from the old *patio*, also other residue, which yielded a net return of $2210.

The accounts are not clear as to profits, but show the following items: (dividend declared by the Compañia Beneficiadora de Pachuca, a subsidiary Company, which operates the mill, $634,000); balance for the year, $610,000; balance from previous year, $36,400; losses on current and loan accounts (Grenfell affair), $110,500; depreciation of investment, $45,200; cash, $452,000; and balance to current year, $456,000.



CLAIM MAP OF PACHUCA DISTRICT, HIDALGO.

GRANBY CONSOLIDATED MINING SMELTING & POWER COMPANY, LTD.

A short abstract of the financial results of this Company for the year ended June 30, 1914, appeared in the *Press* of October 17. Further details of operations are as follows, as given by the general manager, F. M. Sylvester; superintendent of mines, O. B. Smith; superintendent of smelters, W. A. Williams; and mine superintendents at Phoenix, Valdez, Ketchikan, and Anyox, C. M. Campbell, H. J. C. MacDonald, E. E. Campbell, and N. W. Sweetser, respectively.

Ore reserves in the various mines are as follows:

	Tons.	Tonnage available per day.
Phoenix	4,691,531	3,000 to 4,000
Anyox	18,153,000	2,000
Mamie	135,200	300
Midas	116,344	100
It-Dean	5,000	30
Total	23,101,075	5,430

The Phoenix ore yields 17 lb. copper, 0.033 oz. gold, and 0.2 oz. silver per ton; Anyox, 1.4 to 2.2% copper, and 30c. per ton gold and silver; Midas, 4% copper, 0.065 oz. gold, 0.46 oz. silver; Mamie, 2.25% copper and 25 to 50c. per ton in gold and silver; and It-Dean, $15 to $20 per ton. Development at Phoenix amounted to 13,647 ft. underground, and 19,670 ft. of diamond-drilling, a total of 121,495 ft. and 75,812 ft., respectively. All mining costs totaled 80c. per ton. At Anyox, work covered 5319 ft., of which nearly half was on the 530-ft. level. Thirty holes were drilled, a total of 6072 ft. from the surface and various levels. In all, there have been drilled 166 holes, equal to 43,591 ft. The high-grade ore, 9,563,000 tons of 2.2% copper and 30c. gold and silver, is surrounded by 8,589,500 tons of low-grade material, with 0.6% copper, making a total of 18,153,000 tons averaging 1.4%. Mining costs should not be over $1 per ton. At the Midas mine, near Valdez, Alaska, 2000 ft. of work was done, 1500 ft. being in ore as described above. This ore should be extracted and delivered to the boat at about $2 per ton. A wharf, ore bunker belt, 5½-mile tramway, 200-hp. Diesel engine power-plant, 30-hp. Foos engine, 15-hp. Fairbanks-Morse distillate engine, and other equipment was erected. The Mamie property is near Hadley, on Prince of Wales Island. There are eight claims, on which the Granby company started work in December 1913. Work done in charge of Mr Heldman, the foreman, has shown that the zone rather than being a number of small orebodies as described in a report by the U. S. Geological Survey, is largely one large lense with 'islands' of barren siliceous rock occurring throughout the lense. Two other smaller shoots so far have no connection with the large body. Extensive faulting has caused this formation. The future of the mine is promising. The It and Dean mines are on the same island, four miles from Kasaan. Work was started by the Company in June 1914. The ore consists of chalcopyrite in a gangue of garnet, epidote, and calcite. It averages 40c. per ton gold to each 1% copper. There are five lenses of ore opened. Natural advantages for operation are numerous.

The Grand Forks smelter had a high average of furnaces in blast, with good tonnages smelted, and good recovery. Silica was high in the slag. Costs were a trifle higher. There were 208 men employed in charge of W. B. Bishop and heads of departments. At Anyox the first furnace was blown in during March. There were some mechanical troubles, especially with the worm-drive of the converters. Metallurgical problems presented include the trouble with fine ore. Mr. Bone and others did good work in this new plant. During the year the smelters did the following work:

Mine.	Tons smelted.	Metals produced.	Value.
Phoenix	1,201,955	23,320,097 lb. copper	.....
Anyox	63,105	435,275 oz. silver	.....
Other	23,940	43,882 oz. gold	.....
Total	1,289,000	.....	$4,504,766

The total expenditure was $3,882,695, or $2.73 per ton of ore, and 11.5c. per pound of copper. The profit was $622,071; surplus from 1912, $3,199,271; dividends, $899,900; interest, etc., $182,520; surplus remaining, $2,738,922. There was a sum of $3,002,691 spent in developing and equipping the Anyox mine.

BROKEN HILL PROPRIETARY COMPANY, LTD.

The fifty-eighth half-yearly report of this 'Barrier' company, New South Wales, covers operations for the period ended May 31, 1914. The manager, G. D. Delprat, reported as follows:

Two diamond-drills were engaged in prospecting ground outside of the known orebody by means of horizontal holes from the 400, 500, 650, 800, and 1000-ft. levels, but nothing was found. Working two shifts produced 147,577 tons of ore.

The mills treated 139,991 tons of sulphide ore, yielding 24,059 tons of concentrate assaying 61.46% lead and 27.02 oz. silver per ton. The Luhrig vanners have been scrapped, and six additional Wilfley tables installed. With the concentrate from the regrinding plant the total output of lead concentrate was 27,395 tons. The flotation plant treated 168,558 tons, producing 37,745 tons of zinc concentrate assaying 46.33% zinc, 6.65% lead, and 12.89 oz. silver per ton.

The Port Pirie smelter, with four furnaces, treated 109,752 tons of mixed material, producing 48,404 tons of lead-silver bullion. The Dwight-Lloyd plant treated 44,445 tons of concentrate prior to smelting. The refinery produced 2,067,182 oz. silver, 916 oz. gold, 40,125 tons lead, and 221 tons of antimonial lead. The distillation plant yielded 2043 tons of spelter and 248 tons of blue powder.

Revenue for the period was £1,147,196, and gross profit £180,251. Dividends totaling £107,050 were paid.

MINING DECISIONS

Mining Claims on Alaska Seashore

The provisions in the Acts of May 14, 1898, and March 3, 1903, extending the homestead laws to the territory of Alaska, providing that no entry shall be allowed extending more than 160 rods along the shore of any navigable water, and that along such shore a space of at least 80 rods shall be reserved from entry between claims, have no application to mining claims asserted under the general mining laws as extended to Alaska.

Francis Clarno (Land Department), 43 Land Decisions, 120. February 19, 1914.

Subsurface Support—Right to Waived

A deed to the surface of coal land excepted, "all coal and minerals beneath the surface * * * with the right to mine and remove the same * * * without thereby incurring in any event whatever any liability for injury caused or damage done to the surface of said lot or buildings, which are now or hereafter may be put thereon." Held that the grantee or his successors in interest under said deed could not recover for damages to the surface resulting from insufficient support given the same by parties mining beneath the same.

Graff Furnace Co. *v.* Scranton Coal Co. (Pennsylvania), 91 Atlantic, 508. March 30, 1914.

Miners' Liens—Effect of Assignment

Under the Oregon code, an assignment of a miner's lien, prior to its recordation, would be invalid, carrying title only to the debt and not to the right to perfect the lien. The affidavit of verification may be made by a person other than the lien claimant providing he has knowledge of the truth of the facts set forth in the affidavit. A sale of mining property on foreclosure of a mortgage extinguishes the liens of a mortgage, so that they do not affect a subsequent proceeding for a lien against the property for labor and supplies. Failure to post notices of non-responsibility by a lessor renders the mine subject to liens for obligations incurred by the lessee.

Loud *v.* Gold Ray Realty Co. (Oregon), 142 Pacific, 785. July 14, 1914.

Placer Patents—'Known Lodes'—When Excepted

Six lode locations were made in October 1912, upon land for which placer patent was applied in 1873. The land was a typical gulch placer gold claim. Some lode outcroppings had attracted attention in early days and lode locations were made as early as 1865, abandoned, relocated, and again abandoned. The lodes claimed by defendants to be 'known lodes' excepted from operation of the placer patent, were shown to have been discovered in the bedrock after removal of the overlying placer deposits. Held, that no valid location could be based on such a discovery. The court said: "Float, outcroppings, lodes, and abandoned locations separately or combined, are not sufficient to constitute a 'known lode' within the exclusion of the placer law. To be impressed with such character, the lode must, at the time of the application for the placer patent, be clearly ascertained and defined, and of such extent and content that it will then, in view of conditions then, justify development and exploitation and because of which the placer claim is valuable and more valuable for placer mining purposes." Mere lapse of time, however, does not estop a lode claimant from making a valid location of a lode claim as against a placer patentee. The exception of 'known lodes' applies for all time as to the United States or any one claiming under the United States.

Barnard Realty Co. *v.* Nolan (Montana), 215 Federal, 996. July 25, 1914.

BOOK REVIEWS

Laboratory Course in Electrochemistry. By Oliver P. Watts. P. 150. Ill., index. McGraw-Hill Book Co., New York, 1914. For sale by the *Mining and Scientific Press*. Price, $1.

Electrochemistry is an important branch of chemical work, and is making great strides, especially in separation of metals. This little work was written primarily for the author's classes in the University of Wisconsin, and embodies notes originally prepared by C. F. Burgess, former head of the chemical engineering department of that institution.

Corporation Laws, Arizona, California, and Nevada. Compiled by Calvert Wilson. P. 288. Index. Baumgardt Publishing Co., Los Angeles, California. For sale by the *Mining and Scientific Press*. Price, $2.

The corporation laws of states and countries are often puzzling and of great length. In this volume are given a general outline of these laws in the above states of the Union, pertaining to general private corporations. It also contains the forms in ordinary use for corporation purposes, not including forms for creating bond issues, and the like. It is brief but practical.

College Physiography. By R. S. Tarr and Lawrence J. Martin. P. 837. Ill. The MacMillan Company, New York, 1914. For sale by the *Mining and Scientific Press*. Price, $3.50.

The text-books of physiography written by the late Professor Tarr are deservedly widely known. At the time of his death he had in preparation the manuscript of a larger and more comprehensive work on the subject. This came into the capable hands of L. J. Martin, one of his former students, now at the University of Wisconsin, for completion, and it is no disparagement to Tarr to say that the completed work seems to be the gainer thereby, since two heads are proverbially better than one. All of the last seven chapters, the bibliographies, and much of the remainder of the text are due to Mr. Martin. The book is primarily intended as a text for college students, but it is compendious enough to serve as a reference book, and readable enough to appeal to the general reader interested in the scientific description of the visible features of the world he lives in. For the general reader the book would have been improved if the discussion of each physiographic feature had been sufficiently extended to show its economic significance. In Chisholm's Commercial Geography, for example, the economic significance of physiographic features is discussed by countries, but it would be somewhat more logical, and more illuminating, to treat them according to topics. Thus the disturbing effect of the advance and retreat of glaciers on road-building and railroad building in the vicinity, the work of the winds as affecting agriculture and commerce, the course and rate of flow of rivers as affecting trade, the effect of ocean currents and oceanic winds on international trade, and similar topics might all be discussed in connection with the description of the phenomena concerned, with the result that the college student would be able to perceive the economic significance of any given set of conditions encountered in his travels. To some extent this has been done in the present volume, as in the discussion of the Allegheny plateau, on page 513, but it might well have been pushed even further. The illustrations in the book are unusually good, having been culled from a great range of sources. The use of comparatively fine print is a slight drawback which was probably caused by a commendable desire to keep the weight of the book down to a point where it would not be a burden to the reader. The study of physiography is a topic which deserves more attention by the general public, and it is to be hoped that this readable book will conduce to that end.

RECENT PUBLICATIONS

U. S. Bureau of Mines publications, Washington, D. C., 1914:

PREVENTION OF ACCIDENTS FROM EXPLOSIVES IN METAL MINING. By Edwin Higgins. *Miners' Circular* 19. P. 16. Illustrated.

PRODUCTION OF EXPLOSIVES IN THE UNITED STATES IN 1913. Compiled by Albert H. Fay. *Technical Paper* 85. P. 15. The total was 463,514,881 pounds.

U. S. Geological Survey publications, Washington, D. C., 1914:

Abstracts from 'Mineral Resources of the United States, 1913':

ZINC AND CADMIUM. General report. By C. E. Siebenthal. P. 51. Chart.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN MONTANA. Mines report. By V. C. Heikes. P. 38.

PRODUCTION OF COAL. By Edward W. Parker. P. 220. Ill., chart. The total output of all coals in 1913 was 570,048,125 tons, and since 1807, a total of 9,844,247,843 tons.

SLATE IN THE UNITED STATES. By T. Nelson Dale and others. *Bulletin* 586. P. 220. Ill., charts, map, index. The value of slate produced in 1913 was $6,175,476.

MINERAL RESOURCES OF ALASKA. Report on progress of investigations in 1913. By Alfred H. Brooks and others. *Bulletin* 592. P. 413. Ill., maps, index. Contents of this valuable work are published in the news section of this issue. A complete bibliography is included.

Contributions to *Economic Geology*, 1913, part II-C.

THE MOORCROFT OIL FIELD AND THE BIG MUDDY DOME, WYOMING. Papers by V. H. Barnett. *Bulletin* 581-C. P. 34. Maps.

PHOSPHATE DEPOSITS OF SOUTH CAROLINA. By G. Sherburne Rogers. *Bulletin* 580-J. P. 37. Map. The output in 1912 was 131,490 tons, and is a great decrease on the 541,645 tons of 1889. Future prospects are poor.

Water-Supply Papers:

SURFACE WATER SUPPLY OF THE UNITED STATES, 1912. Part XII.—North Pacific Coast Drainage Basins. C—Lower Columbia River, and Rogue, Umpqua, and Siletz Rivers. By F. F. Henshaw and E. S. Fuller. No. 332-C. Prepared in coöperation with the States of Oregon and Washington. P. 226. Index.

STREAM-GAGING STATIONS, AND PUBLICATIONS RELATING TO WATER RESOURCES. 1885-1913. Part III. Ohio River Basin. Compiled by B. D. Wood. No. 340-C. P. 65. Index of areas, subjects, and streams.

QUALITY OF THE SURFACE WATERS OF OREGON. By Walton Van Winkle. Prepared in coöperation with the state of Oregon, John H. Lewis, engineer. No. 363. P. 137. Ill., map, index.

WATER ANALYSES, FROM THE LABORATORY OF THE U. S. GEOLOGICAL SURVEY. Tabulated by F. W. Clarke. No. 364. P. 40.

DETERMINATION OF SILVER AND BASE METAL IN PRECIOUS METAL BULLION. By Frederic P. Dewey. Reprint from *Journal of Industrial and Engineering Chemistry*, August and September, 1914. P. 47. This is a valuable contribution on the art of assaying bullion by one of the staff of the Bureau of the Mint.

MAP OF THE STATE OF OKLAHOMA. 26 by 50 in. Published by the Oklahoma Geological Survey, C. W. Shannon, director. Compiled from U. S. Geological Survey quadrangles, General Land Office map of 1914, post route map 1914, actual location of railroads obtained from respective companies, and information furnished by county surveyors. Frank Gahrtz, in charge of drafting department. Norman, Oklahoma 1914.

GOLD FIELDS OF NOVA SCOTIA. By W. Malcolm. *Memoir* No. 20 E. Compiled largely from the results of investigations by E. R. Faribault. P. 331. Ill., maps, plans, index. Department of Mines of Canada, Geological Survey branch. Ottawa, 1912. This is another of the excellent publications issued by the department, and covers everything of interest connected with the history, fauna and flora, geology, and mines of the province. To the end of 1910 the gold output was 919,047 oz. from 2,080,403 tons of ore.

MINES STATEMENT FOR 1913. Statistics, reports relating to metalliferous mines, and quarries, state aid to mining, roads in goldfields, prospecting drills, water-races (flumes), schools of mines, inspection of mines, examinations for certificates in mines and mills, geological survey, state coal mines, etc., in New Zealand. Compiled in the Department of Mines. P. 186. Ill., maps, plans. Wellington, 1914. Abstracts from this interesting report will be made from time to time in the *Press*.

REPORT OF THE DEPARTMENT OF MINES OF WESTERN AUSTRALIA FOR 1913. P. 111. Ill., maps, plans. Perth, 1914. Contains statistics, details of minerals produced, claims held, men employed, accidents, state aid to mining, reports on the various goldfields, legislation, inspection of machinery, school of mines, state mining engineer's report, state custom mills, government geologist's report, and notes on explosives, etc. The mineral output of the state in 1913 was £6,036,265. Abstracts from this report will appear in the *Press* from time to time.

Department of Mines, Canada, publications, Ottawa, 1914:

MAGNETITE OCCURRENCES NEAR CALABOGIE, RENFREW COUNTY, ONTARIO. By E. Lindeman. P. 16. Maps.

MOOSE MOUNTAIN IRON-BEARING DISTRICT, ONTARIO. By E. Lindeman. P. 14. Ill., pocket of maps.

ILLUMINATING POWER OF KEROSENES. By William Kunerth. *Bulletin* 37. P. 31. Ill. Iowa State College Engineering Experiment Station, Ames, Iowa, 1914.

THE RESOURCES OF TENNESSEE. Vol. IV., No. 4. P. 72. Ill. State Geological Survey, Nashville, October 1914.

THE ITABIRITE IRON ORES OF BRAZIL. By E. C. Harder. Reprint from *Economic Geology*, March 1914. P. 11. Ill. Also THE IRON INDUSTRY OF BRAZIL, reprint from *Transactions* of the American Institute of Mining Engineers.

REPORT OF THE ILLINOIS STATE MUSEUM OF NATURAL HISTORY. By A. R. Crook. P. 73. Ill. Springfield, 1913. A brief account of the work and collections of this, a "state institution for the people, for education, for science, and for business."

INLAND LAKES OF WISCONSIN; THE HYDROGRAPHY AND MORPHOMETRY OF THE LAKES. By Chancey Juday. Wisconsin Geol. & Nat. Hist. Surv., *Bull.* 27. P. 137. Ill., index. Madison, 1914.

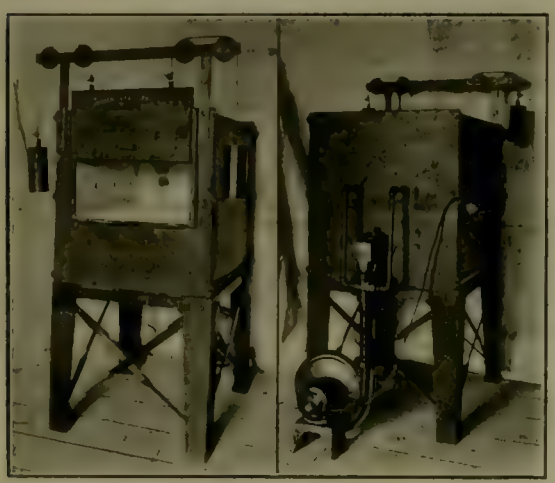
MISSISSIPPIAN BRACHIOPODA OF THE MISSISSIPPI VALLEY BASIN. By Stuart Weller. State Geol. Surv. Illinois, Monograph 1. Text and plates. 2 vol. P. 508. Ill., index. Urbana, 1914. This is an elaborate and authoritative scientific study of the sort that underlies and makes possible the highly useful work of the modern economic geologist. It is a work for specialists, though in the introductory pages is given a general statement regarding the classification of the Mississippian rocks (the series in which the Joplin zinc ores occur) which makes available to the general worker the most recent results of the specialist.

New Machines and Devices

A Laboratory Roaster

In the determination of the proper metallurgical practice for the treatment of ores it is essential that a thorough investigation be made of all possible treatments and that one chosen which proves to be the most economic. Testing laboratories for making such thorough investigations are few, as such tests require such a wide variety of machinery and equipment. However, in the more modern laboratories and ore testing plants are to be found equipment for conducting such tests.

The general construction of this roaster will be seen from the accompanying halftone, showing two views of it. The hearth of the furnace is 20 by 30 in., thereby affording ample space for a fair sample of the ore to be tested. In each sidewall of the furnace are three pyrometer holes, seen in the



ROASTER SHOWING FUEL OIL BURNER.

halftone. These holes are positioned at such an angle that it is possible to place the pyrometer in such positions in the orebed that one can take accurate readings and keep a complete record of the performance of the furnace. The fuel is admitted through the rear of the furnace by means of a Case low-pressure fuel-oil burning system, shown in the left of the halftone. The oil flows by gravity to the oil burner and the air is supplied by a direct-driven motor blower of special design. The blower is driven by a ½-hp. motor and supplies 4000 cu. ft. of air per minute. Electricity for the blower may be supplied by connecting with the ordinary lamp socket.

In the rear of the furnace will be seen two air vents connected with the blower. These have been provided in order that after the roast has been completed and sulphur driven off, the air may be turned into the furnace over the charge at the rate of 4000 cu. ft. per minute and the oxidation thus made complete.

The furnace is strongly built and the lining is easily replaced in a few minutes. In addition to its use as a laboratory roaster, it will also undoubtedly find a field in metallurgical plants as a convenient means for roasting precipitates. This interesting little roaster is manufactured by the Denver Fire Clay Co., Denver, Colorado, and the roaster shown is the first to be built and will be installed in the laboratory of the mining department of the University of Wisconsin.

Commercial Paragraphs

HYATT ROLLER BEARING CO., Chicago, is distributing a folder addressed to the buyers and builders of machine tools.

SUTTON, STEELE & STEELE, Denver, Colorado, is operating a demonstrating and custom mill, which treats a wide variety of ore by dry concentration methods. The mill equipment includes crusher, dryer, elevator, de-duster, storage bins, mechanical sizer, dry concentration tables, dry jigs, rolls, and other equipment, including static electric machines.

PAWLING & HARNISCHFEGER CO., Milwaukee, Wisconsin, has issued Bulletin 301-A, entitled 'The Application of the Electric Hoist.' Whenever loads are too heavy to be moved by one man, the electric hoist is recommended. The hoist discussed is an overhead monorail hoist, traveling on the lower flanges of an I-beam. The illustrations show the application of this type of hoist to a large variety of purposes.

WESTINGHOUSE ELECTRIC & MFG. CO., of Pittsburgh, Pennsylvania, has just issued a pamphlet entitled 'Central Station Power in Coal Mines.' The pamphlet is devoted to the use of electricity in coal mines and points out the advantages of obtaining a power supply from central station plants. A number of tables are given showing the cost of operation; curves are also given showing the day and night lode in the mines.

LEHIGH CAR WHEEL AND AXLE WORKS, Catasauqua, Pennsylvania, has recently issued Catalogue 50, entitled 'Fuller Quality Products,' which contains the new list prices covering the face-hardened sprocket and traction wheels, also general descriptions of the high-grade chilled charcoal iron castings for all uses manufactured by this Company. The catalogue is illustrated and contains a great deal of information concerning the Company's products.

'The THERMIT PROCESS OF PIPE WELDING' is the title of a new publication by the Goldschmidt Thermit Co., New York. The object of the booklet is to call attention to the many advantages of the thermit process for pipe welding in plants for high-pressure steam, hydraulic, and compressed-air pipelines. The process is described in detail, telling how the welds are made and giving full information on the cost of this operation. The booklet is fully illustrated and contains a great deal of information on this type of welding apparatus. Another attractive publication by the same Company is entitled 'Thermit Insert Fully Welded Rail Joint.'

ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, tienes por distribucion Boletin No. 1808. Este catalogo es discriptiva de maquinaria de extraccion, dando mucho espacio a malacates. Esta Compania habienda tenida mucha experienca en el diseño y funcionamiento de toda clase de maquinaria de extraccion, disfruta de opportunidades excepcionales para alcanzar un conocimiento perfecto de todas las exigencias y la solucion de los problemas de ingenieria relacionados con la maquinaria de extraccion. La Compania fabrica malacates de todas clases por todos usos. En este catalogo son presentanda con illustraciones y detailles una discusion de esta clase de maquinaria.

Supposed Values vs. Demonstrated Values

The value of gold, copper, iron, coal phosphates or other mineral bearing lands, depends upon the quantity of ore demonstrated to be present. What **may** be there any man may guess, but mine property is neither bought nor sold upon conjecture. For the man who wants to **know, DRILLING** will tell the story. But there is a vast difference between "peppering a hillside with holes" and drilling with the directed intelligence of Longyear Drill Men, equipped with Longyear Diamond Drills and answerable to the requirements of

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ANNOUNCEMENT

So much has been said recently about the possible rapid expansion of the trade of the United States in the countries to the south, that we are presenting this week a full editorial review of the situation so far as it touches mines and mining. It is our belief that there are opportunities for large increases in commerce between the Americas, and that the larger trade will be greatly to the advantage of the peoples of all the countries concerned. It is, however, but the part of good business to recognize the many difficulties that lie in the road and also the fact that the increased trade can neither be expected to develop over night nor be maintained when normal conditions in Europe are restored, save on the solid basis of mutual profit. The United States wants trade and closer relations with Central and South America. One step toward the new order is the weaving of closer ties among the men in the same lines of work both north and south. As a beginning, we are sending extra copies of this number of the *Press* to a large number of engineers and firms in Central and South America not on our regular mailing list, in order that they may learn just how these problems appeal to us here. A number of our advertisers have chosen to tell their story this week in Spanish. We are glad of this, since at present we think the advertising literature sent out by North American manufacturers and dealers is of first importance. A knowledge of modern technology is available in any language, but the specific things of immediate importance that North America can furnish to South America, are described in the selling pages of our magazines. Mining and metallurgy have made great strides in the United States and the machinery and devices that have made them possible are available on equal terms to others. It has been no part of the plan of this issue to prepare a 'special number,' since we prefer to get out especially good numbers every week rather than to follow a feast with a famine. We publish regularly much material about Latin America; this week we print more than usual; but the things of real importance to our friends of the mines and mills to the south are the facts regarding the technology and business of the industry, such as we have printed week by week for over half a century and propose to continue to print.

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EDITORIAL

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THE Rand gold output is increasing, it was 733,746 fine ounces in October as compared with 702,170 in September, and 718,431 in October 1913.

COMPLAINT has been made that men answering advertisements for situations open, at times receive no acknowledgment of the application, to their own inconvenience and occasional loss. The courtesy of a reply should certainly be extended to one who, in a sense, has answered your request for information. This is all the more imperative since the advertisements are usually 'blind' and the applicant has not even the means of knowing whether the work lies in a region to which he would willingly go. Any company desiring to maintain its anonymity can send replies through the publisher of the advertisement.

ORGANIZATION of the California Metal Producers' Association has been completed by election as directors of Messrs. Albert Burch, George W. Starr, E. C. Hutchinson, C. E. Knox, Newton Cleaveland, George W. Metcalfe, and Seeley W. Mudd. The finance committee consists of Messrs. J. H. Grady, Henry Malloch, and William Hague. Mr. Burch was made president, and Messrs. Metcalfe and Hutchinson vice-presidents. Mr. John Mocine, recently in the service of the Goldfield Consolidated Mines Company, has been selected as secretary-treasurer, and an active canvass is being made to complete the membership.

CONFESSION of Boris Thomason clears the mystery regarding recent fires at Goldfield and Tonopah, and fixes the responsibility upon the I. W. W. of which Thomason has been a leader in the mining districts and at Stockton, California. Thomason has been sent to the penitentiary for twenty years, but the I. W. W. as a trouble-making organization is still at large. We have every sympathy for the men now out of work, many of whom are recruited to the ranks of the I. W. W., but the first function of a civilized government is to maintain order, and we do not believe that the way to better things is through such means as the I. W. W. has adopted. Also, we believe that quick determined work by the officers of the law will forestall much of such trouble. We would not like to look forward to living under martial law, but we would rather live under it than no law.

SAN FRANCISCO members of the Mining and Metallurgical Society of America signalized the beginning of the winter season by a 'home coming' dinner to Mr. F. W. Bradley, at the Palace Hotel last Monday. The occasion was particularly enjoyable and the members and guests were glad to hear informally of the progress of work at Juneau, Treadwell, and Kellogg, where Mr. Bradley had been spending a long summer of hard work. It is pleasant to record that developments both in Alaska, where the first unit of the Alaska Juneau mill was under study, and in Idaho, where dry chlorination is being tried on lead ores, have been most satisfactory. Mr. C. H. Munro discussed briefly the black sands of the California beaches, Mr. Seeley W. Mudd gave interesting details of the newly discovered platinum deposits of southern Nevada, and others contributed to a general discussion that was stimulating and helpful. Such dinners cement friendships and develop professional solidarity. They are all the more pleasant when made the means of expressing appreciation of the work and attainments of a distinguished member of the profession.

PLANS for 1915 at San Francisco have been but little changed by the war in Europe. The Panama-Pacific Exposition will open on time and the great buildings will be filled with exhibits from all parts of the world. The Engineering Congress will be held in September as originally planned. Of the 290 papers for the latter originally contemplated, 220 are either definitely promised or well assured, including papers from England, Spain, Sweden, Holland, Canada, India, Italy, China, Japan, Australia, and various South American countries. A few from the war zone are uncertain, though some of them are expected. It is believed, however, that by substituting other papers that have been offered, the general plans outlined last year may be realized. The honorary president of the Congress will be Colonel G. W. Goethals. The honorary vice-presidents include Messrs. Richard Beck, Sir J. H. Biles, Otto T. Blathy, Commander Christian Blom, André Blondel, C. E. L. Brown, Emil A. Budde, Henry Le Chatelier, Hermann Hullmann, William Henry Hunter, Luigi Luiggi, Rear Admiral Yoshihiko Mizutani, W. M. Morday, Sir Charles Parsons, Jean L. de Pulligny, V. E. Timonoff, R. P. J. Tutein-Melthenius, H. H. Vaughn, and Sir William Willcocks. The coöperation of these men assures an interesting program.

COPPER QUOTATIONS

Discussing copper quotations last month, we incidentally mentioned *The American Metal Market*. That journal, greatly to our surprise, chose to interpret what we wrote as an attack, and replied with a couple of caustic criticisms without waiting for an exchange of letters which, we are glad to say, removed much of the misapprehension. Our excitable contemporary protests that it does not depend upon the New York Metal Exchange—a correction we gladly make, merely calling attention to the fact that we said "depend largely" and advances argument to show that its quotations afford a better guide than do those of the "technical journals." As to that, more later. Let us first acknowledge an error into which we fell in stating that the quotations in *The Iron Age* agreed with those of the *Press* rather than of *The American Metal Market*. Since the first of the year, apparently, the reverse has been true. Our statements were based upon a fairly complete investigation made some two years ago when we were studying the whole situation. The figures should have been checked by recent quotations.

The American Metal Market characterizes as "stupid" and "irresponsible" our suggestion that if quotations had not been withdrawn copper would have dropped to five cents or less. We see no reason to change our opinion, and that certainly was the belief of several of the largest producers early in August. It is proverbial that 'hindsight' is easier than foresight, and foreign demand has been better than was anticipated. Certainly no one doubts that if quotations had been continued the price would have fallen far below the cost of production, which is the main point. The particular number of cents suggested is unimportant. The effect would have been the closing of plants, and as the relations of supply and demand became gradually adjusted the price would have risen to cover cost, at least, of the companies continuing to produce. The same result has been brought about in another way, with the difference that there has been no sacrifice of stocks of copper at absurdly low prices. Withdrawing quotations was a war measure designed to stop the flow of contract copper, as we stated. It was a distinct benefit to everyone concerned, save metal users, who would, naturally, have liked to profit from panic prices. Quotations have now been resumed, and in the interim we have printed the prices at which copper has been paid for, but we have no illusions as to there having been an open market for copper for the past two months, whatever professional traders in New York may hypnotize themselves into believing.

The reason that average quotations do not check with average returns for the year in the case of the larger companies has already been sufficiently explained. There is a radical difference between selling a raw product such as ore, where steady shipments are the first consideration, and marketing a finished metal already in the warehouse and ready to be moved when the market is favorable. The quotations we give are those at which copper in ore is paid for, which is the price that mainly concerns our circle of readers who are ore producers. We believe that the prices are at the same time those at which the metal companies sell copper. It is to be remembered that our quotations, being for record rather than for trading, represent transactions already closed. At best they are two days old when made public. Under these conditions it is possible to get information that no metal company could afford to give to a reporter if it was to enter into prices used for trading the next day. Differences of opinion as to the market on any particular day exist or there would be no trading, but at the end of the week it is possible to know the price at which metals did move on each day, and that is the fair and right price for settlement of deals as of that day. We reiterate our protest against the implication that differences in opinion are necessarily founded in differences in honesty.

AMERICAN MINING CONGRESS

Phoenix, Arizona, has just been visited by a serious fire which destroyed a number of its main business buildings. Phoenix, however, can be expected to prove true to its name, and in the meantime facilities for entertaining the visiting mining men and their wives during the meeting of the American Mining Congress, December 7 to 11 inclusive, are ample and uninjured. Under the capable chairmanship of Mr. Will L. Clarke, an attractive series of local excursions and receptions has been arranged and the delegates and guests will be certain to see Arizona at its best. The program committee has been not less active. The subjects announced for discussion include the topics of Western mining conditions, mining investments, safety, federal aid to mining and mining schools, water-power development, conservation, workmen's compensation, developments on reservations, rights-of-way on the public domain, mine taxation, revision of mining laws, and compulsory arbitration; certainly a comprehensive list. Many of these topics are controversial, and all of them concern matters that mining men should discuss frankly among themselves. Possibly it would have been better to abbreviate the program and centre it upon a few definite subjects, since one or two measurably well rounded out conferences accomplish more than much desultory speaking. We understand that the conference idea is to dominate the meeting in place of the older one of a series of set speeches. We are glad to see this, as also the persistent study by the Congress of the business side of mining. It is in this, as we believe, that its largest field of usefulness exists, since its membership includes non-technical as well as technical men.

One topic, not down upon the program, is sure to come up for thoughtful discussion, and that is, the future of the Congress itself. As is well known, the organization has never been adequately financed for the work it has undertaken. A report made public this year by the Ways and Means Committee showed that

membership fees have not yielded enough to meet expenses and that in fact the work of the past few years has been accomplished largely through the self-sacrifice of the secretary, Mr. J. F. Callbreath, Jr., to whom the Congress has been chronically in debt. The matter is given especial significance at this time through the circumstance that Mr. Callbreath has had, this year, to abandon active work for a time and retire to a sanitarium. We are glad to report that his health and strength are returning, but a great public work such as the Congress has accomplished and such as it has yet to do, ought not rest so largely on the shoulders of one man. The situation is a grave one and should be frankly faced. Important as the work is, it should be abandoned for the time unless adequate support can be assured. We hope no such retreat may be necessary, and we trust that at the Phoenix meeting the members will not only have the enjoyable visit that is assured, but will also find a way to meet the very pressing needs of the Congress itself.

SEEKING SOUTH AMERICAN TRADE—A WORD OF CAUTION TO HOME FOLKS

Elsewhere in this issue we present a review of South and Central American countries from the business standpoint. Much of what has been said in the public prints recently concerning the possibility of developing increased trade with South America has been so visionary and ill advised that it will be well briefly to review the actual situation. In the first place, it is evident that no one wants to sell goods to South America unless some provision is made for paying for them promptly. It is equally evident that South American countries can only pay for the goods which they import by selling their own products, either in this country or in Europe. Any country is likely to buy most of its goods in the same market in which it sells its products, just as the farmer who brings a basket of eggs to town buys his supplies in the store in which he sells his eggs, and for the same reason; any buyer will make better terms with a seller who is willing to take out his credits in trade. A fundamental difficulty is here involved, for the main products of South American countries are those which this country also exports largely. Coffee, rubber, wool, hides, beef, tin, and nitre are all South American products which we must have, however, and with proper cultivation of markets practically every South American country can sell enough of its products here to establish sufficient credit to secure large quantities of American-made goods. Another difficulty has been the absence of adequate banking facilities. Until recently the law forbade our national banks to have foreign branches. This blunder has now been corrected and the National City Bank of New York has already established branches in Rio de Janeiro and Buenos Aires, and doubtless others will soon follow. A difficulty remaining to be overcome is that there is no direct exchange of our money for South American money. A purchaser in Brazil, for example, is obliged to buy, in Brazilian money, exchange on London in pounds sterling and then negotiate this in New York to pay his bill there in dollars. Even the freight between South American ports and this country is reckoned in pounds sterling. This extra exchange involves extra cost, which is to our disadvantage. It is hoped that when American banks are firmly established in South America this can be overcome, and a daily exchange rate established between the United States gold and the moneys of the different South American countries.

Another problem that will be difficult for us to meet is the lending of money to these countries. Practically every one of these countries is a borrower of capital, some borrowing in very large amounts. Every borrower is under a good deal of pressure to do business only with the interests which lent him the capital for financing his operations. Mr. C. M. Pepper, former South American agent of the Department of Commerce, has estimated that the United States must be prepared to lend South American countries $500,000,000 in the next five years if we expect to 'capture' South American trade. It is dangerous to prophesy what will happen after this war, but it seems beyond the bounds of possibility that we shall be able to furnish anything like such a sum. Doubtless a good deal more trade than we now have can be secured without making such huge loans, but it is well to keep in mind that the whole South American trade is not to be ours for the mere asking.

We are keenly conscious in this country that the war in Europe has seriously and unfavorably affected us, and are perhaps inclined to overlook the fact that South American countries have been similarly affected. Brazil was in a precarious financial condition before the war broke out and had arranged to overcome her difficulties through large foreign loans which cannot now be placed. The European market for rubber and coffee is in large part cut off and, with the present low prices for coffee and rubber, increasing our trade with Brazil will not be as simple as rolling down hill. Argentina was also in a financial crisis before the war, and as nearly all her grain and much of her wool is sold in Europe, her situation is also serious. The largest sales made by Chile are of nitrate and copper to Europe, and both these products can now only be marketed in limited amounts and with difficulty. The copper and cotton exports of Peru are similarly affected, while the cocoa exports of Ecuador are finding a lessened market at a lower price. In short, if times are hard here they are likely to be harder in South America, and the expectations of immediate trade profits with South America must not be too rosy. On the other hand, having suffered in this way from the troubles in Europe, South American countries are the more likely to turn to us for mutual help, and if the two Americas stand together now, closer relations will be engendered that will bring big returns in the future.

A final word must be said as to methods of getting trade. It is absurd to send to Brazil or Peru a traveling salesman who has made a good record in the middle

western states and expect him immediately to send back large and profitable orders. A salesman must know the language and customs of the country, and must conform to those customs. The typical drummer who is so obvious in railway cars and hotels will not get results in South America, where business is conducted at a slow pace with rather formal courtesy and along lines which seem to us stilted and old fashioned. Traveling expenses of representatives are high, from $10 to $20 per day, and often long distances must be traveled between points at which sales can be made. The handling of foreign orders by firms here is often highly unsatisfactory to customers. Orders are filled by clerks and office boys who know nothing of even the geography of the country from which the orders come, and the goods are often packed, consigned, and routed in a way which is greatly to the disadvantage of the customer, sometimes even in disregard of explicit instructions as to the method to follow. Within the past few years the Department of Commerce has been carrying on a campaign of education in this country which will doubtless be productive of excellent results. Trade with South America much resembles the situation of the Irishman who remarked that he could get on his new boots after he had worn them a few days. With increasing community of interest our trade relations with South America will grow, and there can be no doubt as to the large possibilities of the future.

ATTEMPTS AT DOMESTIC TIN PRODUCTION

Much attention has been directed of late to the apparently anomalous fact that although the United States consumes about 50,000 tons of tin produced in the world, all of it is imported into this country, no foreign ore being smelted here, nor is there any appreciable production of domestic ore, most of that produced being sent abroad for smelting. It is interesting in this connection to review the attempts which have been made to develop a domestic production of that useful and essential metal. There seems to be a general impression that there are no tin deposits of any value in this country, but as a matter of fact there are several of distinct promise. Circumstances have been unfavorable to their development, and perhaps the most vital circumstance has been that the opportunities for profitable investment of capital in mining in this country during the past fifty years have been so great that some of them have been perforce neglected, while our prospectors have been unfamiliar with tin ore.

Perhaps the most promising of our deposits are those which lie along the border line of North and South Carolina, extending from Cherokee county, in the latter state, over into Lincoln county, North Carolina. Thirty years or more ago these were brought to the attention of Phelps, Dodge & Company, which firm took an option on a large area in which cassiterite occurs as an original constituent of pegmatite dikes. A careful study of the deposits made by Mr. A. R. Ledoux indicated that if worked on a sufficiently large scale the ore could be mined at a profit and would yield about 15 pounds of tin per ton of ore. The price of tin fluctuates widely and there was room for doubt whether it might not decrease to below 20 cents, the price at that time, at which the indicated operating profit would disappear, so the option was surrendered. Since then the area has been divided into small holdings, some of which have been worked in a rather desultory manner, and the Cherokee Tin Mining Company, at Gaffney, in South Carolina, and the Piedmont Tin Mining Company, at Lincolnton, North Carolina, are still engaged in developing their holdings. If it were feasible to organize a great operating company, like the Utah Copper, it seems quite probable that a notable production might be developed in this area. The climate is favorable, labor and fuel cheap. Even if concentrates only were produced at first, they could be marketed abroad, temporarily, as freight rates to Norfolk are cheap, and cotton ships take heavy material for ballast at low rates.

About the same time Benjamin Silliman, when in the Shenandoah valley of Virginia, about twenty-five miles from the well known 'natural bridge,' was handed a piece of mineral which proved on later examination to be cassiterite. Exploration disclosed numerous veins, resembling in many ways the famous deposits of Cornwall. They yielded twenty pounds of tin per ton in mill tests, and it would have been easy to finance the development of the mine if a valid title to the property could have been secured. Unfortunately the lands in question had been handed down from one generation to another without the making or probating of any will. As soon as their probable value became known, a host of claimants sprang up and litigation over the title became so involved that no mining company could be persuaded to risk investing its capital.

About the same time occurred the advent of Mr. Samuel Untermyer into the world of mining finance, a group of British investors being persuaded by him to put great sums into the Harney Peak Tin Mining Company, a corporation previously formed to work a group of claims near Harney Peak in the southern Black Hills of South Dakota. The tin-bearing veins proved to be of very low grade, much of the black mineral which many regarded as cassiterite in the hand specimen proved to be tourmaline. It was not long before the venture disclosed itself as a fiasco. Allegations of bad faith were made, long litigation followed which was of little benefit to the unfortunate investors, and the notoriety which the venture attained has undoubtedly reacted to discourage the investing of capital in tin mines in this country. Not far from this property are the mines near Tinton, South Dakota. These are of much more promise, but the first attempt to work them ended in failure, not due to the character of the ore, and the mortgage on the property was foreclosed by the Bank of Montreal. Since that time the property has been considered by more than one group of investors, but so far not much progress has been

made toward the reopening of the mines.

Of recent years a small amount of tin concentrate has been produced in Alaska, chiefly by dredging in an area a short distance east of Cape Prince of Wales. These deposits have been described in considerable detail in earlier issues of the *Mining and Scientific Press*, but while they are of local importance they have as yet only produced a fraction of one per cent of our domestic tin requirements. Some years ago it was proposed to smelt tin concentrate from the Malay peninsula in this country, thus rendering consumers here more independent of the fluctuations in the European tin market, but although the smelting plant was built it was never operated, for the government of the Federated Malay States promptly levied an export tax on all tin concentrate consigned to ports outside the British Empire, the rate being so heavy that operations here could not be conducted at a profit.

Since the period which we have been discussing, the tin deposits of Bolivia have been developed to a point where they yield nearly a quarter of the world's production of the metal. The tin concentrate has heretofore been shipped to Europe for smelting, but with the outbreak of war this became nearly impossible, and many of the Bolivian producers became keenly interested in the possibility of shipping their ores to the United States for reduction. This presents obvious advantages, since the distance from the west coast of South America to the Atlantic seaboard through the Panama canal is much less than to Europe, and if the tin, which is the chief export of Bolivia, were sold directly to the United States the imports of Bolivia would presumably be bought here rather than in Europe. There are difficulties in the way, however. Many of the Bolivian producers have ties with Europe in the form of invested capital, and if a smelter were built here which depended on buying ores in Bolivia it might reasonably be expected that strong competition in ore buying would have to be met as soon as peace is restored in Europe. Nor does it seem practicable to secure control of any large group of the mines on terms that are likely to appeal to investors. The Bolivian government has taken up the matter with Ladenburg, Thalmann & Company of New York, and the proposal has been made that the Bolivian government issue bonds to cover the cost of building a smelter near New York, to be operated under the supervision of Mr. R. M. Atwater, Jr., of Ladenburg, Thalmann & Company, as agent, the profits from the smelting enterprise accruing to the Bolivian government. Presumably the Bolivian government is not yet ready for public ownership of utilities, for it has not yet accepted this proposal. A variety of suggestions has been made by other interested parties, but no agreement has yet been reached, and the matter is still in a fluid state. The interest in the matter, both in Bolivia and this country, is so keen that some workable arrangement is likely to be devised, and after a half century of abortive attempts it seems quite probable that at last domestic production of tin will become a reality.

ORIGIN OF SAND FILLING.

Sand filling or hydraulic stowing of mine workings is attracting attention in many mining districts. We print this week a lengthy abstract from a most interesting discussion of the subject by Mr. B. C. Gullachsen, presented to the October meeting of the North of England Institute of Mining and Mechanical Engineers and to be published in full in the *Transactions* of the Institution of Mining Engineers. Mr. Gullachsen discusses briefly but clearly the methods that have been found applicable on the Rand. Mining the ore, extracting the gold, and returning the waste to fill the stope, without even temporarily stacking the residue on the surface, is a new development of 'continuous processes' that warrants study. There is little doubt that filling systems must be used in many mines and districts where they are yet unknown, and Mr. Gullachsen's description is therefore welcome and timely. In one particular we disagree with him, and that is in giving credit for the development of hydraulic stowing to the operators in Silesia and in passing over as of minor importance earlier work elsewhere. The whole subject has been discussed informingly and authoritatively in *Bulletin* 60 of the United States Bureau of Mines. From that, confirmed by private communication from Mr. R. V. Norris and Mr. William Griffith, it appears that the distinction of developing the system belongs to the engineers of the anthracite region in Pennsylvania. As early as 1884 hydraulic filling was used, by John Veith at the Buck Ridge colliery near Shamokin, and the subsequent year Mr. Pardee used it at Hazleton. Shortly after it was employed at the Kohinoor colliery of the Reading company near Shenandoah, and by 1886 it was in common use throughout the Lehigh region. In 1890 filling was introduced as a regular practice at the Black Diamond colliery at Plymouth. About that time the district was visited by several German engineers, who spent some time in studying the practice and gave full credit to the Americans for its novelty. Since then it has been more rapidly adopted abroad than in the United States because the higher price received for coal and cheaper labor permitted refinements that have been regretfully postponed by many a thoroughly well informed American engineer. On the Rand and at Cripple Creek in Colorado, sand from the mills is used. In Europe material is commonly taken from neighboring hillsides, or from valley lands as at Japanese mines in Manchuria. In the anthracite region the main source of supply has been the culm banks, and this has materially reduced the cost of the work. This claim that the process originated abroad is not new and has been repeatedly disproved. *The Colliery Engineer* published the facts January 1912 (page 321), February 1912 (page 385), and especially in May 1914 (page 537). We regret that Mr. Gullachsen was evidently not familiar with the true history of the matter, though the real merit of his article lies in the other part of his paper, and it will be widely welcomed.

Trade Possibilities in Latin America

AN EDITORIAL REVIEW

For many years there has been much public comment on the fact that the trade of the United States with the countries of Latin America is a comparatively small part of either our or their total trade, although it might perhaps be expected that the countries of the Western hemisphere would have the greatest amount of trade with each other. The interruption of trade between Europe and Latin America by the deplorable war now raging in Europe has brought this heretofore desultory interest to a focus, and merchants, manufacturers, shipping companies, and bankers are all giving much consideration to the means of increasing the trade between the United States and the countries to the south of it. How large the possibilities are can be seen by a glance at the following table:

	Area, Sq. miles	Population	Imports	Exports	Rank of U. S. Imports	Rank of U. S. Exports
Brazil	3,291,416	20,515,935	$ 258,000,000	$ 325,000,000	3	1
Argentina	1,135,840	7,200,000	365,000,000	320,000,000	5	7
Bolivia	911,146	2,267,000	23,000,000	33,000,000	9	11
Mexico	767,060	15,663,207	96,000,000	147,500,000	1	1
Peru	713,674	4,500,000	23,000,000	32,000,000	2	2
Colombia	482,329	5,032,000	17,000,000	17,600,000	1	1
Venezuela	364,000	2,685,606	12,500,000	18,000,000	1	1
Chile	294,665	3,500,000	130,000,000	125,000,000	3	3
Paraguay	145,000	800,000	6,400,000	4,100,000	6	10
Ecuador	120,000	1,500,000	8,000,000	16,000,000	2	2
Uruguay	72,210	1,112,000	48,800,000	49,300,000	4	4
Nicaragua	49,500	600,000	2,500,000	3,900,000	1	1
Guatemala	47,810	1,992,000	5,514,000	17,497,000	1	2
Honduras	45,000	553,446	2,600,000	2,450,000	1	1
Cuba	44,000	2,277,492	118,000,000	128,000,000	1	1
Panama	31,580	419,029	10,000,000	1,800,000	1	1
Costa Rica	23,000	410,980	8,000,000	8,500,000	1	1
Santo Domingo	18,045	673,611	6,300,000	11,000,000	1	1
Haiti	10,204	2,000,000	7,948,000	18,554,000	1	1
Salvador	7,225	1,700,000	3,700,000	7,300,000	1	1
Totals		75,402,306	$1,152,262,000	$1,286,501,000		

How this trade was distributed is indicated by the next table, which shows the total imports of all these countries from the principal nations:

Great Britain	$322,036,347	Belgium	$48,747,164
United States	317,323,294	Austro-Hungary	9,026,478
Germany	216,010,418	Netherlands	8,293,859
France	103,220,223	Switzerland	6,189,050
Italy	55,494,412	All others	217,290,517

The relative distribution of the trade of the largest two countries is as follows:

ARGENTINA

	Imports from	Exports to	Total trade with
United Kingdom	$114,515,000	$117,125,000	$231,640,000
Germany	61,703,000	52,105,000	113,808,000
United States	57,057,000	31,257,000	88,314,000
France	36,301,000	34,790,000	71,091,000

BRAZIL

	Imports from	Exports to	Total trade with
United Kingdom	$ 77,519,000	$ 43,012,000	$120,531,000
Germany	52,952,000	51,864,000	104,816,000
United States	48,049,000	141,739,000	189,788,000
France	27,716,000	35,471,000	63,187,000

Thus, it is seen, although the United States holds first place in trade with the small countries of South and Central America, it has only third place with the countries which have the largest trade and is second as a whole.

There are a number of reasons why the United States does not have a larger share of the trade of South America. The first is that all the countries of this hemisphere are economically similar, having been comparatively recently settled, and all having progressed varying distances along the road from the production of raw materials alone, so characteristic of new countries, to the production of finished products which marks a later development stage. The natural trade relations of all American countries are with Europe, not with each other, just as farmers do most of their trading with city dwellers, and not with each other. The United States is now in process of transition from a producer of raw materials to a producer of finished products, and now is the time to get South American countries in the habit of buying their finished products from us. Another reason why European countries do so much business with South American countries is that Europe has loaned to these countries the capital with which to finance their enterprises, and trade follows the loan as

surely as night the day. The amount of money which Great Britain has thus loaned is estimated by Sir George Paish as follows:

	In 1913	In the past seven years	All told
Argentina	$ 93,205,000	$591,695,000	$1,600,000,000
Brazil	104,350,000	441,135,000	739,000,000
Chile	12,920,000	137,815,000	305,715,000
Peru	4,500,000	34,945,000	170,865,000
Others	7,195,000	55,640,000	180,620,000

A third reason why South American trade goes largely to Europe is that all the countries south of Colombia have been nearer Europe than they are to the United

MAP SHOWING RELATION OF NORTH AND SOUTH AMERICA.

States. North and South America lie *en echelon,* so that all South America is east of our Atlantic seaboard and all the countries on the east coast of South America are nearer Europe than they are to New York. When shipping had to travel through the Straits of Magellan to reach the west coast of South America, this was also true of the countries of the western seaboard; but now that the Panama canal is open, the reverse is true, and the Pacific ports of South America are about 3000 miles nearer to New York than to Europe. Until this year our banking facilities with South America were very poor, since our national banks were not permitted to have foreign branches; but this defect is now in process of being remedied, and the National City Bank of New York has been especially active recently in extending its South American connections, having already sent J. H. Allen, former manager of the Banque Nationale d'Haiti, and G. H. Colton, former governor of Porto Rico, to open a branch in Buenos Aires.

So much for general conditions. What chance is there for the sale of mining equipment in South America, and the sale of mineral products in the United States? South American countries obviously cannot buy largely in our markets unless they can also sell us their products, in order to establish a credit here.

Brazil.

Beginning with the largest, it is well known that Brazil has a flourishing mineral industry. This country in area is 40% of all South America, and its population is 46% of the total. Unfortunately, it lies nearer Europe than it does to us, and also has utilized large amounts of European capital, wherein may lie the explanation that it sells us $141,000,000 worth of material each year and only buys $48,000,000 worth from us. Brazil has, therefore, the largest field for trade increase. Of the Brazilian gold mines, the Morro Velho, at Villa Nova de Lima, in Minas Geraes, is worked by British capital, and the Ouro Preto, at Passagem, is also. The Morro Velho has paid over $10,000,000 in dividends. Most of the Brazilian gold output comes from the state of Minas Geraes, though gold has been found and worked in nearly every state. The production of diamonds is also important in Minas Geraes, though much less so than in former years, the yearly output of diamonds being worth about $1,000,000. While North Americans are interested in the field, there is little chance of selling much equipment to the diamond miners, who use little beyond a crowbar, hammer, scoop, and a wooden *batea* in their operations. Larger scale working, such as dredging, has been tried, but the returns have not as yet justified the increased expense. There ought to be opportunity for the sale of equipment for the gold mines, however, especially if North American capital is forthcoming to develop new ones. Last year an engineer from the United States examined a large area in Minas Geraes in the interest of New York and Philadelphia investors, but difficulties arose regarding title, and nothing has yet been done. Greater possibilities exist in the iron ore deposits of the states of Sao Paulo, Minas Geraes, Santa Catharina, Esperito Santo, Bahia, Matto Grosso, Goyez, and Rio Grande del Sul. It has been estimated that the known ore reserves in Minas Geraes alone amount to 500,000,000 tons of ore averaging 50 to 70% iron. Experienced engineers from the United States have studied the field, and North Americans have acquired extensive holdings, as also have European investors. The St. John Del Rey Mining Co., owner of the Morro Velho gold mine, has extensive iron ore lands, but so far the lack of coal for smelting, and the high cost of transportation, have acted as a brake on active development. Manganese ore deposits exist in Minas Geraes, Matto Grosso, and Bahia, and the annual exports amount to 150,000 to 250,000 tons. The world is decidedly rich in manganese ore deposits, however, and the possibility of working any given deposit

is wholly dependent on commercial conditions, chiefly low freight rates. Monazite sand is one of the important products of Brazil and is mostly collected along the seacoast between Bahia and Rio de Janeiro. Monazite is so much in demand that it is quite possible that improved methods for its recovery would permit the establishment of a profitable industry. Deposits of zinc, copper, tin, lead, graphite, and coal are known to exist, but their exploitation is hampered by poor transportation facilities, railroads only having reached into the southern part of Minas Geraes, while Bahia, Matto Grosso, and Goyez are almost without railroads. Brazil is short of coal, importing about $20,000,000 worth per year, almost all from Great Britain. It also buys $5,000,000 worth of cement each year, chiefly from Germany and Great Britain. It buys about $50,000,000 worth of iron and steel manufactures each year, of which the United States furnishes a good part. Of locomotives and sewing machines, this country now furnishes more than one-half the Brazilian imports. Structural material and industrial machinery comes largely from Germany, rails from Belgium and France, tools and pipe come largely from Great Britain. The market for well-drilling outfits, water wheels, and turbines, dynamos and motors, etc., is good, and is growing. In railways, electric lighting, and power systems, American equipment holds a prominent place. In view of this, and of the huge size of Brazil, that country appears to be the best hunting ground for American firms looking for business. It must not be forgotten that the language of Brazil is Portuguese, and not Spanish as in other South American countries. Here as elsewhere throughout South America, business correspondence may usually be conducted in French without trouble.

Argentina

Argentina has a much larger import and export trade, in proportion to its size, than Brazil. The reason for this is that it is less self dependent, producing mainly grain, meat, wool, and hides, importing the other articles of daily life. Much of Argentina resembles Kansas, Nebraska, and the Dakotas, and is correspondingly unpromising from a mineral standpoint; but back of these regions lie the Andes, of which the eastern slope belongs to the Argentine Republic. Lead, copper, antimony, borax, sulphur, and coal deposits are known to exist. These fields were studied for the Argentine government by I. C. White. Strong efforts have been made to develop coal mines as a domestic supply for the Argentine state railways, but coal imports are likely to continue to be important. Oil has been found at Comodora Rivadavia, on the coast 700 miles south of Buenos Aires, and every effort will be made to develop an adequate domestic oil supply. American enterprise in Argentina has had a strong asset in that Bayley Willis, formerly of the United States Geological Survey, has been serving as consulting geologist to the Argentine government in the development of its mineral resources in connection with the Argentine state railway system; of which nearly 4000 miles is now in operation, though not very successfully. There is over 17,000 miles of privately owned railway. As the capital with which these railways is being built is being furnished by British investors, it is natural that equipment is largely purchased from Great Britain. The United States is fifth in the list of countries selling goods to Argentina and seventh in the list of countries to which exports go. Except for hides and wool, we do not offer a market for the products of Argentina and are not prepared to buy much from that country in return for sales to it. Most countries buy their imports in the same markets in which they sell exports, and this, coupled with the large amount of European capital invested in Argentina, which usually carries with it some obligation to buy supplies of the European affiliations of the capitalists, makes it difficult to increase the trade with the United States. The foreign trade of Argentina is so large and our other advantages, already mentioned, are such that it is well worth while to direct efforts toward increasing our trade relations.

Bolivia

Bolivia is the next in size of South American countries and is the only one which has no seacoast, all her foreign trade passing through Chile and Peru. The foreign trade of Bolivia is small, only a tenth of that of Argentina, and the part of it falling to the United States is almost negligible, ranking eleventh in exports and ninth in imports. The reason for this is that over two-thirds of the exports of Bolivia consist of tin concentrate which is sent to Great Britain and Germany for smelting. Bolivia imports iron manufactures, cotton goods, sugar, machinery, coal, and a variety of other goods, and naturally buys them in the countries where she sells her tin and has credits. Bolivia is an undeveloped country with a sparse population, about one half of whom are Indians and almost another quarter mixed blood or *Cholos*. Mining conditions in Bolivia were discussed by Carlos Sanjines in our issue of March 9, 1912, while G. W. Wepfer has contributed a series of articles on Bolivia which have appeared at various times in the past year. F. C. Lincoln has also written of mining conditions in the country. The tin deposits of Bolivia have been described in detail by Mr. Wepfer and also discussed at length in our editorial columns. The yearly output of tin in Bolivia amounts to about one-half our imports of that metal, and if the smelting of Bolivian concentrate could be diverted to the United States, the credits thus established here would lead naturally to the purchase of equipment and other machinery in this country. The silver mines of Potosi are so well known as to need no further reference; after a long productive activity they are steadily waning. Copper is of considerable importance. Bolivia is the principal producer of bismuth, most of which comes from the Huayna-Potosi tin mines, near La Paz. Zinc, tungsten, and gold are mined, but the total output is small as yet. One great drawback to the development

of Bolivia is its lack of coal. Possible sources of hydro electric power are abundant, and oil has been discovered in Bolivia, so that this power difficulty bids fair to be overcome. The country offers great future possibilities, but, excepting those in connection with tin, already mentioned, not much immediate returns as a trade field. The interest of the United States in Bolivia is steadily increasing. H. G. Knowles, till recently American minister to the country, is president of the Bolivian Development & Exploration Co., which is financing and developing a number of properties.

PACKING EQUIPMENT TO THE INCAORO MINE IN BOLIVIA.

Peru

Peru is another big country with a comparatively small foreign trade, in which mineral products are the leading exports. The total output of copper in Peru was over $9,000,000 in 1912, and of silver $5,000,000 in the same year. The copper was exported for refining, but most of the silver remained in the country. The mines and smelters of Peru were described in some detail by Howland Bancroft in our issue of January 25, 1913, page 173. General conditions in Peru were described by Pierre Bouery in our issue of June 14, 1913, page 890, and prospecting conditions in Peru were described by C. S. Haley and C. A. Rodegerdts in that of December 13, 1913, page 922. Spencer Bishop described the Cerro de Pasco smelter in January 24, 1914, page 177, while Lester Strauss reviewed the preceding year's progress in mining in Peru March 21, 1914, page 482. The opening of the Panama canal renders Peru one of the most accessible, instead of the most inaccessible of South American countries, and with the improved banking facilities now becoming available, there should be considerable increase in our trade there.

Chile

Chile has a tremendous export trade, in proportion to its size, because of its shipments of sodium nitrate and copper, which go mostly to Great Britain and Germany. Cotton goods, manufactures of iron and steel, and coal are its principal imports, though it buys a wide variety of products. Cotton goods and coal come mostly from England. The United States has a fair share of the trade in iron and steel manufactures, and supplies nearly all the crude petroleum, refined petroleum products, and lumber. The mineral deposits of Chile were discussed in detail by Juan Blanquier in our issues of March 29, April 5, and April 19, 1913. The nitrate fields of Chile were described in detail by S. H. Loram in our issues of January 15 and 29, 1910, and further discussed by Walter S. Tower September 27, 1913. They were recently reviewed by Lester W. Strauss in the issues of June 13, June 20, and June 27, 1914. The iron ore deposits were described by Carlos Vattier in our issue of December 6, 1913, and the development of hydro-electric power in Chile and Peru was discussed by Lewis R. Freeman, February 21, 1914. Numerous other articles on Chile have appeared in our columns

in the past year. The copper of the Braden mine which formerly went to Europe for refining has recently been diverted to Baltimore. The great developments of the Chile Copper Co. at Chuquicamata, illustrated on our cover this week, presage what is possible by joining North American money and technical knowledge to South American opportunity. We printed April 4 a review of progress at this great mine by Daniel Guggenheim, and May 2 an account of the leaching process that is to be used, written by E. A. Cappelen Smith, the metallurgist. Regular shipments to this country of the iron ores owned by the Bethlehem Steel Co. in Chile will soon be made. This increasing stream of trade with Chile, together with the improved banking facilities now afforded, should lead to rapid growth in other lines of trade.

Ecuador

Ecuador is the smallest of the countries on the west coast of South America, having an estimated area of 116,000 square miles and a population of 1,500,000, of whom only 100,000 or 200,000 are whites. Guayaquil, the chief seaport, and Quito, the capital, are the only two cities of over 50,000 inhabitants. The government of Ecuador has arranged to spend $10,000,000 in improvement of the port of Guayaquil and J. G. White & Co. has the engineering work under construction. With these improved facilities the trade of the country will probably increase largely. The geology of Ecuador was described by W. A. Wolf in our issue of July 27, 1912. Of the known metal deposits, the gold placers are the only ones that have been worked to any extent, about $300,000 worth of gold being exported yearly. The principal quartz mine, owned by Americans, is at Zaruma. The petroleum deposits are very promising, as fuel is scarce along the west coast of South America. Deposits of copper, iron, silver, lead, coal, and sulphur are reported, but comparatively little is known about them.

Uruguay

Uruguay is only one-half the size of Paraguay, but has nearly double the population and has ten times the foreign trade. It is chiefly a pastoral country and exports wool, sheepskins, and hides in large amount, taking in return as imports sugar, coal, beverages, and all kinds of manufactured products. It is therefore a good country to trade with. There is a good deal of capital invested in gold mines, but the ventures have mostly not been very profitable as yet. A great variety of mineral products is worked, the total output in 1912 being valued at $3,000,000. A note in regard to the mineral deposits of Uruguay appeared in our issue of September 14, 1912, page 332.

Paraguay

Paraguay, which is generally associated in the public mind with Uruguay, has about double the area of the latter and only about one-half the population, having lost about half its people in the war waged between 1865 and 1870 with Argentina, Brazil, and Uruguay. The country is divided into two nearly equal parts by the Paraguay river, the western half being a low lying plain which is almost unexplored. The eastern half is rolling country, the ridges being less than 2000 ft. high. The foreign trade is small and is principally with Germany and Great Britain, imports from the United States amounting to less than $400,000 per year, chiefly hardware. When developed, Paraguay will probably have large exports, but there does not seem to be much likelihood that it will ever be an important mining country.

Colombia

Colombia also has comparatively little foreign trade. With a range of climate from a tropical seacoast to high cool plateaus, it is able to produce within its borders most of the things it needs. Coffee, hides, and bananas are the principal exports: textiles account for one-half of the imports. Gold production in Colombia has been the subject of many articles in our columns. The petroleum deposits of Colombia assumed international importance last year. The iron ore deposits are notable, and efforts are being made to build up a domestic iron industry. Coal deposits are numerous and will doubtless be extensively worked later. Copper deposits are of wide distribution, silver production amounts to $500,000 to $750,000 annually, and an equal amount of platinum is produced on the west coast; emeralds are an important mineral product. A good deal of the capital engaged in mining is British, and there will be more unless it is possible to secure money in this country. Colombia is so easy of access from this country that it deserves more attention than it has been receiving, practically all the American capital invested there being in gold mining.

Venezuela

Venezuela is much like Colombia in many ways, but has suffered at times from poor government, which has retarded the development of the country. Copper, *balata*, cacao, and hides make up most of its exports. Cotton goods from England and flour from the United States are its principal imports. Gold production was once important, especially in the region south of the Orinoco, but has declined; the easily accessible deposits have been worked out, and lack of means of transport prevents easy access to the others. Iron ore is mined at Imataca by a Canadian company which ships the ore to Philadelphia. Coal is mined near Barcelona, and other deposits exist. Asphalt is produced on Lake Maracaibo and on the San Juan river. Prospecting for oil is in progress. Some copper mining is done, and the South American Copper Syndicate, an English company, with mines near Aroa, pays good dividends.

Nicaragua

Nicaragua, Guatemala, Honduras, and Cuba are four countries of nearly the same size, but greatly different in population, as Nicaragua has only one-fourth the population of Cuba, and less than one-fiftieth its foreign

trade. The mining industry of Nicaragua has been so frequently and fully described in the columns of the *Mining and Scientific Press* that it is unnecessary to review it here. The best known district is the Pis Pis, which was fully discussed in our issue of February 17, 1912, by Oscar S. Hershey. In the issue of August 12, 1911, T. Lane Carter writes on the mining possibilities of Nicaragua, and in the issue of December 7, 1912, Arthur Feust describes the Chontales mining district. H. B. Kaeding gave valuable data on operating costs, October 28, 1911. In our issue of January 6, 1912, T. Lane Carter reviewed the progress in Nicaraguan mining for the preceding year. Other articles are those by W. A. Connolly, March 5, 1910, and September 21, 1912. The Deitrick concession was discussed February 21, 1914, p. 332, and the Eden Mining Co., controlled by the Tonopah Mining Co., February 21, 1914, p. 352. The most important group of mines is that controlled through the Canadian Agency by the Camp Bird, Ltd., discussed December 27, 1913, p. 1033.

PASTO, COLOMBIA, ONE OF THE DELIGHTFUL SMALLER CITIES OF SOUTH AMERICA.

Guatemala

Guatemala, which is separated from Nicaragua by Honduras and Salvador, has three times its population and nearly four times its foreign trade. Fruit, sugar, coffee, rubber, and timber are the principal products, and the country is a good one to do business with in that its exports are, in value, about four times its imports. January 6, 1912, T. Lane Carter discussed mining in Guatemala, which has not been greatly developed as yet.

Honduras

Honduras is almost the same size as Guatemala, but has only one-fourth its population, and of its 500,000 people the majority are Indians. The country is comparatively undeveloped and has a public debt of nearly $30,000,000, the money having been borrowed over 40 years ago to build an inter-ocean railway, but it was mostly spent for other purposes. The country is rich in agricultural and mineral land; most of its exports are agricultural products and timber. The mineral wealth of the country is apparently great; the best known mines are those of the New York & Honduras Rosario Mining Co., to which frequent reference has been made in these columns. The new 20-stamp mill was described by R. B. Rogers, March 29, 1913; it was also described in the issue of December 14, 1912. Nearby is the tract of the

Antigua Gold-Copper Co., which is developing deposits of copper ore, containing gold and silver, in limestone. To our issue of July 12, 1913, A. D. Akin contributed an intensely interesting account of the gold placers and other mineral deposits of the Olancho Mountain region. Mining progress in Honduras in 1911 was reviewed by T. Lane Carter, January 6, 1912.

Cuba

Cuba is about the size of each of the three preceding countries, but has a population about equal to all theirs combined and a foreign trade equal to ten times their combined trade. Because of its output of tobacco and sugar Cuba has always had considerable foreign trade, but this has greatly increased since 1900, when a stable form of government was set up under the suzerainty of the United States. This is doubtless indicative of the progress which is likely to be made by the other Central American republics when more stable governments are established. The iron mines of Cuba, chiefly owned by the Spanish-American Iron Co., are well known; in our issue of August 8, 1914, C. F. Rand, the president of the Company, described the sanitation work at these properties, and the method of mining the ore was described in our issue of October 4, 1913. El Cobre mines, near Santiago, now owned and operated by the Cuba Copper Co., were the first copper mines worked in the new world, having been opened in 1532. The flotation plant at these mines was described in our editorial columns, May 24, 1913. Cuba offers much promise of mineral production, but capital has so far found such profitable fields for investment in agriculture that mining has as yet been less developed.

Panama

The recently constituted republic of Panama is a little smaller than Honduras and has about the same proportionate population. Just now, for obvious reasons, the import trade of Panama greatly exceeds the exports. The gold mines of the isthmus of Darien have been famous ever since the Spaniards began to traverse the isthmus on their way to and from the west coast of South America, but their fame exceeds their real importance. The methods of working at the Darien mine, which was very profitable, but is now nearly worked out, were detailed in our issue of August 24, 1907, by A. B. Chase. Altogether about 170 mining properties have been denounced by mining companies, covering such a wide range as gold, silver, copper, iron, sulphur, asbestos, and limestone. Under the steadying influence of the United States, Panama seems likely to exhibit as rapid progress as any South American country.

Costa Rica

Costa Rica, adjoining Panama on the north, is somewhat smaller, but has almost exactly equal population. The mineral resources of the republic were interestingly described by Lee Fraser, January 21, 1911. The best known mines are the Abangarez and the Montezuma. Cyanide practice at the latter was discussed by F. S. Shaw, January 28, 1911. The Abangarez company has a hydro-electric plant and has spent much money on improving its property, so although the mill has been producing about $20,000 per month in bullion this has been expended in betterments. La Union Mining Co. is another producer. Gold and silver exports from Costa Rica are over $1,000,000 per year, and the stable political conditions which exist there make the region attractive to investors.

Santo Domingo and Haiti

Santo Domingo and Haiti can well be considered together, since together they form an island and exhibit similar political interest. Santo Domingo is nearly double the size of Haiti, but has only one-third the population of the negro republic. In Santo Domingo there are promising mineral areas which have attracted attention almost continuously during the past 40 years. Unfortunately they have been made the basis for scheme after scheme by the jackals of mining. In our issue of February 14, 1914, J. W. Ledoux described some of the more recent of these unsavory ventures. To the issue of September 7, 1907, F. Lynwood Garrison contributed a paper on the sulphide ores of the San Christobal district.

Haiti is a less attractive mining field than Santo Domingo in that political conditions are less stable and the mineral areas seem less promising. An exploration syndicate did considerable work in Haiti about ten years ago, and the Cia. Miniére de Terre Neuve is now attempting to develop a copper mine. There is no present production.

Salvador

Salvador is the smallest of the countries of South and Central America, but by no means the least important from a mining standpoint. Though smaller than the state of New Jersey, it has a larger foreign commerce than any of the immediately adjoining countries and boasts of several valuable mines, and an annual gold and silver output of about $1,500,000. The Butters Salvador mines are the best known; others are the Los Escuentros, El Tobanco, Comacaran, and Monte Mayor. Salvador is more thickly settled and has been more thoroughly prospected than have the adjoining regions.

Mexico

During the past three years there has been a general decline in all branches of trade with Mexico, and due to the unsettled conditions it has not been possible for the central government to compile detailed statistics covering this period. The imports and exports from Mexico have been, however, of primary importance to the American producer and manufacturer, for in addition to being our nearest neighbor it affords one of the largest marts for trade in the western hemisphere. The figures for the fiscal year 1911-12 are the last general compilation available and are fairly representative of a normal year, although showing a decrease in imports of about

₱20,000,000 from the preceding year. The figures presented in the following table for 1910-11 and 1911-12 may be considered the last two normal years of trade, and in this last year, 1911-12, will be noted a general decline which has consistently continued since that time.

	1910-11	1911-12
Animal products: including live-stock, hides, meats, furs, manufactured materials, etc.	₱17,433,251	₱16,466,311
Vegetable products: including textile fibres, fruits, grain, lumber, manufactured products, etc.	38,600,222	31,285,563
Mineral products: including gold, silver, copper, lead, zinc, tin, iron, stones, earths, etc.	52,030,587	46,711,978
Textiles and manufactured products: including cotton, linen, wool, silk, etc.	24,640,269	21,281,571
Chemicals and drugs	12,990,250	12,074,088
Fermented and unfermented liquors	6,813,346	6,744,083
Paper and paper products	5,608,939	5,120,770
Machinery and apparatus	25,811,176	23,383,811
Vehicles	9,095,206	4,600,890
Arms and explosives	3,212,567	5,388,344
Other products	9,638,455	9,604,897
Total imports	₱205,874,268	₱182,662,306

It will be seen that there has been a general decrease in all branches, with the exception of arms and explosives—evidence of the beginning of revolutionary activity. While the figures quoted are in pesos, it must be remembered that foreign trade is practically all done on a gold basis, and the exchange at the time of this compilation was about 50, or two for one (at the present it has fallen to 20, and it, therefore, is doubly necessary that all manufacturers make their quotations in American currency and f.o.b. factory, in the event of their not keeping stocks in Mexico).

The distribution of this import trade with various parts of the world during these two years has been as follows:

	1910-11	1911-12
Europe	₱86,469,309	₱78,171,459
Asia	3,142,661	3,047,939
Africa	307,813	111,722
North America	113,916,705	99,390,251
Central America	195,424	98,290
South America	1,492,923	1,576,194
Antilles including Barbados, Cuba, Haiti, Jamaica, Porto Rico, Santo Domingo, Trinidad, etc.	203,278	163,969
Pacific Isles: including Australia, Borneo, Philippines, Hawaii, etc.	146,155	102,545
Total	₱205,874,269	₱182,662,369

The imports from North America were divided as follows:

Canada	₱ 769,722	₱ 964,578
United States	113,146,983	98,425,673

It is evident from the above figures that the United States has had a large percentage of the Mexican trade in the past, but it is also to be noted that there is a large percentage of the imports, amounting to ₱78,171,459 in 1911-12, which were supplied by the European market. With a revival of industry in Mexico, which now seems highly probable, a large part of this trade can be met by American producers, since European trade has been so seriously crippled.

LANDING FREIGHT FOR BOLIVIA AT LAKE TITICACA, PERU.

The export trade of Mexico is of course largely of mineral products; out of a total of ₱297,989,129 of exports during the fiscal year 1911-12, ₱186,206,803 was the value of the products of the mines. An analysis of these figures shows that the United States is the recipient of a very large part of the Mexican exports, the exports for 1911-12 to this country amounting to ₱224,103,220.

The division of Mexico's export trade for the last two normal fiscal years, 1910-11 and 1911-12:

	1910-11	1911-12
Europe	₱63,296,542	₱68,159,099
Asia	40,012	18,192
North America	226,334,110	225,459,911
Central America	1,802,770	2,157,655
South America	69,374	66,443
Antilles	2,210,831	1,958,011
Pacific Islands		169,818
Total	₱293,753,639	₱297,989,129

With the reëstablishment of peace, resumption of railway traffic, reopening of the mines and *haciendas*, toward which there is an undoubted tendency at the present, Mexico bids fair to again become a factor of importance in our export trade and is well worth study and consideration.

The Incaoro Mill, Bolivia

By R. B. T. KILIANI

The mill of the Incaoro Mines Co. at Pallaya near Yani, in the district of Larecajas, department of La Paz, Bolivia,* is of interest as illustrating some of the difficulties to be overcome in the operation of mines in the interior of South America. Owing to the fact that all machinery has to be taken into the mine, 120 miles, from the head of Lake Titicaca, on mule-back, over a pass about 16,500 ft. high, it was necessary that it should all be sectionalized to a limit of 350 pounds. Some of the difficulties of transportation are shown in the illustrations, pages 795 and 799, showing the landing of material on the shore of the lake and packing it up to the mine.

The ore from the mine is lowered to a stone storage bin by an incline gravity tram and is then taken to the mill in small hand trams as required. The power plant is a 24-in. sectionalized Pelton wheel belted to a line-shaft running the length of the mill. Ore from the tram is delivered to a Buchanan jaw-crusher, thence into a mill-bin, from there into a 4½ ft. by 13-in. sectionalized Hardinge ball-mill from which it is passed to a 6 ft. by 22-in. sectionalized Hardinge pebble mill.

The recovery is by amalgamation only, partly inside the two mills and partly on outside plates. Mercury is fed in at the head end of the ball-mill, amalgamated in this machine, and passes through to the pebble mill, which catches the greater portion of the coarse gold. The machines are shut down once a day to make a clean-up of the amalgam in the mills, from which approximately 75% of the total recovery is made. The amalgam in these machines is very hard, containing slightly over 50% gold. This is attributed to the fact that the pounding of the balls and pebbles in the mills squeezes out all the free mercury, leaving a very hard amalgam which balls up and tumbles around. The other 25% of the recovery is made on two sets of plates below the pebble mill. The ore milled per day amounts to about fifty tons.

The labor is entirely native, about one hundred Indians being employed; the wages vary from 16c. for boys to $1.60 for mine captains. The mill itself is operated by two men, each receiving $1.40 per day. One of these men attends to the feeding of the ore from the mill-bin and such other work as is required on the lower floor, the other man attending to the crusher. This makes the milling cost about 15c. per ton, as water-power is used, and the repairs are very light.

The Hardinge mills were both sectionalized to a maximum of 350 lb. and were assembled and set up according to marking and instructions from the factory. The ball-mill is lined with chrome steel plates and uses forged steel balls for grinding, as it has been found that it is cheaper to import this material from the United States than to purchase cast iron in La Paz. The pebble mill is lined with quartz bricks about 6 in. thick, which are roughly chipped to size on the property. These bricks are fastened in the machine, without any cement being used, by means of dry wooden wedges which swell in operation and hold the lining tightly in position. Danish pebbles were first tried for grinding in the pebble mill, but it was later found that hard quartz roughly chipped to spherical form proved cheaper, owing to cost of transportation.

*For description of the mine by F. C. Lincoln see *Mining and Scientific Press*, April 4, 1914.

HARDINGE MILL AND PLATES AT INCAORO.

PELTON WATER-WHEEL AT INCAORO.

Hydraulic Stowing in the Gold Mines of the Witwatersrand

By B. C. GULLACHSEN

*Hydraulic stowing of mine workings is a subject that is coming more into prominence. As is well known, Upper Silesia receives the credit of being the birthplace of hydraulic stowing. Even if it had been employed on a small scale at a previous date in other parts of the world, it remained for Herr Bergrat Williger to introduce it on a large and economic scale at the Myslowitz mine in Upper Silesia during the year 1901. In Upper Silesia at the present time no less than 30 collieries, employing 48 separate plants, out of a total of 58 collieries, have adopted hydraulic stowing.[1] In Westphalia the system is also extensively employed, and no doubt would be more so if it were not for the difficulty of securing suitable stowing material. During the year 1909 H. C. Annett read a paper before the Institute dealing with hydraulic stowing in Westphalia, in which a full description of the plant, together with costs, is given.[2] In Westphalia 27 collieries, employing 40 equipments, use the process daily. In Prussia, the method is employed in the iron, potash, and salt mines, as well as at the Saint Ingbert collieries in Bavaria. In Alsace Lorraine a plant is at work in the district of Petite Rossette. Outside Germany the hydraulic process of stowing is also widely utilized. In France it has been considerably used, especially at the collieries in the Department of the Pas de Calais, and also in the coalfields of St. Etienne. In Belgium it is also used at several collieries. L. D. Ford recently communicated a paper to the Institute dealing with hydraulic packing of the goaf in Belgium.[3] In Spain the Penarroza colliery is erecting a plant, and several collieries in Austria, as well as in Poland and Russia, are employing the system.

Hydraulic stowing is extensively used at a number of mines in the United States, at lignite mines in Manchuria, and in the gold mines of Australia and the Transvaal. In the Transvaal hydraulic stowing was first used in the gold mines about the middle of 1909, but credit is often given to the late President Kruger for having several years previously suggested that the unsightly residual sand dumps, which were then commencing to make themselves objectionable, should be conveyed underground to fill up the excavated portions of the mine.

The first mine at which hydraulic stowing, or 'sand filling,' as it is more generally called on the Rand, was commenced was the Village Main gold mine, to be followed shortly afterward by the Ferreira gold mine, and by June 1910 the Village Main was sending underground about 1200 tons of sand per day. During 1911 several more mines were equipped, and in the annual report of the Central Mining & Investment Co. for 1912 it is stated that at seven mines of this group alone 984,650 tons of sand was stowed into the worked out stopes. At the present date 15 mines on the Rand have erected hydraulic equipment, and more are to follow in the near future.

Hydraulic stowing on the Rand may be divided into two systems, namely: (1) sand taken from dumps; and (2) sand taken direct from the cyanide vats. In the first of these two systems the sand to be used for stowing is taken from the mine dump (the dump consisting of the residual sand after the gold has been extracted). The following description is that of the sand-filling arrangements employed at the Geldenhuis Deep gold mine, Fig. 1.

Sand filling at the Geldenhuis Deep gold mine.—The sand at the dump is shoveled into trucks, which are then taken by an endless rope haulage to the collecting bins, situated near the entrance to the mine. The sand is tipped into these bins, which are furnished with sliding doors, through which the sand is made to pass when required. Projecting through these doors are short lengths of 3-in. piping, having a flat shaped nozzle end, and perforated along its length with small holes. Water under pressure is turned into this pipe, and is injected into the surrounding sand, which is then washed through the doors into the launder. In the event of the sand coming through too thickly, more water may be added in the launder from the water pipe provided for that purpose at the end of the launder. The pulp flows down the launder, which has a gradient of about 15°, into a box shaped receptacle at the top of the shaft, from which box the pulp is conveyed through 6-in. cast iron pipes to its desired destination underground.

At the Robinson gold mine the arrangements are different, as at this mine the dump was so conveniently situated to the mine workings that it was found unnecessary to convey the sand to storage bins. The sand is washed direct from the dumps by means of high-pressure water thrown upon it by hydraulic monitors with 3-in. nozzles, which force of water breaks into the dump and washes the sand away into launders. The pulp then proceeds direct into a small shaft, from the bottom of which the pulp is conveyed into the workings by means of launders.

*Abstract of a paper read before the North of England Inst. Min. and Mech. Eng. and printed in the *Trans.* Inst. Min. Engineers.

[1]See 'The Hydraulic Stowing of Goaves,' by George Knox, *Trans.* Inst. Min. Eng., 1913, Vol. XLV, p. 13.

[2]'Hydraulic Stowing of Gob at Shamrock I and II, Colliery, Herne, Westphalia, Germany,' by H. C. Annett, *Trans.* Inst. Min. Eng., 1909, Vol. XXXVII, p. 257.

[3]'Notes on the Working of the St. Nicholas Pit of the Société des Charbonnages de l'Espérance et Bonne Fortune, near Liége, Belgium, with Special Reference to the Hydraulic Packing of the Goaf,' by Leo Dorey Ford, *Trans.* Inst. Min. Eng., 1913, Vol. XLVI, p. 439.

Unless, as in the case of the Robinson mine, the sand can be washed direct into the workings from the dump, this system has the disadvantage that the sand must be shoveled from the dump into trucks and then conveyed to the collecting bins, an expense not incurred by the other system. When sand from old dumps is used, considerable quantities of lime must be added in order to neutralize the sulphuric acid formed by the decomposition of the pyrite. Another disadvantage of using old dump sand is that the sand is mixed with a considerable quantity of colloidal slime, the presence of which is very objectionable underground.

Sand taken direct from the cyanide vats.—This system was first employed on a large scale at the Simmer and Jack mine, although current sand residue had previously been employed to some extent at the City and Suburban mine.

The essential feature of this system consists of using the sand as soon as it is discharged from the cyanide vats, thus doing away with the cost of transporting it to the top of high dumps, whence, as in the first system, it has again to be shoveled into trucks and transported to the collecting bins. What was at first looked upon as a grave objection to this system was the presence in current sand residue of dangerous quantities of potassium cyanide, and it was found to be absolutely necessary to destroy the cyanide before the sand could be used. This was accomplished by introducing into the water a small amount of permanganate of potash solution. The residue pulp should be kept alkaline, so as to assist the oxidizing effect of the permanganate. The consumption of permanganate may vary from 0.04 to 0.08 lb., which is equivalent to about ¼d. to ½d. per ton of sand used. According to the Mining Regulations, no solution containing more than 0.005% of total cyanide may be sent underground. The tests for such small quantities are naturally very delicate operations, but those employed by A. McA. Johnston have proved perfectly satisfactory.[4]

In this system it is a great advantage if the sand-treatment vats are situated so that the sand immediately on being discharged can be mixed with water and permanganate and run directly into the mine. As frequently occurs, the vats are placed some considerable distance from the bore-hole or entrance to the mine, in which case, as at the Simmer and Jack, the pulp has to be pumped to the position where it is required. The pulp then passes through dewatering cone classifiers, the underflow from which is then discharged into the bore-hole or pipe-line leading to the mine workings, while the overflow runs or is pumped back to the mixing bin, when it is again utilized to bring up more sand.

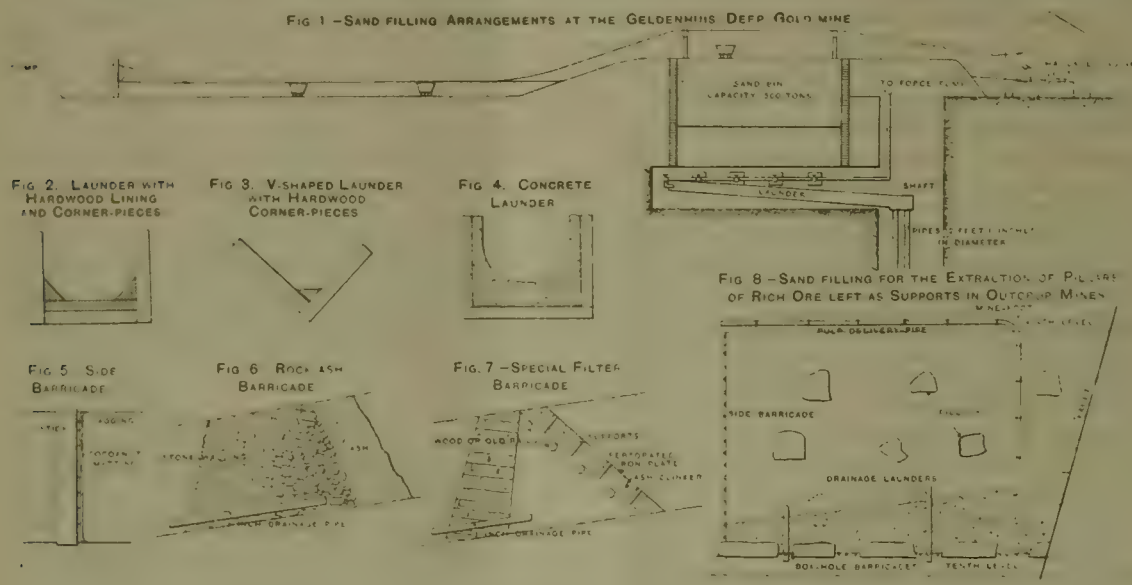


Fig 1.—Sand filling arrangements at the Geldenhuis Deep Gold mine
Fig 2. Launder with Hardwood Lining and Corner-pieces
Fig 3. V-shaped Launder with Hardwood Corner-pieces
Fig 4. Concrete Launder
Fig 5 Side Barricade
Fig 6 Rock ash Barricade
Fig. 7.—Special Filter Barricade
Fig 8.—Sand filling for the Extraction of Pillars of Rich Ore left as Supports in Outcrop Mines
SAND BIN CAPACITY 300 TONS
TO FORCE PUMP
SHAFT
LAUNDER
PIPES
SIDE BARRICADE
DRAINAGE LAUNDERS
BOX-HOLE BARRICADES

It is interesting to note that in this system the ore hoisted from the mine about a fortnight previously is returned again minus its gold content, and that a ton of the ore which occupied a space of 12 cu. ft. *in situ* in the mine yields about the same volume of sand for return underground, after the ore has been well crushed and classified into 50% sand and slime, respectively.

Conveyance of the sand down the mine.—There are two methods of doing this, namely: (1) by means of pipes, and (2) by means of bore-holes. In the first case the pipes are hung in the shafts, care being taken to make them secure, on account of the considerable vibration caused by the passage of the thick pulp through them. The pipe-line must also be easily accessible, so as to allow of the easy and rapid removal of the lengths of pipes that become worn through. A great objection to the sand-filling pipe-lines being placed in the shaft is that, in the event of a pipe becoming

[4] 'Rand Metallurgical Practice,' Vol. I, p. 324.

worn through, or bursting, a considerable quantity of pulp is discharged into the shaft, causing a very objectionable mess.

It was at first considered that bore-holes would be unpracticable, on account of their becoming choked, but in practice this is not the case if the bore-hole is of a reasonably large diameter. Bore-holes 7 or 8 inches in diameter have been found to give little trouble through choking. If a bore-hole should become choked, it can be cleared by running a small amount of water into it for a few hours.

Bore-holes have the great advantage over pipe-lines that after once the first cost has been met, there is no upkeep cost, as in the case of a pipe-line. There is also the additional advantage that they can be put down at the best point for the distribution of the filling material underground, thus avoiding in many cases the great lengths of more or less horizontal piping necessary when the pipe-line is taken down the shaft, and which are so liable to become choked.

Bore-holes are in use at the Simmer and Jack and Robinson Deep mines; that at the Simmer and Jack was put down by means of a jumper drill at a rate of 8 ft. per day, and at a cost of 17s. to 20s. per foot. The Robinson Deep bore-hole was bored by a steel shot drill to a depth of 1700 ft. in nine months, and cost £2625, or a little over 30s. per foot. The bore-hole at the Simmer and Jack mine has now been in use for four years, and no trouble has been experienced.

After the stowing material has reached the bottom of the shaft or bore-hole, the next consideration is the method to be used for its distribution underground. For this purpose, two methods are employed, namely: (1) by transport under pressure in pipes, and (2) by transport in launders. Transport under pressure in pipes is necessary in all mines when the filling material has to be conveyed along roads that are either horizontal or that only slightly dip or rise, the pressure being obtained by the head of pull on the vertical pipes in the shaft.

As there is naturally heavy wear and tear upon the lining of the pipes, many methods have been devised for their protection. In Germany pipes are manufactured with porcelain, wood, glass, and detachable steel linings. Oval pipes are used having half-oval liners bolted into them.

On the Rand, only three kinds of pipes have been used, the ordinary cast iron pipe, wood-lined pipes, and, to a very small extent, porcelain-lined pipes. The pipe-line is laid either along the foot of the drifts and stopes, or, when this is not practicable, the pipes are hung from the 'hanging' by means of chains attached to eye bolts, or else they are supported on timber trestles. The pipes may have loose or fixed flanges, rubber (insertion) washers being placed between them. After a few months' use the pipes are given a turn, in order that the bottom segment of the pipe, where the greatest wear takes place, may be replaced by a portion of the pipe which has suffered comparatively little damage through the abrasion of the sand particles. By this means the pipes can be used for a considerable length of time. The life of the pipes used on the Rand appears to be very variable, and it is therefore difficult to give any exact figures on this point.

Transport in launders is preferable to that in pipes wherever the gradient is suitable. The gradient required is dependent not merely upon the size of the sand particles and the ratio of sand to water, but also upon the volume of pulp and the roughness and internal shape of the launder. In a wooden launder, pulp containing 30% of moisture will flow slowly on a grade of 30%, approximately 17°; with 40% moisture on a 20% grade, approximately 11°; and with 60% moisture on a 10% grade, approximately 6 degrees.

Launders are made up of planks, the bottoms being provided with a liner of hard wood and with angle-pieces of hard wood in the corners, as shown in Fig. 2. V-shaped launders (Fig. 3) are easy of construction, cheap, and, being light, are useful when frequent replacement is necessary. At the Robinson mine, launders having concrete liners (Fig. 4) were used. These were made in 3-ft. lengths and placed inside the wooden launders. Drainage launders are used for carrying off the water from the surface of the filling. These launders are in box form, and must be of fairly strong construction in order to withstand the pressure of the filling material down through which they pass. Fresh lengths are added as the filling rises, each length provided with some means of escape for the water as it rises along its entire length. Either holes are drilled or the top plank is left off and short lengths nailed on as the water rises, cocoanut matting or wire netting being placed over the openings for the purpose of clearing the water.

Barriers.—Before filling can take place underground, the place which it is desired to fill must be prepared for the purpose. Wherever possible, faults, dikes, or portions of unprofitable bodies of ore are used as natural barriers; but as in many mines these natural barriers do not exist, or, as is more often the case, do not occur in that portion of the mine where they could be made use of, it is necessary to build artificial barriers.

Barriers should be built with two purposes in view—first to hold the sand in the position required, and second, to allow of the drainage of the water. The first barriers built underground on the Rand were constructed as water tight as possible, all the water being carried off from the surface of the filling by means of special drainage launders, which passed down through the sand and barriers, and were gradually lengthened as the sand was filled in. It is now found to be preferable to drain as much water as possible through the barriers, which must therefore be constructed to act as a form of filter-bed. Draining the water off directly through the barriers naturally reduces the pressure upon them to a very considerable extent, with the result that they need not be of such heavy construction as previously.

A barrier which has given good results, and does away entirely with the use of timber, is one built up of waste rock in the form of a pack. The outer wall is first built of large stones, and on the inside of this smaller stones are used, gradually decreasing in size until sufficient thickness of barrier has been constructed, ash being last of all thrown on. Such a barrier is shown in Fig. 5, and, if well constructed, will retain all the sand and only allow practically clear water to pass through it.

Several types of timber barriers have been used, all somewhat similar in construction, only differing slightly as to their method of drainage. Fig. 6 shows a barrier suitable for supporting the sides of the sand-pack, and consists of props set from 4 to 6 ft. apart and hitched at the bottom and the top. On the inside of the props either pitch pine or blue gum planks are nailed. The top and bottom planks are scribed to the roof and floor, and hay is often used to fill up any remaining openings. Cocoanut matting may be nailed to the planks, so as to act as a filter for the escaping water. Fig. 7 shows a barrier which is intended for use in a narrow opening, such as a box hole, and should only be used at the lowest point in the portion of ground that is to be filled. As will be seen, its object is to act as a filter-bed; ash is used as the filtering medium, and the filtered water is conveyed through the stone-pack by means of a 3-in. pipe.

Hydraulic stowing in deep mines.—When sand filling was first introduced on the Rand, it was only employed at the outcrop mines, in order to permit of the extraction of valuable pillars of rich ore which had been left as supports (Fig. 8). As time went on, sand filling was carried on at greater depths, and in the very deep mines it is especially necessary on account of the great roof pressure.

When filling takes place at a depth of from 3000 to 4000 ft., a heavy charge is incurred for pumping all the extra water introduced into the mine with the stowing material from this depth, as well as the extra cost for pipes due to their rapid destruction, caused by the high pressure and velocity of the pulp. In order to avoid these extra costs, a system was introduced at the Cinderella Deep mine, by which the sand was sent into the mine in a dry condition. In order to effect this, a wooden box launder was constructed measuring 12 by 11 in. inside cross-section. This launder was carried down the vertical shaft to the level at which the filling material was required, which was at a depth of 3900 ft. The sand, which should not contain more than 7% moisture, is stored in a surface bin, from which it is taken on a conveyor-belt to the top of the shaft and there discharged into the launder. On reaching the bottom of the launder, it falls upon a steeply inclined iron plate, at which point jets of water are turned into the sand, which is then carried away as a pulp either by means of pipes or by launders to wherever it may be required.

The great objection to this system is the difficulty of securing a constant supply of dry sand. As soon as the sand contains more than 7% of moisture, it is inclined to adhere gradually to the sides of the launder, which in time becomes choked. The launder was connected up to a Roots blower and jets of compressed air introduced, the idea being to assist the drying of the sand and to increase the velocity of the falling stream, but this device was found to result in only a very slight improvement. The system has much in its favor, but unless some method can be devised to enable sand containing more than 7% of moisture to be used successfully, it is certain to be a failure.

Drainage.—The clarifying of the overflow water before pumping is a matter of some importance, as, of course, water containing only a small percentage of sand and slime is injurious to the pumps. At those mines where old dumps are being used for filling, trouble is experienced with the large quantities of slime present with the sand. Great difficulty is found in getting the slime to settle, and on this account the use of current sand residues is much to be preferred. Slime has also the additional objection that it prevents, to a considerable extent, the rapid filtration of the water, on account of its forming a fairly impervious covering on the filter-bed at the barriers.

All the water overflowing from the sand filling is made to pass through the catch pits and filter-beds constructed in old drifts or stopes. The catch pits and filter-beds should always be constructed in duplicate, so that, in the event of one becoming filled up with sludge, the water may be turned into the other while the first is being cleaned out, thus preventing any stoppage. It is often found necessary to add lime to the water before pumping, on account of its having become acid, due to the decomposition of the pyrite in the sand. The lime can be conveniently added at the catch pits.

Costs.—The cost of sand filling varies considerably at different mines, but will, no doubt, be reduced as further economies are introduced.

COST OF SAND FILLING ON THE WITWATERSRAND

		Tons of sand lowered.		Av. surface cost.		Av. underground cost.		Av. total cost.	
Mine.	Period, months.	Total.	Av. per mo.	Per month.	Per ton of sand lowered.	Per month.	Per ton of sand lowered.	Per month.	Per ton of sand lowered.
Simmer and Jack	9	172,535	19,171	£269 0s. 1d.	3.368d.	£523 10s. 3d.	6.554d.	£792 10s. 4d.	9.92d.
East Rand Proprietary	av. mo.	.....	19,490	£189 0s. 0d.	2.320d.	£374 0s. 0d.	4.610d.	£563 0s. 0d.	6.93d.
Witwatersrand Deep ..	12	328,645	27,387	£440 1s. 6d.	3.820d.	£426 12s. 7d.	3.740d.	£866 14s. 1d.	7.56d.
Robinson Deep	4	103,261*	25,815	£191 14s. 2d.	1.780d.	£821 14s. 2d.	7.600d.	£1013 8s. 4d.	9.42d.

*It is interesting to note that the 103,261 tons of sand lowered at the Robinson Deep represents 98.1% of the total production of sand residue at this mine.

Some Tailing Dumps in the Peruvian Andes

By HOWLAND BANCROFT

A few months ago I went to Peru to examine several tailing dumps represented to contain an aggregate of 1,000,000 tons of tailing, and reported to average 8 oz. silver, 90c. gold, and about 70c. in mercury to the ton. Perhaps through ignorance on the part of the vendor's engineers, the tonnage was grossly overestimated. The topography of the country in which these dumps accumulated, together with the mode of deposition of these tailings, may serve in part as an excuse for the overestimation of the tonnage. Because of these facts, I submit the following brief description of the dumps, together with a few diagrams, as illustrations, with the hope that others having anything to do with similar dumps may be benefited.

Situation and Extent

The dumps under discussion lie at a general elevation of 14,000 ft. and are in scattered localities contiguous to railroad transportation in the central Peruvian Andes. Three different localities were examined, in each of which were two or more dumps. These dumps covered areas ranging from 20,000 sq. ft. to over 1,000,000 sq. ft., and varied in depth from a thin film of tailing less than an inch in thickness to small local accumulations having a maximum depth of 10 ft. In general, however, the dumps were exceedingly shallow, having an average depth of only a few inches. In the three localities examined, test pits were sunk, and estimates of tonnage made on 13 separate dumps. The result of the investigation disclosed the presence of 200,000 tons of tailing, instead of 1,000,000 tons as represented! And these were so scattered that the cost of collecting made the commercial treatment of the tailing impossible under existing conditions.

FIG. 3. PLAN OF TAILING DUMP SHOWN IN FIG. 4, CENTRE OF CIRCLES MARKING TEST PIT.

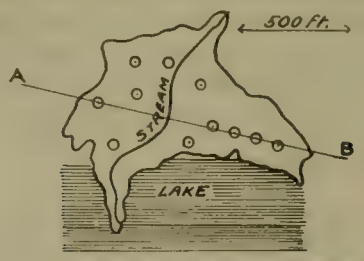


FIG. 1. PLAN OF TAILING DUMP, CENTRE OF CIRCLES MARKING TEST PIT.

Relation of Topography to Dumps

East of the main range of the Peruvian Andes occur several smaller ranges separated by comparatively broad flat glacial valleys. Within the natural depressions in some of these valleys the tailings have accumulated. As the old mills were placed near a source of water supply and the drainage naturally followed the valley courses, the dumps in consequence have been formed where the streams or ditches debouched into flats. The surface of these dumps is extensive, and deceptive as regards the total amount of tailing to be expected beneath.

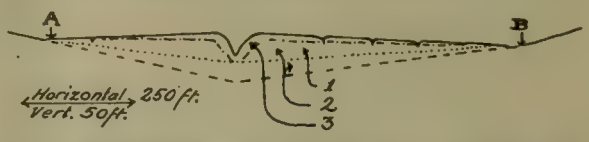


FIG. 2. GENERALIZED SECTION THROUGH DUMP. 1, ESTIMATED AS TAILING BY VENDOR; 2, DETRITAL DEPOSITS, DRIFT, ETC.; 3, PROVED TAILING.

The small streams flowing through the valleys were

FIG. 4. PANORAMA OF TAILING DUMP, LOOKING SOUTH AND WEST. FOR OUTLINE SEE FIG. 3.; VIEW FROM POINT X. THE LAKE IN THE BACKGROUND APPEARS IN FIG. 1.

made to serve as power to turn the Chilean mills. The same streams carried off the tailing in suspension. Under normal conditions of stream flow, the major part of the tailing would be deposited where the stream or ditch emptied into a flat. However, when the streams overflowed the banks, due to floods caused by cloudbursts, or damming up of the outlets, or any other cause, the tailing was spread as a thin covering over a large area.

Estimation of Tonnage

The only excuse for the vendor's overestimation of the tonnage in the dumps examined is the partly excusable mistake of assuming that the courses of the streams now running through the tailing dumps were formed after the deposition of the tailing. Having this view in mind, the tailing was estimated, by the vendor, to be at least as deep as the bottom of the stream course, and to have an even slope along the bottom to the sides of the dumps.

As a matter of fact, there is every reason to believe that the present stream courses antedated the deposition of the tailing and that the streams were the chief agents in carrying and depositing the tailing. Consequently, these courses are lined by tailing, and wherever the gradient of the stream courses fell rapidly or the streams overflowed their banks, with a consequent decrease in the velocity of the current, the larger part of the load was dropped.

Attention is here called to Figures 1 to 5. Fig. 1 represents the outline of one of the dumps examined. Fig. 2 is a cross-section of this dump along the line A B shown in Fig. 1. It will be noted that the horizontal scale in Fig. 2 is 250 ft. to the inch, whereas in Fig. 1 it is 500 ft. Test pits were sunk in all the dumps examined. The position of these is shown by the circles, the pits being sunk at places represented by the centre of the circles. The test pits were, in general, 2 ft. wide, 4 ft. long, and varied in depth from 2 to 5 feet.

Reference to Fig. 2 will show that alluvium and silt cover the bedrock which forms the valley bottom. Through these the stream has cut to a depth of 10 ft. or more. As the banks of the stream are lined with tailing and the surface of the flat was covered with the same material, the vendor assumed that the tailing had an average depth of one-half the depth of the stream under all ground showing tailing on the surface. There is but little excuse for estimating tonnage in this manner. However, it was done.

When I examined these dumps their superficial nature attracted my attention from the first, and a few test pits served to prove conclusively that the deposits were, in general, very shallow. Fig. 2 illustrates in section the proved tailing and that part estimated as tailing by the vendor (which in reality is nothing but alluvium, silt, tundra, or similar material).

One can readily perceive how the vendor's estimate of 1,000,000 tons was cut down to 200,000! In conclusion, it is well to state that similar conditions may influence the deposition of tailing in localities other than those above described.

The New Zealand Government has introduced a bill in the House of Representatives to authorize the expenditure of £150,000, at a rate not exceeding £30,000 per annum, to provide bonuses for the production of iron and steel in the Dominion. The sum of 12s. ($2.88) per ton is payable for pig, puddled, bar iron, or steel from pig iron, and 24s. ($5.76) for steel direct from the blast-furnace, reducible after the first three years by 2s. (48c.) and 4s. (96c.) per ton, respectively, each succeeding year. The bill, if passed, will not come into operation until 1923, the intervening period being required for preparatory work in connection with the proposed new industry.

The Broken Hill South mine, working half time in September, produced 13,610 tons of ore, yielding 2431 tons of concentrate assaying 67.4% lead, 22.2 oz. silver, and 7.7% zinc.

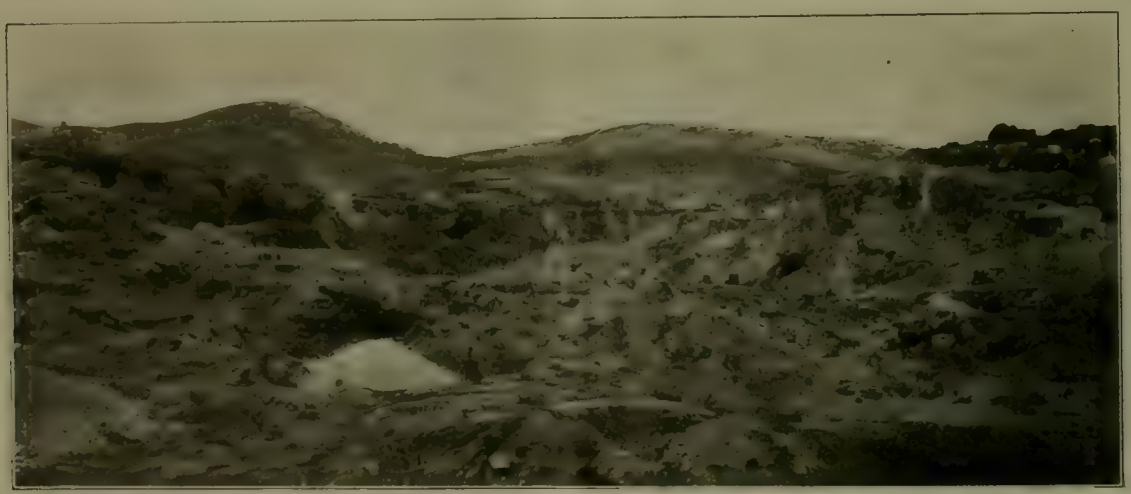


Fig. 5. PART OF A LARGE OPEN CUT OR *tajo*. THE TAILING RESULTED FROM CRUDE MILLING OF ORE FROM THIS *tajo*.

SHOVEL MACHINE IN OPERATION AT FLAT RIVER LEAD MINES.

Shoveling Machines at Flat River

By E. H. LESLIE

Among the new devices that have been developed within the past few years to meet the requirements of increased tonnage operations, the shoveling machine has been offered to mine operators as an efficient substitute for the shoveler, and with a reduction in labor and mining costs. The shoveling machine has been given a thorough trial in the mines of the Flat River district, but while the figures presented in this article may be taken as fairly representative of the performance of this machine in the lead mines of Missouri, they can not be said to be completely representative. Conditions here are not ideal for the best results, in that its operation was not as continuous as could be hoped for to attain the highest possible efficiency.

The machine is not adapted to all classes of underground work, and economy through its use will depend upon its adaptability to the local conditions. Large stopes with an abundance of broken ore available at all times for shoveling afford the ideal condition for most efficient operation, as continuous operation and few changes in the position of the machine make for economy in its operation. Small stopes where only a few hours' work of shoveling can be provided and it is necessary to move the machine frequently from one stope to another in order to keep it supplied with ore, increase the operating cost and decrease the efficiency to that point where it is not possible to use it profitably.

The chief argument for the use of this shoveler in large mining operations is that it can be operated by one man and under favorable conditions will handle a large tonnage at a reduced cost. The machine will operate on either a smooth or rough floor, spading into the material and moving lumps which could only be moved by hand with difficulty. The conveyors on the machine may be used as picking tables when it is in operation. A full crew for operation consists of a runner with one man in front to clean up and two men behind to shift the cars. After the ore has been broken, the shoveling machine is run over the track to the stope and placed in position for work. The cars are moved into position by hand from the sidetrack and attached by a spring coupling to the loading machine in such a position as to receive the ore from the conveyor. As the cars are filled they are removed and empty cars brought into place, making possible an almost continuous operation.

Stability of the machine is obtained solely by its weight, no struts or anchors of any kind being used to hold it in position. When a narrow-gage track, of 24 in. for example, is used, as at Flat River, in order to enable the jib or shovel to swing laterally, it was found necessary to use outer rails at the loading faces and to place smooth-faced wheels on an extension of the axles to bear upon these rails, as will be seen in the halftone. This shoveler reaches 10 ft. to each side of the centre of the track, and can, therefore, clean up a space of 20 ft. from one position. The tracks are laid at distances which permit the machine to reach all of the broken ore.

This shoveler at Flat River is driven by a 22-hp., 60-cycle, 3-phase, 220-volt motor, and the reel which is seen mounted in the illustration carries 250 ft. of 3-conductor mining machine cable. The entire control is from a platform on the jib, one man controlling all of the movements of the apparatus. The vital part of the machine is, of course, the shovel and conveyor motions by which the material is picked up by the shovel and discharged on the conveyor, which is mounted on the jib, and delivered from that conveyor to the conveyor mounted on the main frame, which second conveyor delivers it into the mine cars.

In handling the disseminated lead ores of the Flat River district, the following figures present a record of its performance:

RECORD OF MYERS-WHALEY SHOVELING MACHINE

AT FEDERAL LEAD CO., SHAFT NO. 11

Tons shoveled 6962

Delays inherent in machine.	Hours.	*Miscellaneous delays.*	Hours.
Moving machine	10:48	Cleaning and repairing track	19:16
Off track	14:55	Blasting rock	35:30
Repairs	53:40	Scaling bluff	18:28
Total	79:23	Block-out	4:39
		Shifting cars	53:30
		Miscellaneous	5:57
		Total	137:20

There were 27 working days in the month, of two 8-hour shifts, or 54 8-hour shifts.

	Hours.	Per cent.
Time machine might have worked	432:00	100.0
Delays inherent in machine	79:23	18.4
Miscellaneous delays due to local conditions	137:20	31.8
Net running time	215:17	49.8

Average tons shoveled per hour 32.3
Average tons shoveled per shift 129.0

Repairs on the machine average about $60 per month, or approximately 1c. per ton of ore shoveled.

AT ST. LOUIS SMELTING & REFINING CO., SHAFT NO. 4

Shifts machine operated	67
Tons ore loaded	9,830
Average tons loaded per shift	146.7
Labor cost	$680.79
Repair cost (labor and material)	322.48
Total	$1,003.27
Labor cost per ton	$0.069
Repairs, cost per ton	0.033
Total cost per ton, exclusive of power	$0.102
Tons shoveled	9830

Delays inherent in machine.	Hours.	*Miscellaneous delays.*	Hours.
Moving machine	44:02	Cleaning and repairing track	6:45
Off track	20:50	Breaking rock	42:52
Repairs	34:38	Miscellaneous	24:49
Total	99:30	Total	74:26

	Hours.	Per cent.
Total time machine might have worked	536:00	100.00
Delays inherent in machine	99:30	18.56
Misc. delays (due to local conditions)	74:26	13.89
Net running time	362:04	67.55

LABOR REQUIRED TO OPERATE MACHINE FROM SEPTEMBER 3, TO OCTOBER 1, 1913

Average number of men per shift	4.3
Shifts	42
Runners	42
Sledgers	53
Car shifters	84
Scale of wages:	
Runner	$2.75
Sledgers	2.35
Car shifters	2.35

The repair charges of 0.033c. per ton at the St. Louis Smelting & Refining Co.'s property will appear high, but it must be said that the loader was operating at a shaft three-fourths of a mile from the machine-shop, and was charged with the time of the men going and coming as well as when actually working on the machine. The loader was new at the time of the test, and it was thought best not to have the operating men look after the repair work. The machine was carefully inspected at the end of each shift. The shovel used here is capable of handling 1000 lb. of material.

While sufficient data are not available at this time to state with any degree of accuracy just what the limits of economic performance are, there is reason to believe that the shoveling machine has found a place in the working of certain types of deposits, and a wider use will be found for it in the wholesale mining operations which are being conducted in this country.

Titus Chlorination Process

In his application for United States patent No. 1,111,976, the inventor, Court C. Titus, of Helena, Montana, describes his chlorination process as follows: According to the preferred process, the ore is crushed to about 20 mesh, dried by heating in a rotary drum, and then delivered into one end of a long narrow inclined revolving cylinder. A mixture of dry chlorine gas and air is introduced into the other end of this cylinder, converting the iron into its oxide, and the other metals and the metalloids into their chlorides. The metalloid chlorides, such as those of sulphur, arsenic, or antimony, are volatilized and are either allowed to escape from the upper end of the cylinder, or are collected and condensed. The treatment with chlorine and air is continued for several hours, the ore meanwhile gradually moving downward through the cylinder and discharging from its lower end. While the reactions evolve considerable heat, it is as well to apply heat to the lower end of the cylinder, and finally to raise the ore to as high a temperature as possible without causing it to fuse partly and agglomerate, say to 240 to 250°C. The ore may then be treated in any appropriate manner to recover the metals.

GOLD OUTPUT of Rhodesia in September was worth £309 398, making a total of £2,621,586 for the nine months of 1914. The Cam & Motor produced £16,709 from 11,870 tons. In August the Shamva treated 47,718 tons for £31,283. Ore reserves of the Globe & Phoenix were estimated as 188,000 tons averaging $29.10 per ton on September 30.

THE MT. LYELL MINE, Tasmania, produced 641 tons of blister copper, 36,353 oz. silver, and 846 oz. gold, from 25,204 tons of ore, in September. Two blast-furnaces worked 28 and one 21 days.

GRAVEL WASHED by the Lena Goldfields company, Siberia, from October 1, 1913, to August 31, 1914, totaled 756,413 cu. yd., yielding 326,802 oz. gold.

Steel Roll Shells

By JAMES C. H. FERGUSON

*The importance of having roll shells which wear even, and have a good life, is recognized by millmen, who know that the use of such shells results in efficient crushing and economy.

Without going into an elaborate history of the subject, the following may be mentioned treating on the evolution of roll shells. During the early days of mining machinery construction, cast iron was used for practically all such grinding devices as those under consideration, usually some good mixture of gray iron being the most suitable for wearing qualities. Sometimes, though not often, shells or muller rings, chilled to a depth of from $\frac{1}{2}$ to 1 in. through the face, were used. But it soon became apparent that cast iron, no matter how well selected as to grade or mixture, or how carefully molded or chilled as to physical appearance, was not a suitable material to use for grinding rings or dies, since, for the proper performance of their work, absolute homogeneity and freedom from blow-holes or other imperfections are highly important. Steel, that is, cast steel, therefore, was next and most logically considered as being more suitable to fulfill the *desiderata* just mentioned. Although it was more expensive than cast iron, it was harder and tougher, and of infinitely better wearing quality. But even cast steel failed to give satisfaction, particularly on the high-speed rolls of narrow face and large diameters designed by the leading manufacturers during the past two decades. It was for that reason that the steelmaker soon recognized the importance of meeting the situation and has during the period mentioned evolved the rolled-steel roll shell. This was a natural evolution, and during the past 10 years practically no other material has been used except for some small or slow-running mills where the expense of steel shells was not warranted. While, as mentioned above, the application of steel shells as wearing parts in the various types of grinding mills was comparatively new, the purely mechanical features of their manufacture were easily accomplished by the use of tire-rolling mills, which for many years previous had been used for making locomotive driving-wheel and car-wheel tires.

Chemical and physical properties of the best roll shells of American manufacture are as follows:

Chemical properties.	Per cent.
Carbon	0.65 to 0.80
Phosphorus, not to exceed	0.05
Sulphur, not to exceed	0.04
Manganese	0.60 to 0.85
Silicon	0.15 to 0.30

The above are the average ranges used. Shells which have given good satisfaction in actual operation had the following analyses in the heats from which they were produced:

	Per cent	Per cent	Per cent
Carbon	0.700	0.730	0.780
Phosphorus	0.035	0.029	0.015
Sulphur	0.022	0.018	0.028
Manganese	0.741	0.786	0.745
Silicon	0.253	0.252	0.258

These results show that the shells are very uniform in composition.

Physical properties.	
Tensile strength, pounds	125,000
Elastic limit, pounds	72,000
Extension, per cent	10
Contraction of area, per cent	15

The following gives the limits of sizes for rolling as used in the practice of one of the largest tire manufacturers in the United States: roll shells 8 to 10 in. wide, 108 in. outside diameter by 3 in. thick; over 10 to 16 in., or under, 68 in., outside diameter by 3 in. thick.

Shells over 16 in. wide and thicker than 5 in. and weighing say 5000 lb., or over, are produced to the best advantage under a hydraulic forging press of adequate power, as a strictly forged, instead of a rolled product. Sufficient stress cannot be laid upon the necessity of thoroughly working the metal in these forgings all the way to the centre by the use of machinery of this kind, which is sufficiently heavy and powerful to perform the necessary forging operation and is better able to do so than rolls. I am quite convinced that most of the cases of uneven wear in roll shells of extreme widths, where not due to improper setting or improper mill feeding, or both, is largely owing to the fact that the metal is not of uniform density, resulting from being worked in a tire mill, which was too light for the heavy and thick section passing through the rolls.

As regards the life of shells, reports from users in Montana, Colorado, Sonora, Arizona, and Utah show interesting results. In one instance the amount of rock crushed per pound of steel consumed was 1.06 tons, and in another 4.25 and 3.8 tons. When new, a set of three shells weighed 4464 lb., and on discarding, 1640 pounds.

*Abstract from *Transactions* of A. I. M. E., Pittsburgh meeting, October 1914.

Mexican Ports of Entry

The amount of imports passing through the various gates of Mexico during the last two normal years were as follows:

	1910-11	1911-12
Gulf ports	₱134,128,467	₱125,654,614
Pacific ports	11,667,537	11,362,240
Northern frontier ports	59,956,902	45,602,016
Southern frontier ports	121,365	43,439
Total	₱205,874,271	₱182,662,309

Of the total imports 79.79% were subject to duty, and 20.21% entered free of duty. It is therefore of importance to the manufacturer to investigate the subject of duties thoroughly if making prices for delivery in Mexico, as in some classes of material this often amounts to from 50 to 75% of the value of the product.

Petroleum in India

*It is announced that during the coming year the Geological Survey of India will make special inquiries into the petroleum resources of the Punjab, Northwest frontier province, and Baluchistan. The petroleum beds of these parts have never been examined minutely, but a good deal is known about them.

The records of the Survey show that the petroleum resources of India are confined to the two systems of folded rocks at either end of the Himalayas, namely: (1) the Iranian system on the west, including the Punjab and Baluchistan and continuing beyond British limits to Persia, and (2) the Arakan system on the east, including Assam and Burma, with their southern geotectonic extension to the highly productive oilfields of Sumatra, Java, and Borneo. In both areas the oil is associated with Tertiary strata, but there, so far as present knowledge goes, the similarity between the two oilfields ends. The great resources of the Burma wells, and of the Assam oilfields behind them, are well known: but the superficial knowledge already available regarding supplies in the northwest, points to the conclusion that what may be found there will hardly compare favorably with the supplies farther east.

The petroleum occurs in loose-textured conglomerates and sandstones, its distribution, which is similar to that of water in porous strata, being controlled as in the Burma area, by impervious beds of clay. It may exude through any accidental fissure at the surface of the earth and thus form natural oil springs, but is chiefly obtained by boring through the impervious covering strata into the oil sands below, from which the oil may be raised by pumping.

The great difference between the oilfields of Burma and those of the northwest, appears to be that, whereas in Burma the conditions for the retention of the oil have been ideal, in the northwest they are not.

*Abstract from *Daily Consular Report*.

Quartz Mining in Dutch Guiana

While attention has heretofore been directed mainly to placer mining, gold-bearing quartz veins are known to occur in Surinam and several attempts have been made to open them. The best known workings are those of the Guiana Gold Placer concession, a Dutch concern, holding claims along Mindrenettie creek, a tributary of Saramacca river, about 120 kilometres from the coast. The region is heavily wooded and low lying. Quartz veins have been reported at a number of points. Near the corner of the De Jong placer, one known as the 'Koolhoven riff' attracted the attention of the Guiana Calloa Gold M. Co., a New York concern, and serious efforts were made to develop it, but without satisfactory results. As early as 1903, attempts were made by the Dutch company to work one of the veins, and a 40 stamp mill was imported from the United States and erected. At the site chosen the quantity of ore proved inadequate. Whether better results would follow more adequate prospecting is not certain, since little definite information about the veins is available, though H. J. Verloop has studied the geology. A railroad traverses the area and much more inaccessible territories have been far more adequately prospected.

RAILROAD THROUGH GUIANA GOLD PLACER CO.'S CONCESSION.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Rand Banket

Reply by Mr. Horwood to J. W. Gregory's Discussion, Dated Glasgow, May 5, 1914. (Continued)

Gregory now maintains that the pseudomorphic nature of the pyrite does not support the infiltration theory, as it does not prove whence the pyrite came. It proves at least that metasomatic processes have occurred similar to those with which one is acquainted in ordinary gold-quartz veins. It also suggests strongly the action of deep seated circulating solutions, as I showed that the evidence pointed to the change having taken place under high temperature conditions.

As regards the carbon, it does also occur, occasionally, without pebbles, in the quartzite, in which case the latter carries gold. I admitted that small proportions of gold, pyrite, and metals of the platinum group may occur that are of detrital origin. I particularly pointed out that the iridosmine from the Rand banket differed in its microscopical characters from that of known detrital origin. In addition to its association with gold, silver, pyrite, carbon, traces of cobalt, and also with chromium, all of which occur in the neighboring dikes, I adduced several further facts and arguments that suggested the dikes as the responsible agents for these rare metals.

Gregory says I have graphically described the main facts in the Rand goldfield and claims that I showed how different it is from any lode-mining field. My description may have indicated how, on first impression or to a casual observer, the banket does seem to differ from ordinary lode deposits, and how it certainly does in appearance; yet, I also tried to make it quite clear that it is in no wise really different in essentials.

Gregory speaks of the poverty in gold when the pebbles are angular. I particularly pointed out that pyrite pseudomorphs are invariably associated with good ore, and I stated that some of these pseudomorphs were formed by the replacement of angular, indurated, slaty-quartzite pebbles, and have retained the original angular outlines, and I called attention to the frequency of this particular form of pyrite replacement.

I defined my terms, taking them from well-known authorities, when dealing with the question of the occurrence of ore-shoots, and showed that they certainly do occur on the Rand, and are particularly in evidence in the Nigel mine. Gregory weakens his argument by inventing for a shoot a definition of his own. He now says that he has examined the best known of these occurrences and shown that it was not a shoot of gold in a widespread sheet of material like a shoot in a quartz lode, but a single band of conglomerate in an old channel and the ore was bounded on each side by quartzite. As he gives no further particulars, I assume that the occurrence that he calls the best known is the one in the May Consolidated mine, mentioned in his paper. He refers to it in the following words: "Ross Browne has kindly given me an account of a band of quartzite in the May Consolidated mine, which had been deposited in a 'wash-out' cut through the banket. The conglomerate had been deposited as a sheet of shingle, through which a channel had been cut and filled with sand. Some patches of the shingle remained undenuded, and thus blocks of conglomerate rich in gold have been left in the barren channel of quartzite. According to Mr. Browne, and the evidence certainly appears to support his conclusion, the gold must have been introduced into the conglomerate before the erosion of the channel: and the gold must have been deposited contemporaneously with the formation of the conglomerate, and not by any long subsequent process of infiltration." Professor Gregory adds a footnote that this case appears to establish conclusively that the gold was deposited simultaneously with the beds. After such a definite statement, followed by such a sweeping conclusion, one is therefore not a little surprised to find, that Ross E. Browne contributed to the discussion on Gregory's paper in the following words: "Professor Gregory, in his very interesting paper, refers to certain information obtained from me in a way that calls for some explanation. The channel mentioned as occurring in the May Consolidated mine was pointed out to me by the consulting engineer, George Hoffmann. We followed the development from level to level and concluded that the well marked course was most probably that of an eroded channel, but, in the absence of cross-cuts or continuous drives to follow the rims and expose the bottom, the evidence was not conclusive. It was stated that in the drives crossing the supposed channel through barren quartzite there were encountered several isolated patches or fragments of gold-bearing banket. To verify and complete the information, there would have been required a very considerable amount of work, and owing to the press of business the matter was dropped."

Gregory says that the distribution of the rich and poor material illustrated by my figures No. 25 and 26 correspond better with the patchy distribution of gold in a placer deposit than with shoots in a lode. These two diagrams, and the two accompanying curves, I had compiled from two mines that were under my

technical control, and I can vouch for their accuracy. There is no such regular alternation of relatively rich and poor ground between two layers separated by varying distances of from 50 to 200 ft. of quartzite in a placer deposit. Also against Gregory's statement is that of no less an authority than Waldemar Lindgren, who in his discussion on my paper dated April 16, from Boston, Massachusetts, writes in reference to these same diagrams and those accompanying them: "Most important are also the statements and diagrams referring to the distribution of the gold in the various conglomerates; these sections are perhaps the most convincing arguments brought forward to support the infiltration theory."

Gregory then deals with nine features to which, *among others,* I drew attention as militating against a placer theory and that may, on the other hand, be regarded as evidence that the auriferous banket is merely an abnormal type of lode deposit.

As regards his criticisms on the first, namely, the great depth to which the profitable ore extends, these are already answered in my reply to T. A. Rickard's discussion.

As regards his remarks on the second, the dryness of mines in depth, I do not know whether he really intends them to be taken seriously. The dryness of mines in depth surely demonstrates that the circulation of the ground-water does not usually account for the formation of veins. Particularly is this so in the case of the Rand, where miles of adjacent deep-level mines communicate with the surface through the old workings of the outcrop mines, and therefore are well placed to act as huge drains to an enormous catchment area; and yet the deep levels are characterized by being dry and dusty. As to the third, the abundant water-ways by which mineralizers could have ascended, Gregory says he is without evidence of such channels, although I pointed out that the gold of the banket is genetically connected with main structural faults and with basic dike intrusions that mark fissure-faults, and that the bankets acted in place of ready made fissures; and Malcolm Maclaren had clearly shown, when he discussed Gregory's paper, that the bankets are more porous than the sandstones. Gregory could hardly have made such a statement had he, during his brief visit to the Rand, spent as much time as possible actually underground in the mines, observing and recording facts for himself.

As regards the influence of dikes, the following is a quotation from a letter to me from Johannesburg, from David Wilkinson: "You are also probably aware that some of our richest specimens have been found associated with dikes, sometimes in quartz veins that occur in fissures in the dikes, and at the Witwatersrand Deep we have often found considerable occurrences of galena and some zinc ore in these quartz veins." He then refers to a specimen rich in gold that occurred in a dike in the Witwatersrand Deep mine, and then continues: "You probably remember the wonderful specimen from the Rose Deep, which was found close to the longitudinal dike that divides the property. Obviously, this is not alluvial gold." S. H. Cox, in discussing Gregory's paper, stated that the fact that the proximity of dikes does not always exercise any influence on the grade of the ore did not affect the question; and that in every case with which he was acquainted where dikes have penetrated rocks that have been subsequently charged by infiltrating solutions there are points of contact where no mineralization occurs, and the ascending solutions have not always passed through well marked channels, but frequently through shattered rocks. Gregory, while admitting the abnormal richness of the banket, does not understand the rôle played by the dikes, because he takes too small, or circumscribed, a view of the occurrence and does not realize that there is no occasion to expect that the ore will in every case be enriched or impoverished at or near the immediate contacts with the dikes. Speaking of the Rand as a whole, one of the outstanding features is that it is traversed by numerous longitudinal diabase dikes. All the gold occurs in their neighborhood and they are exposed in the underground workings of practically every mine on the Rand.

Gregory, after remarking that one of the most important features of my paper is the series of photographs showing the microscopic structure of the banket, states that they reveal its microscopic characteristics to be quite unlike those of any known lode. This surely is only what one would expect as the outstanding physical features of the banket are so different from those of normal lodes. He argues that lodes due to infiltration usually show a gradual passage from the country-rock through a silicified stage into sheets of vein-quartz, unless they have been deposited in fissures; whereas he thinks that in the banket many of the richest samples have been no more altered than barren samples. In the case of these deposits I pointed out that the bankets themselves have served in lieu of fissures. I dealt at considerable length in my paper, when discussing the question of local indications of good ore, with the alterations undergone by the richer portions of the banket; and showed that in consequence of its altered physical character mine managers and mine foremen can readily tell from its appearance whether it is rich or poor. In this connection I would like to mention the following details of an occurrence in the Consolidated Main Reef mine as given to me by David Wilkinson. "Usually, there is above the South Reef Leader a 'bastard' leader of from 4 to 8 inches in width, and sometimes there are two or three of these, but usually only one. I estimated some years ago that I have taken between 500 to 600 samples of this 'bastard,' and usually obtained about a pennyweight in value, and never, with the two exceptions I am now going to give you, as high as 2 dwt. On the 5th East from the old West shaft, the drive encounters a dike which has a southeast bearing. About 12 ft. from this dike, the bastard reef contained a large percentage of silica, so much in fact that the small pebbles in the bastard reef were almost obliterated. I may

say that the South Reef Leader at this place was very rich. I took two samples from the bastard reef, one at 10 ft. from the dike and the other at 5 ft., and was greatly astonished to find that they assayed about 35 dwt. I was so surprised at this result that I went down the mine specially and took two special samples from this bastard reef. I brought them to the surface, had them carefully crushed under my supervision, and found that my original assays were approximately correct. Now you will see that this gold at any rate did not occur originally in the bastard reef, otherwise you must explain how over a length of about 1300 ft. and a number of levels no gold of more than about a pennyweight was found. At the time I took these samples, I regarded this occurrence as an absolute proof of the infiltration of the gold into this bastard reef."

Gregory maintains that since the matrix of the banket consists mainly of grains of silica, it would, if the gold were due to infiltration, have been readily altered into vein-quartz, whereas he supposes that the matrix of even the richest Rand ore is often practically unaltered. Now the matrix of the banket has been greatly altered, for it has been silicified by the abundant deposition of secondary silica; from his argument one is bound to assume that Gregory imagines nature would be so wasteful of her energies as to replace with fresh silica the grains of silica already existing. In this connection, I cannot do better than quote verbatim from Maclaren's criticism of Gregory's paper: "Professor Gregory affirmed that there was no evidence of infiltration in the banket-matrix; but what of the secondary silica? Was not that a mineral of infiltration? And the pyrite, to which such an important rôle had been assigned—was not that a mineral of infiltration? As evidence against infiltration it had been objected that the banket-matrix had not been replaced by vein-quartz. But nature wasted no energy, and finding quartz (as grains) already in position was content to fill up, in obedience to the ordinary laws of mass action, the interstices between those grains; the silica deposited tending to arrange its molecules in consonance with the crystallographic axes of the grain upon which it was deposited. Than that, further silicious deposition was impossible, since in infiltration like did not replace like; like merely added itself to like." As further evidence of the alteration it has undergone and of its resemblance to ordinary lodes, I dwelt at length in my paper on the metasomatism that had taken place in the banket, pyrite having replaced quartz and quartzite, the original structure in some cases having been preserved so as to be distinctly discernible by the aid of the microscope.

The fourth argument, namely, the crystalline character of the gold, Gregory attempts to brush aside by maintaining that "it is part of the placer theory, according to which the gold has been re-dissolved and redeposited during the cementing of the banket." The fact that no nuggets are found and that the gold is usually not discernible to the naked eye and that in exceptional cases when it is visible it is crystalline and shows no sign of being water-worn[1] is usually accepted as strong evidence against an alluvial origin. I shall here quote one of the reasons that D. Wilkinson gave me for his belief in the infiltration theory. When he first came to the Rand, he spent nearly three years in the various capacities of sampler, assayer, and surveyor at the Consolidated Main Reef mine. He told me that he estimated that during that period he took about 8000 samples, which he assayed himself, and that he never saw even a speck of gold in any of these samples. Further, he took elaborate measures to determine the probable occurrence of 'metallics' on a 60-mesh screen, and never found a single particle. As he remarked, his experience as a sampler is in accord with that of other samplers on the Rand, except that in some few mines occasionally visible gold is found; however, in such cases, it is, as far as he is aware, always more or less crystalline in form. Doubtless Gregory would try to explain this by saying that the original alluvial gold had been dissolved and re-distributed in a very fine state of division. However, it is difficult to imagine that such a process over such an extensive area and on such a large scale would have taken place so completely as to have left no trace of any of the original placer-gold. As was pointed out in the discussion on Gregory's paper, in order to explain how such reactions occurred one has to imagine the former presence of conditions and material that were highly improbable, and he has not produced any evidence of such. Further, why attempt to explain the origin of the gold by such a complicated double process, when the well known ones that have taken place in the formation of ordinary gold-quartz veins are amply sufficient to account for the gold in the banket, and the evidence points clearly to them being also in this case the responsible agents?

In dealing with the occasional association of the gold with veins of quartz, Gregory remarks that the latter have no bearing on the main question, as they are secondary products of the same period, and are only of historic interest. As this is merely a dogmatic statement of personal opinion, based on a few weeks' visit to the Rand, and is not supported by any scientific evidence, it calls for no refutation.

The close association of the gold and pyrite—which forms the sixth argument—he maintains is not constant, some rich ore being poor in pyrite, and some poor ore very rich in it. I particularly stated that "other things being equal, the presence of more than a usual amount of iron pyrite in the banket is usually, though not invariably, an indication of good ore." In my treatise I demonstrated the metasomatic origin of the pyrite 'pebbles,' and pointed out that the latter were a sure indication of good ore, and that this fact and also the frequent close and intimate intergrowth of the gold and pyrite formed sufficient evidence that the gold and

[1]The grains of gold are often of very irregular shape with hackly surfaces and jagged outlines.

pyrite had been deposited from the same solutions, often simultaneously. I mentioned that De Launay had stated that while the gold in the banket is constantly associated with pyrite it does not seem to be combined with it and can often be seen, by the aid of a microscope, in crystals enclosed within the pyrite. I showed that the gold present in the pyrite of the Rand banket is mainly bound up in it mechanically, as is clear from the following facts, namely, that in panning, when crushed fine, it is easily detected and separated (or most of it) from the pyrite; from microscopical investigations; from its largely yielding to amalgamation; and from the battery-pulp readily giving up its gold in the cyanide process.[5]

As regards the seventh argument, that the occasional presence of calcite, tourmaline, galena, blende, copper pyrite, pyrrhotite, iridosmine, and other metals of the platinum group supports the infiltration theory, he contends that their presence is fully consistent with the placer theory as, according to him, most of them must have been present as detritus in the pebble beds, and the presence of platinum and iridosmine is thus more easily explained. Were Gregory personally familiar with the way in which the first six occur in the mines, often in conjunction with vein-quartz or occupying vugs, I think his belief in his placer theory would receive a rude shock, for the occurrences are not those of water-worn fragments; they are intimately associated with the gold and pyrite, and are so very similar to the occasional occurrences of such materials that one sees in ordinary lodes.[6] He would, doubtless, summon to his aid the second, or re-solution, portion of his hybrid theory, and say that originally these materials occurred as water-worn débris, and had since been dissolved and re-precipitated. As already mentioned, the improbability of such complicated processes was clearly and ably shown in the discussion on his paper, and as he brought forward no supporting evidence, it seems quite unnecessary to make further comment here. As regards the presence of iridosmine and other metals of the platinum group, while admitting in my paper that there may be a small proportion that is of detrital origin, I stated that the facts and arguments I gave together with its association with gold, silver, pyrite, carbon, traces of cobalt, and with chromium, all of which I had showed occur in the neighboring dikes, indicated the latter as the main source of the minute quantities of these rare metals in the auriferous banket.

Gregory then refers to the distribution of the gold and says: "Its limitation in paying quantities to the beds of water-worn banket, and its absence from the beds of equally permeable 'bastard' reef above and below the rich seams, are facts also consistent with its detrital origin." He then says that my arguments for the infiltration theory appear to be not only consistent with the placer theory, but to tell in its favor. These again are expressions of personal opinion, instead of scientific evidence. In the discussion on Gregory's paper it was conclusively shown that the "bastard reefs" are less porous than the banket proper. I have just given an instance of a normally barren "bastard reef," assaying where greatly silicified near a dike about 35 dwt. of fine gold per ton.

Among some of the facts adduced by me as evidence that these deposits are merely an abnormal type of lode occurrence was the influence exercised by slate and shale on the mineral deposition. Gregory carefully ignored this feature. I explained why certain banket beds had been selected and how the presence of slate and shale had influenced this selection. In his paper he stated that "the most striking feature in the vertical distribution of the gold is its limitation to a seam of conglomerate, which may be only a few inches thick, while the beds above and below are practically barren." However, he is not altogether correct in speaking of its limitation in profitable amounts to the banket. For example, gold occurs in places, in profitable quantity in the pyritic quartzites known as the 'pyritic band.' Although I have already given Mr. Wilkinson's description of one such occurrence, I shall refer to it again here in his own words: "Many years ago, I examined these quartzites very carefully at the Wolhuter, and I found that, while very often the pyrite occurred in layers parallel to the bedding, in many other cases it occurs irregularly across the bedding. This pyrite, to my mind, is undoubtedly due to an infiltration. It cannot possibly be due to the sedimentation of pyrite because of its form, and as you know some of this pyritic quartzite yields from 10 to 15 dwt. of gold in places."

I think I have now dealt with all the main points in professor Gregory's criticism.

C. Baring Horwood.

London, September 22.

[5] An interesting feature that I had not mentioned, showing how intimately the Rand gold is bound up with the pyrite, is that the 5% of pyrite in the sand, after the classification of the pulp leaving the stamp-batteries, contains 70% of all the gold in the sand (*The Mining Magazine*, Oct. 1912, p. 250).

[6] Always allowing, of course, for the difference in the appearance of the lode-filling, due to the presence of the conglomerate pebbles that occupy most of the space between the walls.

Gold output of West Africa in September was 37,525 oz., against 36,611 oz. in August. Returns from the principal mines are as follows:

	Tons.	Value.
Abbontiakoon	11,147	£23,705
Abosso	9,138	16,493
Akoko	140	144
Ashanti	9,149	38,184
Broomassie	4,244	13,653
Cinnamon Bippo	2,278	4,016
Prestea Block A	23,274	37,784
Taquah	5,600	16,544

Men employed at Broken Hill, New South Wales, at the end of June totaled 8932, and at the end of September, 5305. There are also 1067 working on the new water scheme and railroad. Wages are now £10,000 to £12,000 per week, against £30,000 to £33,000 before the war.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

PRUSSIAN BLUE, $Fe_4(FeCN_6)_3$, is sometimes used to color tea leaves.

CARGO WEIGHING 583,949 tons has passed through the Panama canal in the period of August 15 to October 15.

THE SLIDE which blocked the Culebra cut at Panama, on October 15, contained about 720,000 cu. yd. of earth and rock, of equal portions. Five dredges moved 119,605 yd. in 6 days, making a temporary channel for vessels to pass through.

COST of working a 900-hp. Diesel engine at the Anheuser-Busch brewery, St. Louis, totals 0.6506c. per kilowatt-hour as follows: fuel oil, 0.2850c.; lubricating oil, 0.0263c.; water, 0.0388c.; supplies, 0.0043c.; labor, 0.2750c.; and maintenance and repairs, 0.0212 cents.

KAURI GUM, a resin mined in New Zealand, is mostly used in making varnish. In cleaning the material for export, a good deal of 'chips' and 'dust' is made, and which formerly found no market. Recently Germany has taken this refuse and uses it in the manufacture of linoleum.

CAGES in numbers of shafts at Kalgoorlie have gates fitted to them to prevent men falling out during hoisting. No accidents have resulted from their successful use. Fixed chairs, for the cages to rest on at levels, have caused a good many accidents, and they have been dispensed with in favor of traveling chairs attached to the cages.

CALCULATION of wind stresses, and design of framework in tall buildings to afford the most rigid and economical resistance to them, are of great importance. Such pressures are affected by altitude, temperature changes, suction on the leeward side of the building, and gusts. The period of vibration of a high building is from 2 to 4 seconds.

AN EXCELLENT LUBRICANT for use with burette stopcocks, desiccators, etc., can be made by melting together equal parts of paraffin and vaseline, according to E. W. Osgerby, in *The Journal of Industrial and Engineering Chemistry*. The paraffin gives body to the mixture which is therefore superior to vaseline alone, especially in places where high temperatures prevail.

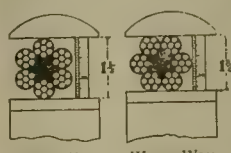
MEN EMPLOYED in gold mining and treatment in Western Australia in 1913 totaled 13,445, producing 393.36 tons per man underground, and 214.08 tons for miners and millmen. This ore contained 181.50 and 98.78 oz. respectively. There were 767 accidents in all metal and coal mines, of which 26 were fatal, equal to 1.76 per 1000 employed (14,780).

THE MINERAL RESOURCES of Morocco, Northwest Africa, are as yet but imperfectly known. Copper, silver, gold, and iron ores exist in the Sus provinces. An international arbitral commission has been sitting in Paris to settle the various denouncements filed by prospecting syndicates prior to the recent promulgation of the mining code for Morocco.

BAGASSE is the term given to the residue of cane after the sugar has been extracted. It has little value as a fertilizer, is sometimes fed to stock, but is a fairly good fuel, as it averages over 8000 B.t.u., against 13,000 B.t.u. for anthracite coal. In sugar mills it is often used under steam boilers. In Queensland this is done everywhere. The clinker produced during combustion is like a highly mineralized rock.

CONFUSION of the terms 'cyanide' and 'cyanite' are sometimes the cause of mistakes by laymen. The former is used in gold extraction and has the formula KCN or NaCN, while the latter is a bluish silicate of alumina, with the formula $Al_2O_3 \cdot SiO_2$. At the start of the war in Europe it was feared that there would be a shortage of cyanide for Western Australia, and it was seriously published in some papers that a deposit of cyanide had been found in New Caledonia!

THE TRUE DIAMETER of a wire rope is expressed by the diameter of a circle which will enclose it. Therefore, in using a caliper rule, be careful to avoid measuring across two strands side by side; measure rather from the top of any one strand to the top of the strand directly opposite, according to A. Leschen & Sons Rope Co., of St. Louis. This is most important, as otherwise the rope ordered is likely to be too small.



IRON is not made in New Zealand, although there are large deposits of ore at Paparoa, and immense quantities of iron sand on the west coast of the North Island. The latter contains 8 to 9.2% titanium. As the result of successful experiments in its treatment by the Waihi Gold Mining Co., it is proposed to erect a small blast-furnace near New Plymouth, not far from the iron sand beaches. The process is to briquette 60% of sand with 40% small coal from the Liverpool state colliery. The briquettes will be coked before being fed to the furnace.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

NEW YORK

THE PORPHYRY COMPANIES IN THE THIRD QUARTER OF 1914.—LABOR AT BUTTE, AND THE ANACONDA COMPANY'S OPERATIONS.—FOREIGN LABOR IN ARIZONA MINES.—OHIO COPPER COMPANY.

The quarterly reports of the principal copper mining companies for the third quarter of the year are appearing, and do not reflect as serious an increase of cost, due to the lessened output, as might have been expected. The Miami reports that although it is producing at half its normal capacity, it has made a slight decrease in operating costs. The recovery in milling now averages between 70 and 74%, and reduction in underground costs has been made, the two together leading to a production cost per pound of copper that is nearly as low as the Company has ever made at any time. The No. 6 unit of the mill is reported as recovering 2 lb. copper per ton more than the other units, and it is said that when the mill is operating at full capacity all will do better work than before. Details of the Ray and Chino reports appear in the news section of this issue.

It will be interesting to see what the effect is of the order of the Governor of Montana suspending martial law and withdrawing the state troops from Butte. Probably matters will remain quiet, for it is scarcely possible that the miners are so ignorant of the present situation that they would attempt to make difficulties at a time when every other consideration points toward the advisability of the Anaconda shutting down completely. It certainly cannot be making much money operating at half capacity at the present price of copper, and if shipments to Europe continue to be interfered with, the Anaconda management might decide that the best thing to relieve the situation would be for it to close and remove its own considerable production from the monthly output, instead of attempting to bring about a further reduction on the part of all the other companies. The transfer of the assets of the International Smelting & Refining Co. to the Anaconda has been almost completely carried out, and all the stock has been turned in on the basis of 3.3 shares of Anaconda for one of International, except a little over 100 shares. Good progress is being made with the construction of the new smelter at Miami, but naturally the work is not being pushed very fast, since the operations of the Inspiration which will be the principal source of ore, are being held back until the copper situation clears.

For some time a certain political element in Arizona has been trying to bring about the passage of a law to prevent the employment of Mexicans in Arizona, although the law is so framed as to include all foreigners, in order not to appear as a direct discrimination against the many Mexicans who come over the border to get employment in Arizona and New Mexico. A law recently passed provides that 80% of employees of mining companies shall be citizens of the state. As about two-thirds of the men now employed in mines and mills are not citizens of the United States, this law, if held constitutional, will cause a considerable change in the labor situation. The climate of Arizona is such that it does not appeal to those accustomed to a more northern latitude, and the Mexicans who are used to such conditions are the easiest to secure. There is some probability that the law will not be sustained by the courts, but even if it is, it may not work out so much to the disadvantage of the mining companies as is being anticipated. If workmen had to be brought into Arizona from other parts of the United States, care would be taken to get the best class of men available, and though they would doubtless demand higher wages, it is quite probable that their greater efficiency would serve to make up the difference.

The control of the Ohio Copper Mining Co. has been taken over by Clark Grove, representing the Mine & Smelter Supply Co., E. McCormick of the Railway Steel Spring Co., and Charles T. Lark, the Heinze interests, the three men representing the creditors. It is reported that the whole staff appointed earlier in the year, when the control of the Company passed to the Allison interests, has been dismissed.

The copper market was fairly firm throughout last week, and scored a marked advance, ½c. per pound, at the close when domestic consumers began to place considerable orders. Shipments to England and France continue in good volume, but no figures are available. It seems not improbable that some satisfactory arrangement can be reached in regard to shipments to other European countries, as Denmark, Norway, and Sweden have already given such sweeping guarantees that Great Britain has announced that it will not interfere with shipments to those countries.

HOUGHTON, MICHIGAN

PROTEST SENT REGARDING COPPER SEIZURES.—TAXES.—COPPER SHIPMENTS.—TAMARACK REGRINDING PLANT.

The Copper Country Commercial Club has sent a telegram to the Secretary of State protesting against the action of Great Britain in detaining vessels bearing copper from the United States to neutral foreign countries and the putting of unwrought copper on the list of absolute contraband. The protest calls attention to the fact that the Michigan copper district produces 230,000,000 lb. of copper annually, of which more than 60% is exported.

Several weeks ago a petition was sent to the State Tax Commission requesting a review of the Houghton County assessments. The Commission replied that because of scheduled duties, it would not be able to comply with this request until December 1. According to state law, the supervisors must have their tax rolls completed and in the hands of the treasurers on December 1. On that date the treasurers begin collecting the tax, and until January 10 a 1% commission or collection fee is added to the tax. From January 10 to March 1 a fee of 4% is added to the tax. Since it requires about a month for the supervisor to prepare the tax roll for the treasurer, and if the Tax Commission review should last for any length of time, it is evident that the treasurers will not receive the tax rolls until after the period during which the 1% commission is added. The interesting question then arises as to whether the taxpayers of Houghton county will have to pay the 4% collection fee after January 10 as provided by law, if the payment of these taxes is held up by the State Tax Commission.

Recently a cargo record was made at the Presque Isle harbor of the Marquette iron range. During the past week the largest shipment of refined copper ever made from the Michigan district was taken to Buffalo by the Mutual Transit Co.'s steamer *North Star*. The cargo totaled 9,000,000 lb. and in-

cluded consignments from the Calumet & Hecla dock on Torch lake, the smelter dock at Dollar bay, and the Quincy and Copper Range docks on Portage lake.

Construction of the railroad spur to the new regrinding plant of the Tamarack Mining Co at Hubbell is now under way. Three cars of steel have been delivered at the mill, and 15 men of the American Bridge Co. are now placing the steel in position. Work on this new plant has continued in spite of the general curtailment, and its erection is being rushed as much as possible.

The Osceola mine is producing about 4200 tons of ore per day from five shafts. In October the output of copper was 1,100,000 lb.——A large reservoir is being constructed by the Calumet & Hecla company for its White Pine stamp-mill. Work at the plant is well ahead.

PLATTEVILLE, WISCONSIN

A Review of the Zinc and Lead Ore and Pyrite Situation in October.—Production of Ore and Ore Buyers.—New Plants.

October in the Wisconsin zinc-lead districts witnessed extremes in all phases of the industry. Prices for ore and metal at the beginning of the month were somewhat buoyed up by the smelter interests, who were given reason to believe that a large foreign demand for spelter might develop, but beyond

GALENA-TRENTON, THE ORE-BEARING FORMATION, AT MINERAL POINT, WISCONSIN.

inquiries nothing of importance developed. Agents for foreign interests were quoted prices in advance of that offered domestic consumers on attractive orders, but before the month had well advanced both home and foreign demand had settled down to low levels, and prices for spelter and ore went down accordingly. The lower and medium grades seemed to be in better demand, as shipments eventually proved that the higher grades were being withheld, until in the closing days of the month there was found at several points in the field a reserve considerably in excess of 5000 tons of concentrate. Prices ranged from the first of the month, on ore from $40 to $45 per ton for 60% ore, to $33 to $39 about the middle of the month, when there was an important closing at about $40 per ton. Spelter closed at $4.75 per cwt., East St. Louis, with business exceedingly dull. Production of raw ores for all districts was well maintained, and deliveries in and out of the field set up a fair record as compared with previous monthly reports. New buying interests invaded the field, stimulating competition somewhat in the southern districts, which made the far better showing of the month over the northern parts, where production was light and sales covered only a portion of the ore offered for sampling. Carbonate of zinc ore producers were practically shut out of the markets all the month, and carried over a large tonnage, which began moving after the first of November. Prices were good, in fact better than quoted in years, but the demand was limited.

Lead ore was in poor demand, and quotations on both metal in pigs and ore reached lower levels than had been reported in years. Production was curtailed and shipments very small.

Pyrite suffered in reduced markets, and production was much lower than usual. A new buying firm failed to stimulate competition or increase production.

The following deliveries were made during the month from the different areas of the field:

District.	Zinc, pounds.	Lead, pounds.	Pyrite, pounds.
Benton	7,790,000	60,000	2,254,450
Galena	4,868,000	65,000	.....
Cuba	4,134,000	.....	783,500
Hazel Green	3,972,000	.....	.....
Livingston	2,524,000	.....	.....
Shullsburg	1,856,000	35,000	.....
Linden	1,316,000	128,000	160,000
Platteville	1,180,000	.....	.....
Dodgeville	544,000	.....	.....
Highland	470,000	.....	.....
Harker	462,000	.....	.....
Montfort	168,000	.....	.....
Mineral Point	56,000	.....	.....
Totals	29,340,000	288,000	3,197,950

The gross production of raw ore from all mines for the month totaled 26,244,100 lb. This showing was made with producers purposely running short time about half of the month. Net refined ores to smelter and shipments of wet concentrate direct totaled 17,814,150 lb. The Mineral Point Zinc Co. delivered 55 cars or 4,152,430 lb., of calcined zinc ore to the Nassau Works, De Pue Illinois; one of the best month's turn-ins of the year.

Distribution of sales among the buying concerns represented in the field were as follows: to Mineral Point Zinc Co., 5000 tons; Grasselli Chemical Co., Cleveland, Ohio, 1484 tons; National Separating Works, Cuba, 1106 tons; Empire Roasters, 888 tons; Illinois Zinc Co., 713 tons; M. & H. Zinc Co., 377 tons; American Metals Co., 574 tons; Linden Zinc Works, 315 tons; Campbell Separators, 160 tons; and American Zinc Co., 163 tons.

The West Hill Mining Co. 'tuned up' a new plant in the Platteville district, and was recovering 5 tons of zinc concentrate per day at the close of the month.——The Wisconsin Zinc Co., in the New Diggings district, started a 600-ton plant and was breaking a car of ore daily by the first of November. ——The New Jersey Zinc Co. commenced operating a new plant, costing $35,000, on the Penna-Benton mine at New Diggings. Numbers of miners' cottages were also added.——The Fields Mining & Milling Co., of Chicago, appropriated $50,000 on October 22, to be made immediately available for development and equipment of the new Thompson mine in the New Diggings belt. Considerable drilling proved a large deposit of zinc ore 60 ft. thick.——The Cleveland Mining Co. is now running a new $50,000 equipment on the Lawrence mine in the Hazel Green district.——The North Unity mine was opened and a new $30,000 plant started at the close of the month. This mine is on the northern limits of the Galena, Illinois, district. Longhenry Bros. were engaged in financing a new surface equipment for their mine in the Benton district late in the month. An option had been secured on an idle plant.——The New Jersey Zinc Co. put a new concrete and steel equipment into active service on the Little Coker mine in the Mifflin district. In the same district the B. M. & B. Mining Co. reconstructed a plant purchased from the Slack

Mining Co., on the new Biddick mine recently developed in this district.

Heavy consignments of zinc-bearing ores were delivered near the end of the month at the Mineral Point Zinc works from Mexico, and a train of 25 cars was unloaded in a single day. The business increased so rapidly that a deputy collector of import duty was reappointed and stationed at this point.

Drilling with steam outfits was under way in the Montfort, Benton, Hazel Green, and Shullsburg districts during the month with fairly good results in the second and third named areas. At Shullsburg, the McMillan Mining Co., of Milwaukee, being satisfied with results, has decided to provide a $50,000 equipment.

LEADVILLE, COLORADO

DEVELOPMENT OF LEADVILLE'S DEEP LEVELS.—TWIN LAKES AND LACKAWANNA DISTRICTS.

The big factor in the mining activities of the Leadville district at present centres around the unwatering of the down-town mines, as mentioned from time to time in the news section of the *Press*. The project has been brought to a successful termination after months of ceaseless endeavor on the part of Jesse F. McDonald, ex-governor, and promoter of the scheme, and his associates in the enterprise. Sufficient capital to finance the work has been secured, and is in the bank here. All of the ground that is desired by the pumping company has been signed over on long-term leases. The best centrifugal electric pumps have been ordered from the Providence Engineering Works, of Providence, R. I., and the motors are to be delivered by the General Electric Co. Neither concern has contracted to have the machinery on the ground before the first of the year.

Mr. McDonald was in the city recently and stated that everything pointed to an earlier start in actual pumping than had been supposed. The machinery is expected to arrive about the end of December.

The unwatering of the down-town area will be the first of a number of similar enterprises which will be undertaken in this district in the near future. The mineral deposits, which are known to exist in the down-town basin, while extensive in proportion, are not as rich as those that underlie Fryer and Iron hills. Propositions are on foot to unwater both of these places, and the former is reported to be all but completed. Leadville is looking ahead to the time when all three territories will again be producing a large tonnage of silver, lead, zinc, and iron ores. Each one of the schemes would give employment for nearly 1000 men, and at the same time offer many opportunities for the lessee to secure certain ground. It has been said for years that deep mining in the Leadville district would be more profitable than in the upper workings. This theory is about to be tested, and by this time next year there will be a marked change in conditions.

The Twin Lakes and Lackawanna districts continue to prove the best new areas in this territory. This winter will find three large properties producing high-grade ore for the first time in many seasons. The Mt. Champion, Lackawanna Belle, and Miller mines are all employing men on extensive orebodies. Milling processes have been arranged for the handling of the poorer ore, but so far very little has been treated. The efforts of the companies have been directed toward getting out all the rich ore possible, while prospecting the veins and the other ore has been allowed to stand. Preparations are being made by the Miller and Lackawanna Belle people to go into milling extensively next spring. They will confine the winter work to the high-grade ore, which averages about $400 per ton.

There is one new shaft being put down on Fryer hill which will be known as the Davis shaft. The manager, W. J. Davis, is sinking to cut the ore-shoot which was mined in the Matchless and Chrysolite properties in the early days. The shaft is now down about 100 ft., and appears to be at the bottom of the wash.

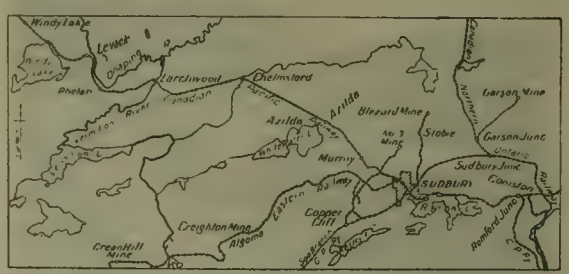
The low price of metals has a quieting effect on mining in the district, but no serious results have materialized as yet. With the chief output of Leadville centring around silver and zinc, the price of those metals is being closely watched.

TORONTO, ONTARIO

DISCUSSION OF THE NICKEL INDUSTRY AND THE EFFECT OF THE PROPOSED EXPORT DUTY ON MATTE.

Although mining operations in Ontario were considerably affected in August and September, conditions are again becoming normal. All the producing mines of Cobalt are now working, and although a further drop in the price of silver has meant decreased profits, there has been no falling off in output.

The copper-nickel companies of the Sudbury district were affected to a greater extent than any others, on account of the entire consumption falling off for the time being. The New Jersey refinery of the International Nickel Co. was closed altogether, while the mines and plant at Copper Cliff were run at only 33% capacity. Since then a revival of the demand for nickel has been experienced, and as a consequence, work has again been started at the refinery, while the output from Copper Cliff has been increased to 75% of its former capacity.



MAP SHOWING THE NICKEL DISTRICTS OF ONTARIO.

Owing to the fact that the Sudbury region is the chief source of the world's supply of nickel, and the International company the largest producer, which is controlled by American capital, there has lately been agitation in certain of the Canadian papers for a greater control of the source of supply, and for the placing of an export duty on the matte, as was provided for by an act passed some years ago. If this act were to become a law, it would mean that the nickel would have to be refined in Canada. This agitation is, of course, an outcome of the war feeling, and is due to the fact that Germany and Austria have drawn their supplies of nickel for armament from a British colony. Such agitation under the circumstances is ill advised, and should it be carried far enough, might work harm to a company that annually distributes in Canada millions of dollars in the form of wages, transportation charges, and payment for supplies.

When the International company was first formed, the refining of the matte, a secret process, was done by the Orford Copper Co. of New Jersey, which was a separate concern. The nickel company spent large sums of money in attempts to refine the matte itself, but was unable to evolve a process as satisfactory or as economical as that used by the Orford company. Eventually in order to acquire a satisfactory process for itself and to protect its own interests, it was forced to buy the Orford company. The plant, which is most advantageously situated as regards shipping facilities,

raw materials, labor, power, and market, and representing as it does an enormous expenditure for buildings and equipment would, in the event of an export duty being placed on shipments of matte from Canada, have to be dismantled and a new plant be built. The matter is one that requires serious consideration, and a thorough study of all the facts before any action is taken.

In time of peace it would be practically impossible to prevent the sale of nickel to any country that desired to purchase it, and in war time the International company can be depended upon to conform to the interests of the country from which it draws its supplies of raw material. As a matter of fact, all foreign shipments of refined nickel at the present time are known to the British government.

During the period ended October 7, the Hollinger, at Porcupine, produced 18,132 tons of ore averaging $13.54 per ton. Mining cost $2.08 and milling $1.23, and all costs totaled $4.41 per ton. The gross profit was $149,798. The surplus stands at $1,100,755.——The Associated company, of Kalgoorlie, Western Australia, has completed payment on the North Thompson property.

Ore shipments from Cobalt in October totaled 1281 tons from 16 properties.——The Nipissing high and low-grade mills treated 171 and 7009 tons of ore, respectively, yielding $200,384. The refinery shipped 630,846 oz. silver. The 'hydraulic prospector' uncovered five veins. Driving east at 900 ft. from No. 64 shaft was continued to 300 ft. in low-grade ore. A winze is to be sunk 100 ft. on the vein.——The Crown Reserve company will pay a 2% dividend on December 15, equal to $35,276. This makes a total of 334% and $5,936,126 since 1908. This Company's Porcupine Crown mine is paying 3%, $60,000, per quarter.

AUSTIN, TEXAS

Mining in Western Texas.—Sheridan Copper Mine.—Asbestos, Mica, and Quicksilver Deposits.—Metal Output.

More prospecting and actual mining development is now going on in the mountains of western Texas than for several years. This condition is accounted for partly by the fact that many of the men who were formerly owners or employees of mines in Mexico have been forced to leave that country, and are taking up properties on this side of the Rio Grande. The new mining law is also causing an increased activity in locating claims upon state lands.

In the Shafter district, the old producing silver mine that is owned by a syndicate of California men continues to keep up a good record of production. It has been worked for about 33 years. Several new claims are being developed nearby.——Favorable reports also come from the mines in the vicinity of Van Horn and in the Davis mountains.

Advices have been received here from the Burnet district that the Sheridan Copper Co. is doing development work on a group of eight claims and sixteen prospects. The Company has opened a vein of copper ore that averages 3.5%, with rich occasional shoots. Plans are also on foot for exploiting, on an extensive scale, several asbestos and mica properties in the Llano district.

Comparatively little is being done in the Terlingua quicksilver district, situated in Brewster county, 80 miles south of Alpine. Two or three of the older mines that have been closed down for several years, would have been reopened within the next few months but for the fact that the existing financial condition has interfered with the plans of the owners, it is stated.

According to the U. S. Geological Survey, the metal output of Texas in 1913 was as follows: gold, $340; silver, 427,553 oz.; lead, 225,227 lb.; copper, 34,665 lb.; and spelter, 652,607 lb., with a total value of $310,411, compared with $269,274 in 1912.

SILVER CITY, NEW MEXICO

Lordsburg, Santa Fe, Florida Mountains, White Oaks, and Socorro County Districts.—Meerschaum Mining. Lead and Copper Ores.

The Eighty-Five Mining Co., at Lordsburg, is again shipping to the Douglas smelter, as well as other operating companies in the district.——The Green King mine has encountered water at 40 ft. in sinking, and a 4-ft. high-grade vein has been opened.——Higgins and Scarborough, Haydan and Weldon, and others, are now extracting ore in the Shakespere area.——The Bonnie Mining Co. is again active.

Two properties were sold recently by receivers at Santa Fe, in Santa Fe county. George Heineman, of Kansas City, Missouri, has purchased the patented claims of the American Gold-Copper Mining Co., at Bonanza, for $3168, and Frederick K. Gilbert has acquired the turquoise mines of the American Turquoise Co., at Cerillos, for $24,000.

In the Florida mountains, 16 miles south of Deming, Luna county, Manuel Pana and associates have opened a good body of zinc carbonate ore, and shipments are being made. It is said to assay 37% zinc, 18.5% lead, and 12 oz. silver.——C. P. Cramer, of Georgetown, is reported to have opened a good body of similar ore.

The Parsons Mining Co., at Nogal, Lincoln county, is preparing for operation and is purchasing equipment. An adit in the Hopeful claim has opened a vein assaying from $4.80 to $13 gold per ton.——The entire White Oaks area is active.

The Tri-Bullion mill of the Empire Zinc Co., at Magdalena, Socorro county, is undergoing reconstruction, which will result in a practically new plant.——The Ozark Smelting & Mining Co. continues to develop ore.

LOADING MEERSCHAUM FROM AMERICAN MEERSCHAUM & PIPE CORPORATION'S MINE IN THE ALUNOGEN DISTRICT.

Mines 30 miles north of Silver City have produced several hundred thousand pounds of meerschaum, and, owing to the war, further development is probable. The property of the American Meerschaum & Pipe Corporation was operated continuously for 10 months during 1913, but on account of impractical methods in the Eastern factory and the failure to carry on work at the mines in a systematic manner, the Company went into the hands of a receiver. There is ore in the mines, and several commercial veins of the mineral lie undeveloped in the district. A complete mill for the treatment of meerschaum was erected.

The bulk of the smelting lead and copper ores and concentrates of this state continues to be shipped to the El Paso smelter. Some is sent to Pueblo and Salida, Colorado; also to Douglas, Clifton, Needles, and Cananea. Bullion and matte go to the Omaha refinery, and bullion to Selby. Zinc ore and concentrate go to Kansas, Oklahoma, Wisconsin, Illinois and Eastern plants.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

The report of Sumner S. Smith, mine inspector for Alaska, covering the fiscal year ended June 30, 1914, has just been published in Washington, D. C. It covers 36 pages and includes the following notes: Practically all parts of the territory were visited. W. Maloney was appointed an inspector for the second and fourth divisions, with headquarters at Nome. The office of the inspector for Alaska requires more assistance and better housing at Juneau. The output of minerals was as follows:

Source.	Ore, tons.	Gold, oz.	Silver, oz.	Copper, lb.
Silicious ores	1,614,506	232,917	30,897	.....
Copper ores	135,756	6,386	273,179	21,659,958
Placers	.....	516,645	58,487	.....
Total	1,750,262	755,948	362,563	21,659,958

The total value was $15,626,813, a decrease of $1,519,138 compared with 1912-13. Other topics discussed are lode mining, greater use of dredges, coal mining, railroads, labor conditions, accidents (15 killed in mines, 7 in placers, and 3 on dredges, or 25 out of 8000 employed, equal to 3.125 per 1000), length of mining season (125 to 170 days), cost data, and a list of mines and their operations. All interested in Alaska mining should have a copy of this report.

Fairbanks

It is reported that Fairbanks creek will be one of the busiest areas in the Tanana valley this winter, as prospecting and taking out dumps will be done by a number of operators. ——There has been a new discovery somewhere near the headwaters of the Tolovana river, and numbers of men have left for that place. The exact locality is unknown so far.

Juneau

A stope boss and a miner were killed, and a shift boss was injured at 2100 ft. in the Treadwell mine, on November 1, by gas asphyxiation. It is thought that a blast destroyed an air-pipe which should have freed the stope from smoke.

The Jualin mine has been closed for the winter. Arthur Reandeau was in charge of the property, which was financed by Belgian capital.

Nome

The steamer *Corwin* arrived at Nome from York during the second week of October, bringing 63 tons of black tin, mostly from the York Dredging Co. The vessel left for Seattle on the 15th.——People who wish to go to Dawson without passing over the open sea route to Skagway, will be able next season to travel to St. Michael and then up the river Yukon to Dawson, or *vice versa*. The steamer *Sarah* is now at Dawson and will make the first trip at the opening of navigation.

The *Nome Daily Nugget* has just published its 'Mining and Dredging Edition.' It consists of 84 pages, with numerous illustrations, and includes the following information: To October 7, gold worth $2,259,780 was passed through the local customs house, and about $80,000 through the post-office. This season's output is estimated at $2,000,000, compared with $2,486,778 last year. The total to date is $56,260,680. A directory of dredge companies gives 41 companies in the Nome, Council, Solomon, Teller, Inmachuk, Candle, and Kougarok districts. Hydraulicking and dredging are fully described as pertains to the Seward Peninsula. The tin industry seems to have a good future. Individual dredges, companies, and districts are described, and a chapter on the wreck and rescue of the Karluk survivors from the Arctic ocean completes an interesting publication.

ARIZONA

Cochise County

Driving on the vein on No. 8 level of the Commonwealth mine at Pearce has advanced 19 ft. east and west. In the latter drift is 6 ft. of $10 to $15 ore. On November 6 the 'old gold streak' was discovered in the old workings near B shaft. It was first cut on No. 5 level, gold showing in a decomposed porphyry. Similar ore was found on No. 6 the next day. During the last week of October the mill received 2111 tons of ore.

Gila County

The Old Dominion company, at Globe, produced 1,616,000 lb. of copper in October, compared with 2,121,000 lb. in September and 3,303,000 lb. in May.

The Ray Consolidated Copper Co., with a mine in Pinal county and smelter in Gila county, reports as follows for the quarter ended September 30: Owing to the copper market, a 50% reduction of output was decided on August 5. All men are being employed on alternate days. During the third week of September all work was temporarily stopped on account of a violent cloud-burst. Development amounted to 10,626 ft., making 448,945 ft. to date. Results were as follows at the mine and mill:

Details.	Third quarter of 1914.	Second quarter of 1914.
Cost of mining, cents per ton	54.867	61.741
Ore milled, tons	546,734	764,040
Average copper content, per cent.	1.691	1.786
Extraction, per cent	67.47	68.69
Copper produced, pounds	12,475,153	18,748,343
Cost of milling, cents per ton	45.85	47.24
Cost of production, cents per pound	8.738	8.541
Net profit	$420,922	$959,494
Dividends paid	.....	$545,358
Surplus over bond interest and dividend requirements	$420,922	$414,136
Copper on hand, pounds	26,405,739	25,819,674
Price of copper for quarter, cents per pound	12.4858	13.9198

A total of $2,708,000 par value of bonds was outstanding on September 30, 1914.

The 300-ft. stacks at the International smelter at Miami are finished. Construction of this new plant has proceeded steadily in spite of the depressed copper market.

Maricopa County

Fire on November 16 destroyed property worth about $300,000 at Phoenix.

CALIFORNIA

Conferences between the mine owners and the Industrial Accident Board have resulted in a proposal from C. W. Fellows, representing the latter, to accept mining risks on a merit rating system, with quarterly adjustment of premiums and a refund of all sums collected not needed to cover ordinary risk, cost of handling the business, and surplus for catastrophe risk. This offer is conditional upon the mining men interest-

ing themselves sufficiently to furnish business equalling $100,000 annually in premiums. The proposal is now before the executive committee of the California Metal Producers Association.

Butte County

The Leland Stanford University estate includes land near Chico, and on account of alleged damages to the land, the board of directors has filed suit in the Superior Court against the Butte Creek Consolidated Dredging Co for an injunction prohibiting further dredging on Butte creek, northeast of Chico.

Inyo and San Bernardino Counties

Salines in the Owens, Searles, and Panamint basins of southeastern California is the subject of U. S. Geological Survey *Bulletin* 580-L, by Hoyt S. Gale. It covers 73 pages, and is illustrated by line-cuts and maps. The author states that the salt-incrusted valley floor commonly known as Searles

MAP OF SOUTHERN CALIFORNIA.

lake has lately come into prominence through the widespread interest in the search for an available source of potash in this country. The previous estimate of 4,000,000 tons of water-soluble potash salts has been confirmed by subsequent development. In discussing the lake history of the basins, each one is considered, as it played an independent part in the whole system. Water from Owens valley, the principal source of supply, passed through Indian Wells, Searles, and Panamint valleys, and probably finally into Death valley. The bulletin describes each area, the salts, crystalline forms of salts, and prospective commercial development.

Nevada County

Taxes paid to this county by the North Star company amount to between $16,000 and $17,000; Empire and Pennsylvania, $7000; and two lumber companies, $7000. These taxes represent 20% of those paid by the entire county.

Placer County

There is increased activity in mining in the Auburn district of late. The Mary Bell has been bonded to San Francisco people, and the Spanish Consolidated to San Diego men. Rich gravel is showing in the Excelsior drift mines, and 35 men are now employed.

Plumas County

It is reported in Quincy that placer mining claims of the Claviank Mining Co., near Slate creek, have been acquired by J. H. Thomas of La Porte, and Los Angeles people. A large restraining dam will be constructed to hold the débris, and hydraulicking started after a lapse of many years, having been stopped since the anti-debris law became effective.

San Bernardino County

(Special Correspondence.)—The mining of tungsten ores in this county is showing activity of late, and there is a probability that the output of this state will be somewhat increased during the current year. This will be due partly to the Atolia Mining Co. Early last spring the management started leasing claims to 'float diggers.' In a few weeks there were over 40 men in the vicinity of the Atolia, working new scheelite dry placers, which later led to a discovery of a network of scheelite and quartz veins. These placer deposits yielded a good tonnage of high-grade tungsten ore, especially near the Papoose mine, but were soon worked out. Following the placer work came discoveries of quartz veins which were the source of the rich 'float,' and those who had placer leases began developing new quartz deposits. The result was that the Atolia company discharged its miners, as the mill was being kept busy night and day on ore produced by lessees. This method has been in vogue all summer. Early lessees received $4 per unit of tungsten ($WO_3$), but later operators received only $3.50 per unit, less $6 over and above 3%. One dollar per ton royalty is charged by the Company, while lessees pay for all timbering, hauling, supplies, and help employed. Lessees cannot sublet, and the Company reserves the right to pay all help of lessees, which is deducted from ore produced by them, including 30c. per shift for each individual hired, as an accident insurance fund, under the state law.

The scheelite veins of this district are found generally in fault fissures, and while rich, at times up to 60%, are not continuous, making and pinching out without any indications. These conditions are discouraging to lessees, and during October the ore production fell considerably below the capacity of the Company's mill, and an additional force of Italian workmen was put to work again on the regular tungsten producing claims of the Company's property.

Quite a number of additional tungsten claims were located adjacent to the Atolia company's holdings during the past few weeks, some of which are promising. The California tungsten belt, that in which the Atolia mines are situated, is known to extend from Table mountain, 30 miles west of Barstow, through Cuddaback lake and Atolia, over and across the Rand mountains to its west side; thence west to Jawbone cañon, a distance of over 50 miles. Specimens from the cañon show a mixture of scheelite and a darker mineral, which is probably hübnerite. Those from the Sidney group, west side of Rand mountains, are speckled cream-yellow, and generally contain gold. Near Randsburg and the 'stringer district' are several tungsten ore-producing mines, both placer and quartz, nearly all of which appear to be increasing in production; but, in general, it is conceded that the Atolia district, as in former years will lead in tungsten production for 1914, owing to rich development in the Papoose, Piute, and adjoining claims, this summer.

Randsburg, November 4.

Sierra County

Rich ore has been opened in the Dreadnaught mine near Alleghany.——Two parallel veins are being developed in the Mammoth Springs, in charge of J. A. McGuire.——Rails and an air-pipe are being placed in the lower adit of the City of Six near Downieville.——A new pump is to be installed in the Telegraph.——Water is scarce for operating the Mt. Alta gravel claim on Oregon creek.——Considerable work is planned by W. Copeland for the Bald Mountain property.

COLORADO

Ouray County

Shipments from Ouray during October were as follows: Concentrates: Camp Bird, 591; Wanakah, 138; Atlas, 330; Cumberland, 11; San Juan Metals Co. (zinc), 20; Barstow (Lundberg lease), 12; and American Nettie mine, 10; a total of 1112 tons. Crude ore: Wedge mine, 250; Arps and Krisher, 27; Bachelor-Khedive, 31; and Wewissa, 40; a total of 348 tons; also 218 tons of matte from the Wanakah smelter.

The Camp Bird company made a profit of $42,000 in September.

Park County

(Special Correspondence.)—The well known London mine is being let out to lessees on the block system, which is now in vogue in the Ibex and New Monarch properties at Leadville. The London has produced high-grade gold, silver, lead, and copper ore right through, and every indication points to a still greater production from it and adjoining claims. All the ore that has been extracted to date has been found in the vein above the tunnel level. No work has been done below, although the ore-shoot continues to go down. The property at present offers a fine opportunity for capitalists who could finance the driving of another tunnel on the vein at a greater depth. The ground has been but little prospected. The ore was found near the surface, and all that was in sight or readily found has been mined, leaving one of the richest areas of mining ground in the state to be opened. There is no doubt that in the future the mine will show many interesting things about the formations in that territory.

Leadville, November 13.

San Miguel County

The Tomboy mill treated 12,610 tons of ore in October, yielding bullion worth $32,500, and concentrate valued at $46,500. The profit was $31,500.

Summit County

It is proposed to unwater a portion of the Breckenridge district, as at Leadville, and recover the ores now covered. ——The Wellington Mines Co. is shipping seven or eight cars of zinc concentrate per week to Bartlesville, Oklahoma.—— The Tonopah Placers and French Gulch dredging companies keep their boats fully employed.

Teller County (Cripple Creek)

Owing to the fire at the El Paso mine curtailing ore production for the Golden Cycle mill, the latter company will probably grant more leases in certain parts of its property. Only one lessee is working below No. 8 level, and so far the monthly output by lessees has been restricted to 5000 tons. A large number of applications are on file for leases in the deeper levels.——Stratton's Independence Co. reports as follows for September: Production, 4590 tons of ore averaging $5.75 per ton; low-grade mine and dump ore milled, 10,830 tons; working profit in milling department, $7554; loss in mine department, $950; and net profit to Company, $6604. ——Twenty feet of $8 to $10 ore has been opened in the upper levels of the Doctor-Jack Pot property. This mine produces 2000 tons of ore per month. L. G. Carlton is manager. ——The main shaft at the El Oro is being retimbered. Robert Mullen is manager.

IDAHO

Lemhi County

At 800 ft. in the Latest Out mine, at Gilmore, 7 ft. of high-grade galena has been cut.——A wide vein has also been exposed in the Allie.

Shoshone County

A comparison of the Coeur d'Alene monzonite with other plutonic rocks of Idaho is discussed by C. A. Stewart, of the University of Idaho, in *The Journal of Geology* for October and November. Until further theories are proved, geologists must be content with the fact that the Coeur d'Alene intrusives, and those northeast and southwest of them, are distinctly different from the average type of Idaho quartz-monzonite.

Twelve inches of galena, assaying 45% lead, has been opened in a cross-cut adit 1765 ft. long in the Nabob mine on Pine creek.——Development of the Calumet claims above Burke will be continued through the winter with M. J. Murphy in charge.——A Callow flotation plant is being installed in the Hunter mill, at Mullan, under the management of Otto Trojownowsky. The mill treats 1000 tons of ore per month, but this capacity is to be doubled.——A wide vein of copper ore has been opened in the Reindeer-Queen mine, east of Mullan. E. B. Crawford is manager.

The Caledonia Mining Co. paid 2c. per share last week, equal to $52,100. Revenue during July, August, and September totaled $248,286, and net profit $154,315. Mining cost $1.34, milling 46.6c., and loading for shipment 1.15c. per ton.

In the suit of the Marsh Mining Co. *v.* the Washington Water Power Co., for alleged discrimination of rates charged by the latter, the Public Utilities Commission failed to substantiate the charge, when the load factor was considered. Up to January 1, 1914, the Marsh company paid 1.13c. per kilowatt-hour, but the Bunker Hill and Federal companies paid only 0.8c. per kilowatt-hour, which rate was demanded by the Marsh company. In its defense, the power concern stated that charges and contracts are based on load factors, and an instance was shown in the case of the Hecla company's agreement.

KANSAS

Cherokee County

(Special Correspondence.)—Arrangements are being made by the New Century Mining Co., at Galena, to start its mill at an early date. A. D. Schriner, superintendent for the Company, stated on October 23 that in all probability operations would begin on November 1. The ground has lain idle for several years until a few weeks ago, when the present Company took charge, and after the installation of pumps began draining the lease. A 10-in. lift pump and a 3-in. force pump have been in operation for some time, and since lowering the water to the 90-ft. level, 13 new companies have begun operation on the lease, all of them having opened a rich shoot of ore assaying from 10 to 20% zinc. The mill, which will be in operation soon, is of 300-ton capacity.

O. W. Sparks and others, of Galena, have made another good discovery of zinc ore on their land at Klondike. They are at present treating the 'dirt' that is hoisted from the new mine with hand jigs, but expect to build a mill in the near future. The development is situated near the Yellow Pup and Yellow Jacket mines, which are on the same land, and have been large producers in the past.

One of the best finds that has been made for some time was that of Morlan and Co., who are operating in a shaft at the rear of the Blue Point building. The new Company has been prospecting for some time and hoisting dirt that will assay 20% lead. In the early part of the third week of the month, an unusually good face of ore was cut; 'chunks' of which, on being hoisted, weighed 375 lb. The ore is being worked at the 80-ft. level.

Galena, October 24.

MISSOURI

Jasper County

Output of the Missouri-Kansas-Oklahoma district for the week ended November 8 was as follows: blende, 7,941,210 lb.; calamine, 634,070 lb.; and lead, 1,186,030 lb.; averaging $41.52, $22.60, and $41.67 per ton, respectively. For 45 weeks the total output is: blende, 422,618,483 lb.; calamine, 27,235,190 lb.; and lead, 73,016,406 lb.; worth a total of $10,109,650.

MONTANA

The geological department of the University of Montana, at Missoula, has received apparatus for testing radioactive ores, and invites miners of the state to send specimens to the department for testing. No charge will be made. To supplement this addition to the department, a new set of 40 radioactive ores has been obtained.

Fergus County

During October, the Barnes-King mine produced bullion worth about $30,000 from 3955 tons of ore, compared with $23,035 and 5593 tons in September.

Jefferson County

The Elkhorn adit of the Boston & Montana Development Co. is in about 1050 ft., two Ingersoll machines being operated two shifts. A 10-in. air-pipe has been installed in the face. At 200 and 700 ft. in the adit, 2 ft. and 3 to 4 ft. of mineralized material was cut. The adit is to be driven 3000 ft., giving a vertical depth of 1200 feet.

Lincoln County

A steam-shovel is being assembled at the Bear Creek Mining Co.'s claims near Libby. F. Chapman is in charge of the work. Placer mining in the district is encouraging.

Silverbow County

The Davis-Daly Copper Co. reports as follows for the third quarter of 1914: Owing to the metal market, cross-cutting on the various levels of the mine was suspended in August. The shaft is down 2434 ft., and another 100 ft. is to be sunk. A station is being cut at 2400 ft. Just below the 2300-ft. level a vein was cut, which is probably that opened at 1700 ft. No mining has been done during the period. Development cost $41,488, and equipment and general expenses $5973. The recent assessment has yielded $220,000 to date.

Water has interfered with sinking at the Reliance mine, in the Moose Creek district, 18 miles south of Butte. A 50-hp. boiler, pump, and hoist are to be installed. D. M. Adams is president.

As soon as troops left Butte, union agitators got busy again, and have tried to get miners at the Speculator and Leonard mines to pay dues to the new union. Guards are still maintained at the mines, with searchlights on approaches.

Some rich copper ore is being extracted from the North Butte's Edith May vein at 2800 ft. The new hoist for the Granite Mountain shaft is being assembled. A 70-ton capacity traveling crane has been erected. The head-frame over the shaft is 450 ft. from the drums of the machine, and the wire rope will run on idlers on steel towers. The engine-room is 52 by 100 ft., and is completed. This hoist was described in the *Press* of December 20, 1913.

NEVADA

Elko County

A 50-ton mill, consisting of a Blake crusher, five 1250-lb. stamps, one 5 by 18 tube-mill, continuous decantation cyanide plant, zinc-dust precipitation apparatus, Bessemer gas-engine of 125 hp., and electric generator, is being erected for the Eastern Star Mining Co. in the Gold Circle district. E. Rheinhardt, of Winnemucca, is a director; and construction is in charge of W. B. Chidester, formerly of Tonopah.

Esmeralda County

The Yellow Tiger Mining Co., Charles D. Wilkinson, manager, intends to replace the buildings and equipment destroyed by fire last week.——Gross production of the Jumbo Extension in October was $101,504, and profit $76,000. A dividend of 5c. per share will be paid on December 15.——Additional miners have been hired at the Silver Pick.——A mishap to the 6-in. centrifugal pump at 1750 ft. in the main shaft of the Merger has been repaired.

Humboldt County

An adit is to be driven by the Rochester Mines Co. to prove the orebodies at a depth of 1000 ft., also to afford a cheaper method of handling ore. The Nevada Valleys Power Co. has started to construct a transmission line from Lahontan to Hazen, Lovelock, Oreana, and Rochester, a distance of 82 miles. The pressure of the current will be 60,000 volts. The installation will cost about $220,000.

Nye County

Eight mines in the Tonopah district produced 10,584 tons of ore, worth $206,472, last week. The following returns are for October: Belmont, 14,840 tons, yielding 319,489 oz. bullion and a profit of $120,465; Jim Butler, 2953 tons for $16,798 profit; and Tonopah Mining, 13,025 tons, producing 247,645 oz. bullion, and 58 tons of concentrate worth $24,585, giving a profit of $105,340.

A rise above 1100 ft. in the Extension has opened rich ore. This shoot has been found on three levels, and is 240 ft. long, and averages 10 ft. in width.

The Montana-Tonopah mill has been closed for 90 days on account of the silver market, or until the price of the metal improves, or higher-grade ore is opened. Development will be continued. The directors of the Company have made an interesting statement, and show that while from January 1 to June 30, 1914, 25,963 tons of ore was treated worth $10.16 per ton (silver at 57.59c. per oz.), the total cost was $7.74 per ton, from a recovered value of $9.55 per ton (94%), the profit being $1.81 per ton; and from July 1 to October 31, 16,545 tons was treated worth $6.57 per ton (silver at 48.25c. per oz.), the cost of $7.74 against a recovery of $6.18 per ton made a loss of $1.56 per ton, or $6456 per month. The ore has declined in metal content, and with silver at 57.59c. per oz., it is only worth $7.93 recovered, less $7.74 cost, leaving a profit of only 19c. per ton. Cash, bullion, and concentrate, and value of final clean-up were estimated on November 13 to be worth $64,318, while expenses to the 15th were $13,500, leaving $50,818 net.

At Tonogold, McNally and Mullins lease has a shaft down 30 ft., showing 5 ft. of formation, which yields quartz panning up to $75 per ton. A parallel vein has also been opened. ——The Campbell and Kelly lease has shipped 240 sacks of ore to a small mill near Tonopah.——Many other claims are yielding good results.

White Pine County

Silver-lead ore is still being mined in the White Pine district, of which Hamilton is the centre. From the Jennie A. mine, in the mountains, ore is packed down, loaded on wagons, and hauled to Eureka. J. W. Nyce is manager. The Hamilton Power, Mining & Transportation Co. is also extracting ore from the Grand Prize claims and hauling it to Eureka.

During October, the Nevada Consolidated safety department recorded seven disabling accidents, causing a total loss of 48 days to the injured men. These accidents were mostly due to carelessness.

NEW MEXICO

Grant County

The Chino Copper Co. reports as follows for the third quarter of 1914: Like other porphyry copper mines, production at this one was reduced to 50% capacity early in August.

For the first time since starting work the smelters paid for gold in concentrate amounting to a credit of 0.1c. per pound of copper. It was expected that, owing to the curtailment of capacity, costs would increase, but two months' work shows that it has been possible to even reduce costs, all equipment being maintained at the usual high standard. The new primary crushing plant was started in August, and makes a product which can be conveniently handled on cars and at the mill. It has resulted in considerable economy. Only

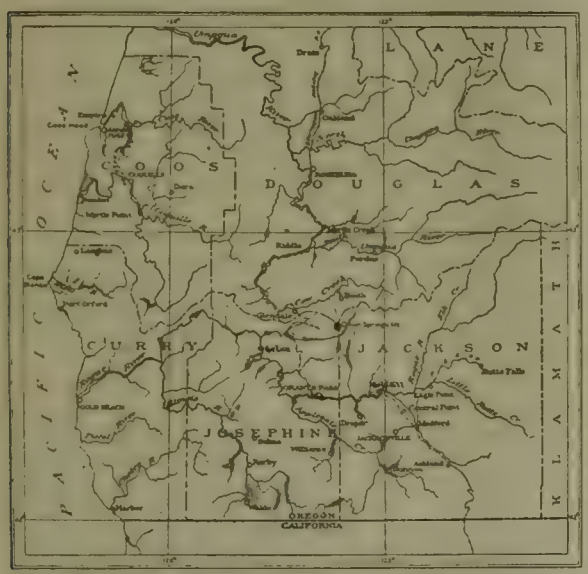
$1500 of first-mortgage bonds are now outstanding. The issued capital stock at the end of the quarter was 869,940 shares.

Details of operations.	Third quarter of 1914.	Second quarter of 1914.
Stripping removed, cubic yards..	702,223	1,119,805
Cost of removing overburden, cents per yard	32.75	30.71
Cost of mining, cents per ton....	21.78	20.42
Ore milled, tons	390,000	587,900
Average copper content, per cent.	2.165	2.165
Extraction, per cent	68.04	66.89
Copper production, pounds (including ore smelted direct)...	11,777,813	18,041,451
Cost of producing metal, cents per pound, net	7.37	7.49
Copper on hand, pounds	23,273,719	.....
Price received for metal, cents per pound	12.4344	13.9191
Total profit	$566,495	$1,102,104
Dividends paid	433,400	652,080
Surplus	133,095	450,024

OREGON

Jackson and Josephine Counties

The petrology and mineral resources of the above counties are described by A. N. Winchell in *The Mineral Resources of Oregon* for August, published at Corvallis by the Oregon Bu-



MAP OF SOUTHWEST OREGON, SHOWING MINING DISTRICTS OF JACKSON AND JOSEPHINE COUNTIES. THE DOTTED AREAS SHOW AURIFEROUS GRAVELS (AFTER U. S. GEOL. SURVEY).

reau of Mines and Geology. The work covers 265 pages, and is well illustrated. The field work on which the report is based was done during the summer of 1913. With the author were S. W. French, L. E. Reber, Jr., C. B. Watson, and Harley Hall. Many men in the various districts visited gave generous help, also the director of the state bureau mentioned, H. M. Parks. The investigations cover the location, topography, history, development, production ($16,314,633 since 1852), geology, mineral resources, ore deposits, mineral waters, coal, placer mines, gold quartz mines, copper, and future possibilities of the nine districts examined. A good index completes a useful work on the most important mining counties of the state.

UTAH

The Commercial Club of Salt Lake City is endeavoring to help the metal producers, especially of copper, of the state, and has asked the Secretary of State, William J. Bryan, to take steps to arrange for the metal to be exported to neutral countries. It is pointed out that the welfare of Utah largely depends on its mining industry, which employs 16,560 people directly, and 50,000 indirectly, and pays $17,000,000 per year in wages, $4,400,000 in railroad freight, $10,000,000 for supplies, and $600,000 in taxes. Out of 10,202,000 tons of ores, worth $44,800,000, in 1913, 9,700,000 tons contained copper. The resolution of the club was signed by the following men of Utah: C. W. Whitley, American Smelting & Refining Co.; C. H. Doolittle, Bingham-New Haven C. & G. Mining Co.; F. G. McGanney, Hercules Powder Co.; C. N. Strevell, Independent Coal & Coke Co.; George F. Waddell, Ohio Copper Mining Co.; William Wraith, International Smelting Co.; H. G. Williams, Utah Fuel Co.; F. R. Sands, Bingham Mines Co.; R. C. Gemmell, Utah Copper Co.; George W. Heintz, United States Smelting, Refining & Mining Co.; E. E. Calvin, Oregon Short Line Railroad Co.; S. V. Derrah, Denver & Rio Grande Railroad Co.; J. H. Manderfield, Salt Lake Route; P. B. Sawyer, Utah Power & Light Co.; and John Dern, of the Lower Mammoth, May Day, and Uncle Sam mining companies.

Utah mines paid a total of $275,657 in dividends during October.

Beaver County

Nearly 1000 mining locations have been made in the east part of this county during the past summer, against 240 last year. This shows considerable activity, especially in gold-bearing areas.——A new shoot of rich silver-lead ore has been cut in the Moscow mine. On the 800-ft. level is 4 to 5 ft. of ore assaying 100 oz. silver and 40% lead.

Juab County

At 700 ft. in the Lower Mammoth mine there has been opened 3 ft. of ore assaying 4% copper, 13 oz. silver, and 50c. gold per ton. This development was in the unprospected part of the property.——The Chief Consolidated company is negotiating for the purchase of the Scotia claims, west of Tintic. The mine has shipped over 16,000 tons of ore to date.——Work has been started on ore at 1400, 1600, and 1800 ft. in the Chief.——A shipment of 35 to 40% lead, 15 oz. silver, and $1.50 to $2.50 gold ore has been made from the 1200-ft. level of the Tintic Standard.

Salt Lake County

The Alta Tunnel & Transportation Co.'s adit is in nearly 1000 ft. into the divide between Big and Little Cottonwood cañons. About four or five feet is being driven daily in hard blue limestone.——Four miles south of the Utah Copper Co.'s Magma mill the Hercules Powder Co. is erecting a plant, which is 95% completed. It consists of between 150 and 200 small buildings, made necessary in the manufacture of dynamite and black powder. The quantity to be made is 1,000,000 lb. and 500 to 1000 kegs per month and per day, respectively. There will be 200 men employed when in operation.

Summit County

The new Daly West mill is in operation, treating second-class ore. F. W. Sherman is superintendent.

Ore shipments from Park City in October were as follows: Silver King Coalition, 2301; Daly-Judge, 2525; Silver King Consolidated, 254; Daly West, 154; Thompson-Quincy, 12; Little Bell lease, 21; Creek jiggers, 42; and Mines Operating Co., 70; making a total of 5379 tons.

CANADA

Alberta

Seventeen wells are being sunk in the Calgary oil belt, and nine in the Sweetgrass area of this province and the state of Montana.

YUKON

Three of the Canadian Klondyke company's boats were operating on October 23. C. A. Thomas is resident manager. Good progress is being made in raising No. 2 dredge which

OFFICE OF THE YUKON GOLD CO., DAWSON.

sunk in October. The Yukon company's hydro-electric power plant on the Twelvemile river closed down on October 23, having operated since May 9, or 167 days. This plant contains three 625-kw. generators. R. E. Franklin is electrical superintendent, and Warren Macfarland is in charge of the ditch.

COLOMBIA

During the week ended October 27, the Pato dredge handled 50,750 cu. yd. for gold worth $28,000.

NICARAGUA

(Special Correspondence.)—The manager of the Javali and Escandalo Mining Co., Ignatius O'Reardon, left for New York last week to purchase machinery for the new 150-ton cyanide plant to be installed at Javali. George Fairbairn, formerly manager of the Babilonia Gold Mines, Ltd., left recently for London. He is succeeded by J. P. Lake. The new slime plant is now in operation. Arthur Feust, superintendent of the Cedro mine, is expected to return from New York shortly.

La Libertad, Chontales, Nicaragua, October 17.

Obituary

ROBERT B. ESTEY, veteran mining man of Leadville, died on November 2, after a long illness. He was born 79 years ago at Calais, Maine, and went to Colorado in 1879.

PATRICK J. HOLLAND, well known as a practical and efficient mining foreman at Grass Valley, died on November 5. He was 45 years old and had been in the district for 21 years. His death will be regretted by his many friends.

HENRY GANNETT, who died at Washington, D. C., November 5, was one of the best known modern geographers. Born in Maine in 1846, graduating at Harvard in 1869, connected for a time with the Harvard Astronomical Observatory, he finally found his real vocation when he joined the Hayden Survey as a topographer. When that organization was merged with others to form the U. S. Geological Survey, Gannett soon became a geographer and as such had charge of many important surveys. For a time he was chief geographer, which position he gave up to take up studies connected with the census. In this work he found congenial occupation, not only in the United States but the Philippines and Cuba. His acute analysis of the figures obtained won for him high rank in geographic circles. Gannett was a powerful influence in promoting the work of making a topographic map of the whole United States and his broad scholarly knowledge of geography made him a most helpful consulting man to many government bureaus aside from the Survey. A man of clean life and fine spirit, he leaves many friends.

PERSONAL

E. B. KIRBY is in New York.

HOWLAND BANCROFT is in Boston.

COREY C. BRAYTON is back from Nome.

SEELEY W. MUDD has been in San Francisco.

H. V. WINCHELL was at Grass Valley recently.

VAN. H. MANNING was in San Francisco recently.

F. J. DENNIS is visiting CHARLES JANIN at Rancho Marcelino.

R. G. CASEY, JR., is going to the front with the Australian troops.

GEORGE H. GARREY was in San Francisco, returning from British Columbia.

FRED T. GREENE was in San Francisco, returning from Arizona to Butte last week.

G. H. BOLIN was reëlected mine inspector of Arizona at the elections on November 3.

THEO. H. M. CRAMPTON is making a detailed examination of some gold properties near Kingman, Arizona.

E. CALLENS has resigned his position as director of companies on the Rand to join the French army.

RALPH S. RAINSFORD was married on Monday, November 9, to Miss MARGUERITE LE BRETON, of Washington, D. C.

REGINALD E. HORE, editor of the *Canadian Mining Journal*, was married November 10 to Miss RUTH MORRISON of Calumet, Michigan.

W. MACDONALD, formerly of the metallurgical staff of the Waihi company, New Zealand, and the Scottish Gympie company, Queensland, arrived recently in San Francisco.

F. J. H. MERRILL was stricken with paralysis while at Mecca, California, last Saturday. While his condition is not critical, he cannot yet be taken to his home in Los Angeles.

JOHN RYAN, manager of El Rayo mine in Chihuahua, Mexico, has been captured by one of Carranza's generals and is being held for a ransom of $50,000, according to JOHN M. CALLOW.

RICHARD KLEESATTEL, president and manager of the Diamond Consolidated Mines Co., has returned to Seattle from Dixie, Idaho, after having operated the Black Diamond mine all summer.

WILLIAM R. BOLLEY has resigned as superintendent of the Baltic Mining Co., controlled by the Copper Range Consolidated. ALBERT MENDELSOHN, for the past two years mining engineer at the Champion mine, has been appointed to succeed him.

Among those attending the 'home coming' dinner of the Mining and Metallurgical Society to F. W. BRADLEY, at San Francisco last Monday were Messrs. CHRISTY, HERSAM, PROBERT, DENNIS, MUDD, BAIN, BURCH, HYDE, CALLAHAN, DERBY, BLAKE, BENJAMIN, SHOCKLEY, MORRIS, MUNRO, SHORT, MERRILL, JUESSEN, LARDNER, SMITH, and CLEVENGER.

J. C. FARRANT, the European manager for the Hardinge Conical Mill Co., enlisted in the English army as a seaman and was among those missing after Antwerp fell. It is now learned that he is a prisoner in the Doeberritz detention camp near Berlin. Mr. Farrant is a member of the Institution of Mining and Metallurgy of London and of the American Institute of Mining Engineers.

Presidential delegates to the American Mining Congress to meet at Phoenix, Arizona, December 7 to 11, are: C. H. LINDLEY and H. FOSTER BAIN, San Francisco; WALTER DOUGLAS, Bisbee, Arizona; SEELEY W. MUDD, Los Angeles; L. D. RICKETTS, New York; WILLIAM B. PHILLIPS, University of Texas, Austin; JOSEPH A. HOLMES, director of the Bureau of Mines; GEORGE OTIS SMITH, director United States Geological Survey, and HENNEN JENNINGS, Washington.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, November 19.

Antimony	15 —15¾
Electrolytic copper	12½—12¾
Pig lead	4.15— 5.10
Quicksilver (flask)	$55
Tin	34½—36
Spelter	6½— 6¾
Zinc dust, 100-kg. zinc-lined cases	10

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, November 19.—Copper is strong at 11.75c., with good domestic demands, lead strong and advancing at 3.70c., and spelter firm at 5c. per pound.

November 12 (delayed in transmission).—Copper, firmer with good domestic demands for current requirements and the future, 11.25c.; lead, strong at 3.50c.; and spelter, quiet at 4.85c. per pound.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver

Monthly averages.

	1913	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.13	Dec.	57.73	....

The following shows the course of prices in New York and London during the week: 48.25, 47.62, 47.62, 48.87, 49, and 49.75c.; and 22.31, 22.12, 22.12, 23, 22.75, and 22 87d. per ounce. By the steamer 'Korea' from San Francisco, on November 14, silver worth $480,828, say 1,000,000 oz., went to Hongkong and Shanghai. Shipments from London to the East for the year, to October 29, were £1,721,500, against £9,263,500 last year, or about 45,000,000 oz. Bullion is being stored at Cobalt, the first shipment for two weeks leaving on November 13, amounting to 95,508 ounces.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slighly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Monthly averages.

Week ending		Nov.	
Oct. 22	50.00	" 5	55.00
" 29	50.00	" 12	55.00
		" 19	55.00

Monthly averages.

	1913.	1914		1913.	1914
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug	40.50	80.00
Mar.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	53.00
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913	1914.		1913.	1914.
Jan.	50.45	37 85	July	40.70	31.60
Feb.	49.07	39 76	Aug.	41.75	50.20
Mch	46 95	38 10	Sept.	42.45	33 10
Apr.	49.00	36 10	Oct.	40.61	30.40
May	49 10	33.29	Nov.	39.77	....
June	45.10	30 72	Dec.	37.57	....

Tin is dull at 32 to 32.62½c. for 5-ton lots, and 31.75 to 32.25c. for 25-ton lots. London quotations are £127 10s. for spot, £127 for futures, and £144 per ton for Straits. The Vulcan Detinning Co., for the quarter ended September 30, reports sales totaling $203 729, and a deficit of $7533, against a loss of $30,532 for this period of 1913. The present surplus is $382,790.

COPPER

Prices of electrolytic in New York, in cents per pound.

Average week ending

Nov. 12	11.25	Nov. 19	11.75

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16 54	14.21	July	14.21	13 26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14 19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

The copper situation, especially regarding the export trade, is summarized on the next page of this issue. London quotations are from £53 15s. to £53 17s.6d. per ton.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Monthly averages.

Date.		Average week ending	
Nov. 12	3.70	Sept. 30	3.75
" 13	3.70	Oct. 14	3.75
" 14	3.70	" 21	3.50
" 15 Sunday		" 28	3.50
" 16	3.70	Nov. 4	3.50
" 17	3.70	" 11	3.50
" 18	3.70	" 18	3.70

Monthly averages.

	1913.	1914		1913.	1914
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.36	3.86	Oct.	4.37	3.60
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

London quotes are £18 5s. per ton.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Monthly averages.

Date.		Average week ending	
Nov. 12	5.00	Sept. 30	4.88
" 13	5.00	Oct. 14	4.55
" 14	5 00	" 21	4.73
" 15 Sunday		" 28	4.90
" 16	5.00	Nov. 4	4.90
" 17	5.00	" 11	4.85
" 18	5.00	" 18	5.00

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5 94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	4.75
May	5 23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

CYANIDE

The situation regarding cyanide is clearing. H. A. Metz, of the House of Representatives, has been appointed to act with the German ambassador as a committee to receive bonds of importers, against re-export of cyanide and dyestuffs received from Germany. Bond must be given for the amount of the invoice. Shipment of cyanide to Mexico will be permitted, in fact Roessler & Hasslacher are reported to have shipped 1000 tons from Rotterdam to Mexico, but no dyestuffs may be re-exported, and no cyanide except to Mexico. For the present, at least, Germany has not consented to shipments to Central or South America. The Roessler & Hasslacher Chemical Co. is building an addition to the Perth Amboy plant and expects, after January 1, to be able to supply everybody. In the meantime further small shipments from Germany are to be anticipated. Charles Butters, who has been keenly interested, has received by cable an offer from Rotterdam of cyanide to be shipped in American bottoms, at a price which figures to 16c. per pound for 100%. This is higher than the contract made by the Nevada Mine Owners' Association for 1915, which called for 120% at 15⅜c. per pound, only 1c. above the 1914 price. Small second-hand lots are still available, and thanks to the good sense of all concerned, no real distress has yet resulted in the United States, though in Mexico mills that might otherwise have resumed are idle. In Japan few of the gold mines have been able to continue operations and there is a real cyanide famine. The steamer 'Sun,' with 1000 tons of sodium cyanide for Roessler & Hasslacher was expected in New York November 20.

The Copper Situation

Interest continues keen in the probable outcome of the situation created by the attempts of Great Britain to prevent copper reaching Germany and Austria, in which it has taken the high-handed method of stopping shipments, to any other country, which are not definitely proved to be retained in that country. The copper on the *Kroonland*, which carried 3,158,400 lb., the *San Guglielmo*, with 1,568,000 lb., and the *Regina d'Italia*, with 705,600 lb., was removed at Gibraltar, and the vessels allowed to proceed to the Italian ports to which they were bound. The *Ascot*, carrying 3,759,160 lb. copper, has been ordered before the British prize court. The principal copper-selling agencies who first made a protest to the State Department have engaged John Bassett Moore, formerly solicitor for that department, to present their case, and the matter was taken up this week. The Chambers of Commerce at Butte and Anaconda have sent a memorial to President Wilson in the following words: "Such narrowing of foreign markets, with the recent restricted demand in this country, will render impossible the continuance of our copper production even at the present curtailed rate, will close our mines and smelters, the main industries of Silverbow, Deer Lodge, and other counties of Montana, and so restrict the labor demand as to entail most serious disaster to these communities."

The British ambassador, Sir Cecil Spring-Rice, has been in conference with the State Department, and it is announced that copper consigned to Italy for home use will not be subject to seizure, but copper which has been consigned to a belligerent country or to order will be subject. The Italian government has prohibited the export of copper from Italy, but not the transit of copper through Italy to a foreign country. However, it is not likely that copper producers would care to chance the transportation through Italy of copper consigned to a German consumer. Copper producers must give assurance that metal shipped to Italy is for home consumption, and not for reëxport to Germany or Austria. It is said that arrangements have already been made for the transfer of copper to Switzerland through Italy. Switzerland is expected to become a large consumer of copper during the war period. Norway, Denmark, and Sweden have given satisfactory assurances to Great Britain, and it has been announced that consignments to named consignees in those countries will be passed by the British patrols without question.

The steamship lines have now taken fright and refuse to accept consignments of copper to Italy and Holland, and the government war risk bureau also refuses to insure shipments. Exports of copper to Europe in the past 10 months have been as follows, in pounds:

To	1914.	1913.
England	155,962,240	104,944,000
France	112,712,320	122,449,600
Germany	198,132,480	275,963,520
Holland	131,969,600	144,506,880
Belgium	6,442,240	4,941,440
Austria	30,932,160	31,050,880
Italy	43,480,640	35,562,240
Miscellaneous	21,911,280	2,755,200
Total	701,542,960	722,173,760

Shipments during 29 days of October were as follows:

To	Pounds.
England	20,932,800
Italy	16,387,840
Holland	4,099,200
France	4,005,120
Miscellaneous	7,022,400
Total	52,447,360

BOOK REVIEWS

Igneous Rocks and Their Origin. By Reginald Aldworth Daly. 563 pages. Ill., index. McGraw-Hill Book Co., New York. 1914. For sale by the *Mining and Scientific Press*. Price $4.

In this volume Mr. Daly has brought together, in revised and extended form, the substance of the series of brilliant papers on igneous rocks that he has published in the last dozen years or more. In doing so he has added to the already deep obligations of his fellow-workers to him, and has at the same time made the material available to the general public. What the igneous rocks are, their relative abundance and the significance of their distribution, the forms in which they occur, and the processes through which they have come into their present position, all these are subjects of fascinating interest to both layman and scientist. There is no one who has attacked these problems more vigorously than the present Sturgis Hooper Professor of Geology at Harvard. His conception of overhead stoping as a means of ingress of igneous masses to the crust of the earth has proved extremely fruitful and is only one of the valuable concepts for which geologists stand in his debt. The layman will be glad to find in this book that after all these years of extreme specialization in petrography, the old names and the old rock groups maintain a place, and Mr. Daly's demonstration of the overemphasis that has been placed on minor phases of rock differentiation clears the way to focusing attention on the really big problems of rock genesis, and it is the big problems that have the widest interest.

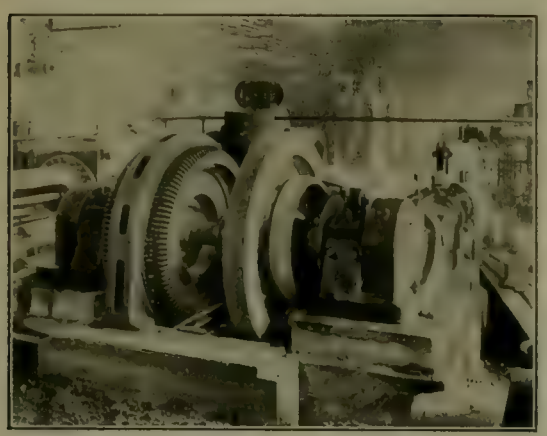
Practical Stamp-Milling and Amalgamation. By H. W. MacFarren. With a chapter on 'Arrangement and Construction Costs of Stamp-Mills' by Charles T. Hutchinson. P. 231. Ill., index. Published and for sale by the *Mining and Scientific Press*, 1914. Price $2.

This is the third edition of the work of 166 pages which first appeared in July 1910 and was well received. The volume under review is an entire revision and enlargement, and includes 77 carefully selected cuts and drawings. The first edition was not illustrated at all, so the value of the present book is considerably enhanced thereby. While there has been much said and written against the gravity stamp as an efficient crushing apparatus, and many machines tried to take its place, it may generally be said that it has held its own. This is mainly due to its simplicity, reliability, and wide range of adaptability. In Part I of this book is discussed in a practical manner the location and design of a stamp-mill, foundations, construction, details of the mortars, stamps, the latest stem guides, feeders, water supply, feeding ore, power absorbed, individual stamps, etc. This is entertaining reading for the millman. Amalgamation plays an important part in the treatment of free-milling ores, and the art is not learned in a day. Parts II and III cover the use of quicksilver in a mill, what affects amalgamation, how to remedy poor recovery, treatment of copper plates, and retorting amalgam and melting the resulting bullion. Also sizing and mill tests, sampling in the mill, all-sliming processes, mill crews, management, and disposal of tailing. Many men working small mines cannot afford to engage an engineer to advise on the cost and erection of a stamp-mill, and in Mr. Hutchinson's chapter on arrangement and construction costs of a plant, small operators will find a great deal to help them decide what is necessary. This discussion deals with several types of mills suitable, details of each part, advantages or disadvantages of jaw and gyratory crushers, lumber needed for buildings, foundations, and unforeseen costs.

New Machines and Devices

Compressor for the Vindicator Company

The big compressor being installed at the Vindicator property at Cripple Creek is of the type shown in the accompanying halftone. The machine was manufactured by the Sullivan Machinery Co., Chicago, and not by the Ingersoll-Rand company as noted in our news department in the issue of October 31. The machine here illustrated is a Sullivan class 'WN-2' direct-connected motor-driven unit of the cross-compound pattern. Its dimensions are as follows: low-pressure cylinder, 26 by 18 in.; high-pressure cylinder, 14½ by 18 in. The machine is operated at 120 r.p.m., and at that speed has a piston displacement of 1984 cu. ft. The compressor is driven by a General Electric 650-hp. motor mounted directly on the shaft of the compressor. This machine will operate at 10,000 ft. altitude. The motor is of the synchronous type and is



DIRECT-CONNECTED MOTOR-DRIVEN COMPRESSOR.

twice as large as the compressor requires. This extra large motor was purchased under a special contract with the power company for the purpose of correcting the power factor on its lines due to a large induction load. It is equipped with a fly-wheel to secure a smooth, even motion at all loads, thus keeping peak points in the load down. The frames are of the heavy duty pattern, the machine weighing about 45,000 lb. without the motor. The frames are provided with housings or hoods, and the cranks, eccentrics, cross-heads, etc., are thus protected from dust and grit. An automatic splash oiling system is provided. The intercooler is a vertical one, placed between the two cylinders and provided with a number of copper tubes through which the cooling water circulates. The intercooling space is unusually liberal. The valve motion on both high and low pressure cylinders consists of semi-rotary or Corliss inlet valves, one at each end of the cylinder. These are operated by eccentrics on the crank-shaft. The discharge valves are of a special automatic poppet type, and, like the inlet valves, are in the cylinder head. Some of these valves are set horizontally, but most of them are set radially around the edge of the head, so as to reduce the length of the pockets or ports leading to them and thus reduce the clearance in the cylinder.

The means for proportioning the load on the compressor to the demand for air consists in an automatic double-beat total-closure unloading valve, placed on the air inlet duct to the low-pressure cylinder. The high-pressure cylinder is provided with a relief valve, by means of which air remaining in the intercooler after the inlet unloader goes into effect is pumped out of the high-pressure cylinder. This it is claimed keeps the no-load power consumption down to a very low point.

Commercial Paragraphs

Western Electric Co., New York City. En Boletin S. I. se muestran y describen las mejoras que poseen los actuales conmutadores de magneto de demiana capacidad y los cuadros distribuidores y de protectores.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pennsylvania, has recently issued a pamphlet entitled 'Central Power Stations in Coal Mines.' The catalogue is fully illustrated and contains considerable data on the power requirements of coal mines.

Percy Pitman, 25 Victoria St., Westminster S. W., London, England, has for distribution pamphlets descriptive of the fluid pressure governors for controlling the speed of water turbines, Pelton wheels, etc. The Company also manufactures a wide variety of Pelton wheels for different requirements.

Burd High Compression Ring Co., Rockford, Illinois, is distributing literature regarding the products of this Company. The high compression piston rings are made of a special mixture of the best gray iron and are adapted to air-compressors, gas, or gasoline engines, steam engines, pumps, and other machinery.

McCord Manufacturing Co., Detroit. An attractive booklet entitled 'Catalog No. 12,' is devoted to the McCord force feed lubricators for steam and gas engines, air and ammonia compressors, Diesel engines, and other machinery. The catalogue is fully illustrated and contains details as to construction and operation.

The Holt Manufacturing Co., Stockton, California, in Bulletin T. E. 61, discusses the use of the caterpillar tractor in road grading and heavy hauling operations. The machine is proving itself a valuable means for hauling wagon-trains on all kinds of roads, and is particularly adapted to work in soft and sandy soil where other machines would mire.

Siebe, Gorman & Co., Ltd., Westminster Bridge Road, London, England, has recently published a catalogue devoted to smoke helmets and first-aid equipment. The catalogue shows a large variety of apparatus and appliances particularly adapted to work in the mines. H. N. Elmer, Monadnock Bdg., Chicago, Illinois, is the American representative for this Company.

The Denver Engineering Works Co., Denver, Colorado, has for distribution Bulletins No. 1065 and 1066. Both of the bulletins are devoted to electric hoists—Bulletin 1065 to hoists with capacities of from 675 to 1600 lb. rope pull, and Bulletin 1066 to electric hoists with capacities from 2500 to 5000 lb. rope pulls. The smaller hoists are especially adapted for use in stopes or winzes, and they can be readily mounted on a flat mine car to serve as a portable hoist. The large hoists are made for both single and double drums. General specifications are given in the catalogue.

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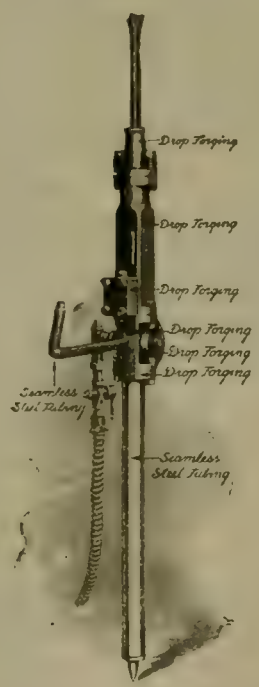

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By Jackson A. Pearce 833

The problem of treating the ores of Clear Creek and Gilpin counties in Colorado is an old one. Gilpin county was the birthplace of a special stamp practice and of an early concentrating table as well as of a pioneer smelting practice. In general, amalgamation has been followed by concentration. Many attempts to cyanide have not seemed to lead to much improvement. The Argo, or 'Newhouse,' tunnel opens a number of mines in such a way as to centralize ore supply and permit operating a large custom mill. Here cyanidation has found a place. Fine grinding is necessary on account of the presence, but recently realized, of a siliceous cement in much of the ore. The success followed earlier partial failure, as discussed frankly by Mr. Pearce, who is superintendent of the mill.

THE VINDICATOR MILL.

By Horace F. Lunt 837

The gold at Cripple Creek occurs, not in the rock, but in seams and on 'facings.' It is customary to sort the ore, the fine material being of value and the coarse rejected. Many attempts have been made to improve practice by saving that part of the gold that goes with the coarse rock. Mr. Lunt, a Colorado mining engineer thoroughly familiar with Cripple Creek problems, tells how the Vindicator company is doing this by moderate crushing, washing, and close screening.

MINE TAXATION AND THE CONFERENCE OF TAX OFFICIALS.

By H. A. E. Chandler 838

Mr. Chandler, an expert on taxation and a member of the faculty of the University of Arizona, attended the annual conference of tax officials held at Denver this fall, and was disappointed at the small attendance of mining men. He calls attention to a serious situation. See also editorial pages.

APPLICATION OF JIGS TO GOLD DREDGING.

By J. W. Neil 839

Mr. Neil has worked for several years on one of the neglected problems in gold dredging, the saving of the black sand and its accompanying gold. He has achieved deserved success and gives here full details, supplemented by working drawings courteously furnished by the Union Construction Co. Mr. Neil's article follows and supplements that by Mr. Charles Janin on 'Recovery of Gold in Dredging,' printed November 7.

MACHINE DRILLING EFFICIENCY.

By Thomas M. Bains, Jr. 843

How much ground can two men drill with no starters, one 4-ft., and two 6-ft. pieces of steel? Such a problem, absurd as it sounds, is a practical one when drill steel is carelessly distributed. Mr. Bains, who is a member of the faculty of Case School of Applied Science, writes of one of the less considered problems of mining economics and makes extremely pertinent suggestions.

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EDITORIAL

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Horace V. Winchell

PERU exported copper to the value of over $8,000,000 in 1913. In August the copper smelters cut their output to about half normal capacity.

ANACONDA strategists are evidently following the lead of European war experts. With barbed-wire defenses capable of being charged with electricity, and a battery of searchlights as protection against possible Zeppelins of the Butte Mine Workers' Union, there seems little probability of the works being taken either by surprise or storm.

IQUIQUE correspondence in *The West Coast Leader* states that the nitrate production of Tarapaca was but 35 per cent of normal and for October not more than 40 per cent. As a result, 35,000 people had left the province and 3000 or 4000 were being supported by public and private charity. This is a radical change from normal conditions when, as Mr. Bancroft Gore showed in our issue of September 5, the labor supply is chronically inadequate.

CURTAILMENT of output has been the order recently in zinc mining as well as copper mining. It is difficult to get at exact figures, but the *Joplin News Herald* states that the local reduction amounts to 5000 tons per month, and estimates the total for the United States at 14,000 to 19,000 tons. While some ore is being imported and more offered, Siberian mines being the latest to make inquiries, it seems certain that prices of metal will be affected by the first of the year. The war is changing the zinc situation markedly.

MANUFACTURERS desiring to extend their trade in Argentina and Cuba are invited to send catalogues, preferably in Spanish, to the representatives of the National City Bank at Buenos Aires and Habana. They should be addressed 'For attention of Commercial Representative, Buenos Aires Branch the National City Bank of New York, 321 Calle Rivadavia, Buenos Aires, Argentina,' and 'Claude V. Allnott, Commercial Agent, Banco de la Habana, Habana, Cuba.' The bank also offers to furnish, through its foreign trade department, credit, information, and other proper facilities. Thus definite progress is being made in opening the way to sale of 'Made in the United States' goods in the countries to the south.

DIFFICULTIES over shipment of copper to neutral countries, discussed elsewhere, are in the way of adjustment. Mr. Thomas T. Read, New York editor of the *Mining and Scientific Press*, was in conference this week with the acting secretary of state, Mr. Robert Lansing, and officials of the department, with reference to the situation. An important announcement will shortly be made at Washington.

FLOTATION tests at Anaconda are proving so successful that it is extremely probable that the process will be adopted in place of leaching for treatment of current tailing. In that event the leaching plant now nearly completed will be used to treat accumulated material, while the Anaconda multiple-deck slime tables, followed by flotation, will be used on current material. Tailing of as low as 0.08 per cent copper content has been made with this arrangement.

DIFFERENCES between dredge recovery and the value of placer ground as indicated by drilling are puzzling and not easy to explain, if it be assumed that both prospecting and dredging be done with equal skill and care. There are instances on record of dredge recovery overrunning not only the average drill showing for the tract, a fact of no particular significance, but also the value indicated for the particular area dredged between clean-ups. On the other hand, the normal rule is that dredge recovery falls below the prospected value of the ground and in particular areas, as at Oroville, an average ratio, here 80 per cent, has been deduced from experience. Why this is true is probably to be explained oftenest by the relative fineness or coarseness of the gold. In close drilling, a sample rarely represents more than one part in 13,000. If the gold be fine it will evidently be more evenly distributed than if it be coarse, and accordingly there will be a larger chance of the gold getting into the sample. If we imagine all the gold contained in one acre of placer ground to be in one piece, the chance of finding it with a drill will be seen to be small, but the chance of missing it with a dredge almost equally small. It is a common experience to find larger particles of gold in the riffles than any in the drill sludge, and we believe this difference in probability of finding the mass is the explanation. It is therefore important in valuing placer ground to take into account the relative fineness of the gold.

LARGE claims have been made for the Reinohl process exploited by the American Rapid Cyaniding Company, and in connection with a test made at Ophir, Colorado, a few weeks since, the name of Mr. Walter L. Reid was used. Mr. Reid writes us that his observations on the test, which was conducted by a competent metallurgist of his acquaintance, convinced him that nothing was accomplished that could not be done at lower cost by several well known machines. He was in fact so unfavorably impressed that he declined to permit a test at the Smuggler Union mill.

GERMAN dealers, it has been said, are writing foreign correspondents that, in lieu of sending cash in settlement of bills due outside the Empire, the equivalent amount has been invested to the credit of the foreign firm in the German war loan at 5 per cent. We have been at some pains to secure an exact translation of such a letter received by one of our friends, and find that the statement is correct. In view of the numerous complications incident to international trade during war times, it is hardly appropriate to rest any preachment on the fact, but Americans and others should be fully informed so as to take proper precautions in selling abroad for the present.

COAL DUST firing is a method of burning fuel that permits of great economies and marked increase in thermal efficiency where it is applicable. Long ago it became the dominant method of applying heat to making portland cement clinker. More slowly it is finding a field in other industries, and just at present is rapidly making headway in copper smelting. Several years ago attempts were made to fire reverberatories at Cananea with coal dust, but with poor results. The main difficulty was that the ash blanketed the charge, and this failure has deterred metallurgists elsewhere from further experimental work. For the past two years or more, Mr. D. H. Browne and his associates have, using the cleaner Eastern coals, achieved excellent results at Sudbury, and for the past year Mr. E. P. Mathewson and his staff at Anaconda have been applying the method with most satisfactory results. Contrary to fears entertained, the ash not only does not blanket the charge, but it is not even necessary to skim. Neither does the dust accumulate in the flues of the waste-heat boilers, it being all caught easily and simply in the chamber at the boiler head. The furnaces work with delightful smoothness and regularity, so much so that a large furnace to handle 700 tons per day is being built, and it is evident that the reverberatory is to make a still further inroad on the field of the shaft furnace. The better results, as compared with those achieved by the pioneers of ten years ago, are not due solely to the use of cleaner coal. A most important factor has been improvement in the art of coal dust firing; mainly in the finer grinding of the coal and its careful drying before being blown into the furnace. Further applications of the process are to be anticipated.

COPPER EXPORTS

Every copper metallurgist, as well as most other people, is aware that of the 1,615,000,000 pounds of copper produced in this country last year, 926,000,000 pounds, or nearly 60 per cent, was exported, chiefly to the countries of Europe. The amounts taken by the various countries in 10 months of 1913 and 1914 was as follows in pounds:

To	1914.	1913.
England	155,962,240	104,944,000
France	112,712,320	122,449,600
Germany	198,132,480	275,963,520
Holland	131,969,600	144,506,880
Belgium	6,442,240	4,941,440
Austria	30,932,160	31,050,880
Italy	43,480,640	35,562,240
Miscellaneous	21,911,280	2,755,200
Total	701,542,960	722,173,760

It is thus seen that Germany was our largest customer, in spite of the fact that it has a domestic output of about 45,000,000 pounds. Germany is a great manufacturing country, and from refined copper makes a large variety of products which not only supply her own domestic needs, but are the basis of a large trade with other countries. The outbreak of the war in August violently disrupted the economic mechanism which had been created out of this international traffic in copper. For a while shipments were completely cut off, as banking and shipping were brought to a standstill. Gradually the currents of trade began to flow again, but shipments to Germany and Austria were permanently stopped, making a tremendous decrease in foreign buying. Domestic buying was much depressed through the uncertainty of the business outlook, and the result was a tremendous increase in stocks of the metal, which for a time threatened to cause a collapse of the copper market. Prompt and united action was taken by the principal producers and sellers of copper, and production was decreased to one-half of normal. Sales to the smaller European countries not at war soon began to increase. This is explained by some on the ground that these countries, which in normal times find it more profitable to buy their manufactures of copper from Germany, were utilizing the opportunity to develop their own manufacturing industry, a view in which there seems a certain amount of reasonableness.

To this, however, the government of Great Britain did not subscribe, taking the view that the increase over the normal takings of copper of these countries was surreptitiously finding its way to Germany. As a result, up to date, some fifteen steamships carrying copper consigned to the smaller European companies have been stopped by British cruisers. In some cases their cargoes of copper have been diverted to England and there paid for at the rate prevailing in England, but considerably less than the rate in the country to which originally consigned. In other cases the copper has been seized and held to await the action of a prize court to determine

whether it is contraband of war destined to supply the enemy. The ground on which these seizures were made was that the copper was not consigned to a well known firm in the country of destination, but was consigned to order at the foreign port, and hence its real destination was indeterminate. The reply of the copper sellers to this is that it is their usual custom to consign copper to their agents abroad, and that when the metal arrives at the foreign port the documents are passed through the banks and the transaction completed. In reply to an inquiry as to what shipping arrangements would be satisfactory, the shippers here were informed that the metal must be consigned to a known firm in the country of destination and a guarantee must be given that the copper would not be resold to Germany. To the first of these conditions the sellers at once acceded, but raised the point that they had no control over foreign firms and could not guarantee what disposal they would make of copper sold to them. The aid of the Department of State was sought, and it at once took vigorous action. As a result, assurances were received from the governments of Italy, Denmark, Norway, Sweden, and Holland that shipments of copper bought in America would not be permitted to pass their borders into Germany and Austria. The government of Great Britain has stated that it considers these assurances satisfactory. Nevertheless cargoes of copper consigned to these countries are still being detained and shipments have been brought to a standstill, since none of the marine insurance companies are willing to insure the copper, nor will any except the few American steamers available receive it as freight. Practically, therefore, nothing has been accomplished to permit shipments, though theoretically the conditions have been met. Fresh representations are being made to the State Department, which is now doing all it can to meet the needs of the copper industry.

NEEDED: CONSTRUCTIVE CO-OPERATION OF MINING MEN

On another page, Mr. H. A. E. Chandler, professor of economics in the University of Arizona, and a gentleman deeply interested in problems of taxation, calls attention to a serious situation. If there exists a sufficient reason why the mining interests of this country should not yield several more millions of dollars for purposes of taxation than they are now contributing to the various state governments, that reason should be clearly set forth by the mining men of America. One thing is sure: there is a general feeling in many states that the mining industry is paying far below its fair share of the expenses of government; and another thing that is almost as sure is that many tax officials are determined to increase the amount of taxes paid by the mining industry as rapidly as means can be found.

In this regard, the mining men may take any one of three positions. They may assume an attitude of indifference, and let come what may. This would be the height of folly, for with the constantly increasing cost of government resulting in constantly increasing pressure upon tax officials for more revenue, the officials are going to do what any other human beings would do under the same pressing conditions—they are going to get the revenue where it is easiest to get it—and the easiest place to get it is in the camp of the indifferent. Secondly, they may assume an attitude of defiance against all increases whenever and wherever they may be suggested, irrespective of the reasonableness of such increases. From a purely selfish point of view, this policy has undoubtedly been successful in some states in the past, because of the preponderance of the influence of the mining interests in legislative matters. Today, however, there are few states, if any, where the mining interests can effectively control public opinion or legislation. With the rising agricultural, commercial, and financial interests all alert to the increasing burdens of taxation, the success of this second policy cannot be expected by any mining man who is sensible to the tendencies of the times.

The mining men of America should learn a profound lesson from the history of railroad transportation in the United States. Few men who are carefully informed upon railroad matters believe that the railroads of the country are getting a square deal from the public at the present time. However, whatever reaction has set in against the railroads is to be traced to the mistaken attitude which the railroads took for many years in regard to public interests. And wherever the almost relentless antagonism of the public against the railroads has been mitigated, this has been the result of a strong effort on the part of many railroads to do whatever the public welfare demanded. Constructive proposals from the railroad men, backed by a willingness to co-operate upon any fair basis, have been responsible for modifying the unkindly attitude of the public toward the railroads; and most of the great transportation systems have come to see that this is the only basis upon which they can expect a 'square deal.'

This suggests the third course that the mining men have open to them in the present matter of the taxation of mines, and it is the only method that can be expected to result satisfactorily to the mining companies.

Men familiar with the work and personnel of the tax assessors of America believe that they would welcome constructive suggestions from the mining men. Of all the problems that confront the tax officials in many states, the question of the equitable taxation of mines is the most perplexing. In vain have the tax officials asked for such suggestions. Many mining men have given some thought to this question, but most of them have looked at it from a narrow point of view; and while their suggestions were mostly of a negative or critical character, the positive suggestions that were made displayed evidence of but a narrow study of the question. Exceptions to this statement must be made; these, however, are rare. The great difficulty from the mining operators' point of view has been that most well informed mining men have been too busy attend-

ing to business to give the matter the attention that it deserved. Out of this difficulty has grown much confusion.

Mining men seem to be almost hopelessly divided upon the subject of taxation. Definite inquiries concerning the fairness of specific methods of taxation bring in most conflicting replies. Not only do the various mining men in the same state differ widely in their opinions as to the same law, but surprisingly different opinions are held by different officers of the same mining company. As the result of an inquiry as to the fairness of a present law addressed to one of the great mining corporations of America, the reply was received from one of the officers of the company that the law was fair and equitable, while another officer of the same company expressed the opinion that "a more unfair law could not possibly have been devised by the brain of man."

While conflicting replies, such as the above, are of considerable interest to the investigator, obviously they do not aid materially in working out a constructive and fair program for mine taxation. If the mining men are to exercise any considerable influence upon the tax legislation of the near future, it is necessary that they should get together and concertedly offer a constructive program to the tax authorities. In this regard, three points stand out with unmistakable clearness:

1. The old time method of obtaining fairness or favor in the matter of taxation by sending a few clever attorneys to the legislature during the session is obsolete. The legislation of the present time is more and more the result of careful study by experts, and especially is this true in present tax legislation. It may be possible for the mining interests temporarily to defeat a revenue bill, but nothing but a constructive program worked out upon sound principles with due regard to other kinds of property will receive permanent sanction from the legislatures.

2. Some well meaning tax officials fail to grasp the important differences which characterize the mining industry as compared with other industries, and these differences should be clearly set forth by mining representatives whose general fairness of mind and spirit of co-operation insure the confidence of the tax officials.

3. If the mining men of the country assume any attitude other than that of constructive co-operation, they will have great difficulty in stemming the tide of opinion that mines should be taxed for a much larger amount than they now bear.

The good effect of co-operative work based upon even incomplete studies of the matter has already been shown by the experiences of the mining men in Nevada and Arizona. In each case strong and representative committees, taking the subject up with the proper officials in a public way, were able to affect materially programs of taxation. In both cases, however, the work was of the emergency order, and the truth seems to be that few mining men have any real knowledge of taxation. The American Mining Congress is about to meet at Phoenix, Arizona. It will be attended by representative men from many states, and particularly by several that took important part in the taxation conferences in Arizona last year. It could not do a more useful thing than to discuss, as fully as the program will permit, the subject of mine taxation and to follow the discussion by the appointment of the strongest possible committee charged with the duty of studying the matter and conferring with the tax officials of the various states, especially at their meeting at San Francisco in September 1915. The needful thing is first to clear up our own ideas as to taxation and then present a united, tactful front to tax officials.

BUCKING VERSUS BACKING NATURE

One of the greatest mistakes which can be made in planning any enterprise is consciously or unconsciously to oppose the forces of nature, for these forces are never-ceasing in their action, and must be met with an equally relentless and correspondingly expensive opposition. If a building is so situated that the surface water drains into its basement, a pump must be kept working to lift it out again. If a building is so situated that the snow drifts about it, much labor must be expended each winter in keeping paths to it open. If the building is so placed that it encounters the full force of the winter winds and does not get the benefit of the sun, many extra tons of coal must be burned each year in order to maintain the interior at working temperature. There are many less obvious cases. Heated gases tend to rise, and if in the flues or other passages of a furnace system they are made to travel downward it is only done at an expenditure of energy which is not visibly reflected in the cost sheet, but is there, nevertheless. A body in motion or at rest tends to continue in that state; to start a body at rest or to stop a body in motion requires a considerable expenditure of energy. If the material in transit through a milling plant is continually being accelerated and retarded, the power plant is furnishing the energy thus consumed. Just because the bookkeeping department does not isolate it as a separate cost does not alter the fact that it appears somewhere in the total. A laborer expends only an average amount of energy in a day's work; if he works in a cold place part of it is expended in keeping himself warm. If he works in a hot place, an equal or greater amount is expended in keeping himself cool; if he has to work in the dark, energy is expended in trying to see; if he has to work in a dangerous place, nervous energy is expended in trying to guard against the dangers. Doors that open the opposite way from that naturally expected, bolts and nuts that screw to the left instead of the right, steps up or down in unexpected places are all "little foxes that steal the grapes" of efficiency. The man who designs his plant so that the forces of nature work with him, has the cheapest and best colaborers; but the man who designs his plant in opposition to natural forces, must pay the cost every operating day.

ARGO TUNNEL AND MILL, IDAHO SPRINGS, COLORADO.

Cyanidation of Clear Creek and Gilpin County Sulphides

By JACKSON A. PEARCE

Clear Creek and Gilpin counties, about 30 miles from Denver on the eastern slope of the Rocky Mountains, embrace a heavily mineralized region which has been continuously mined for the unusual period of 55 years. The first few years of this period were devoted to placer mining, from which an enormous amount of gold was produced. Following this, attention was devoted to the lodes, whose enriched and oxidized surface orebodies yielded great quantities of gold, and whose sulphide zones yielded gold, silver, and lead. The total production has been large. But the placer gold has long since found its way to the mints, the bonanza lode deposits have been looted and milled or smelted, and little is left today except the low-grade ore deposits, too low to stand transportation and smelting charges, too complex to yield satisfactorily to the standard milling practice of the district. For many years operators and metallurgists have busied themselves with these ores, and one may find here a vast number and a wonderful variety of mills. The mills are strewn along the river banks and up the mountain sides in such profusion as to suggest the visitation of epidemics of mill construction. Great as is the number, they represent only in part the money and effort put forth to treat the complex sulphides of this district. Some have been successful in having recovered enough to pay dividends, but, so I am told, fully one-third of the value of the ore found its way to the rivers.

Since the early days of the old Gilpin County bumping table, concentration has been the standard treatment. Frequently the mills are equipped with some auxiliary process, such as amalgamation, magnetic separation, chlorination, or cyanidation. Notwithstanding the world-wide popularity of cyanidation, it is only recently that the process has made headway on these ores. Although it was tried frequently, cyanidation was not successful. The Hudson cyanide plant, rebuilt in 1912 and in operation for several months, was closed down an apparent failure. The Argo mill, constructed in 1912-13 and equipped with modern machinery, was closed down after an unsuccessful run of seven months. Under new management, however, the Argo has been in successful operation since the first of January 1914. Upon the supposition that the success attending the cyanidation of complex sulphide ores in this remodeled custom mill may be of some interest, a brief description of the plant is here given.

Ore Supply

Almost without exception the orebodies are mineralized feldspathic zones, irregular in shape, extent, and in mineralization. Quartz veins are of rare occurrence. Frequently the interstices of these granular feldspathic dikes are so impregnated with loosely adhering, coarsely crystallized pyrite, or other sulphides, that a mere fracturing of the ore disengages a large part of the sulphide. These ores, as exemplified by those from the Gunnell mine, yield a fair amount of their precious metals to concentration, and this explains the strong hold that concentration has on the district. At other places, as for instance in the Gem mine, silicious cementation has attended the mineralization, and a highly silicified though not a quartz orebody has resulted to which concentration is not so readily adapted. The economic minerals are galena, chalcopyrite, chalcocite, sphalerite, argentite and other silver minerals, and gold. Sylvanite seems widely distributed, though not in abundance. Pyrite and marcasite are everywhere abundant.

The ore supply for the Argo mill comes largely from the Argo (Newhouse) tunnel and its many laterals. The Argo 'tunnel' is a great cross-cut adit more than four miles in length, cutting at a depth of 2000 ft. many of those veins which in the early days of surface exploitation were famous producers. Much of the ore now taken from the adit is unsuitable for direct shipment to the smelting works, and must stand a preliminary local treatment. While the ore supply from the outlying properties is well worth considering, it is neither so large nor so steady as that from the adit.

Sampling

The ore is received at the weighing station in trains of three-ton cars, weighed nine cars at a time, and delivered to a storage bin to await a time for sampling. There are 22 of these individual storage bins with a combined capacity of 1400 tons. They are fitted with an overhead track on which is operated a self-contained traveling revolving tipple, capable of discharging three cars of ore at a time. Beneath the discharge chutes on the lower side of the bins a plate conveyor, running the full length of the bins, serves to convey the ore from the bins to the sampler.

The sampling plant is an institution by itself, having no place in the flow-sheet of the mill, except that in it the coarse crushing is done. It serves only to prepare the samples on which settlements are made for the ores. All ore is purchased outright and is paid for as soon as assays are available. Sampling in this manner adds greatly to the costs of mill operation, but seems to be a necessary evil.

Mill Equipment

The mill proper is equipped with twenty 1000-lb. stamps dropping 114 per minute through 6 in.; one 4 by 10-ft. tube-mill, 33 r.p.m.; Dorr classifiers and dewaterers of various sizes and types; five Dorr thickeners, of 20 and 22 ft. diam.; one Dorr agitator, 20 by 12 ft.; one 8-ft. Portland filter, 6-minute cycle; 10 Card concentrating tables; one 14 by 8-in. Blaisdell air-compressor; zinc-boxes, pumps, and all the usual mill accessories. The mill is motor-driven throughout, back-geared motors being used for the battery drive. A modern steel building encloses the ore-bins, sampler, and mill, with concrete floors throughout.

Mill Flow

Owing to the dual nature of the ore, as noted above, it has been found expedient to adopt a somewhat divided flow-sheet. The mill was originally designed to take advantage of the ease with which the sulphide is separated from the feldspathic gangue. The ore was to undergo moderately coarse crushing, say through 12-mesh, to liberate a high percentage of the mineral content, some of which would be slimed; a concentration of the coarse to remove the liberated minerals; discharge of the barren sand to waste; and cyanidation of the slime. It was found, however, by an expensive mill test that this scheme was not applicable to those ores in which silica was deposited, contemporaneously it seems, with the other minerals. This tough, fine grained silicious cement, chalcedonic in appearance, contains minerals finely disseminated throughout its mass. Coarse crushing does not liberate the minerals, which are consequently carried into the sand discharge.

To prevent this loss the battery bin has been partitioned, and a double flow-sheet adopted. One compartment is reserved for those ores from which a fairly clean separation can be made by coarse crushing; the other for those for which fine grinding is essential to good extraction. For the latter, owing to limited tube-mill capacity, 20-mesh screens are used, while 16-mesh screens are used for the former. At present 10 stamps are provided with 16-mesh, and 10 with 20-mesh. With this screen equipment the capacity of the mill is slightly over 100 tons per day.

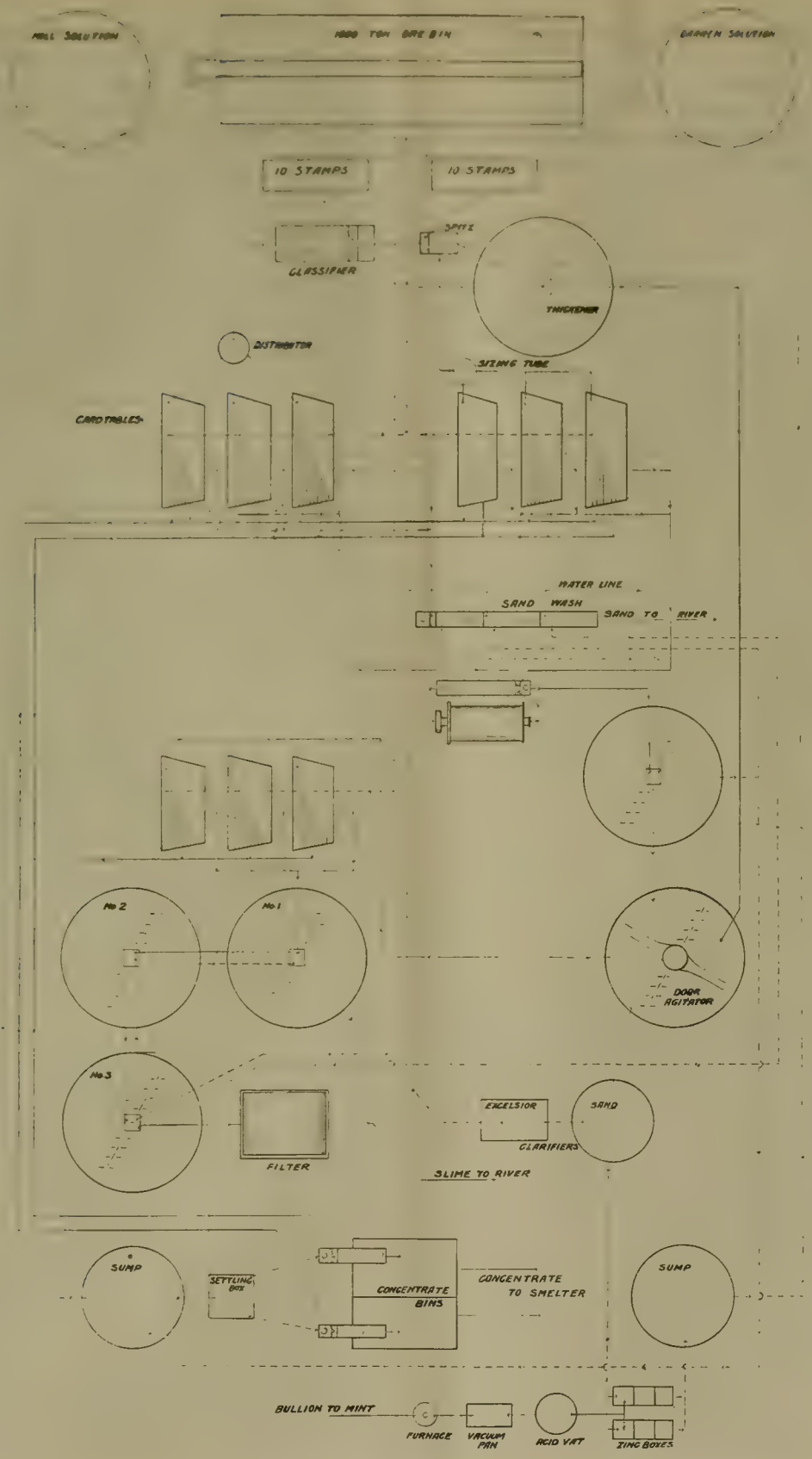
The present practice is to crush in solution. The product from the 16-mesh screens is classified in a Dorr duplex classifier. The sand is concentrated on Card tables yielding the four products, lead concentrate, iron concentrate, middling, and sand.

The Primary Concentrate

A clean iron concentrate is produced on the primary tables, throwing as much pyrite middling to the tube-mill as it will handle. In its course through the tube-mill and agitator a considerable amount of gold is dissolved for which the mill receives $20.67 per ounce from the mint, as against $19 from the smelting company. The difference in price more than covers the difference in treatment cost. For this reason it is advantageous to get as much gold as possible by cyanidation. On some ores it would pay well to cyanide direct, or to cyanide the concentrate, if the mill equipment permitted. It may be said here, in a general way, that the ores of this district are refractory or complex only in the light of local methods of treatment. Some ores on which laboratory experiments have shown good extractions would be refractory if not actually disastrous to a mill of this or any other local type. These remarks apply more particularly to the gold ores. The silver is not so readily cyanided as that in ores of Tonopah and elsewhere.

The lead and iron from the primary tables go by individual pipe-lines to Dorr dewatering classifiers, being dewatered to 12% moisture, thence to their respective bins near the loading station. The middling goes to a tube-mill in closed circuit with a Dorr classifier. The sand from the primary tables goes to a Dorr three-stage sand classifier for wash.

This efficient, continuous, sand washing contrivance is a series of three classifiers delivering the sand from one to another and finally to waste. In the first stage the sand is dewatered and advanced to the second stage. Here it is washed with barren solution and advanced to the third stage. In this stage it is washed with water and discharged to waste. The sand carries sufficient gold to warrant regrinding, but for the limited tube-mill capacity. The only tube-mill is kept to capacity



FLOW-SHEET, ARGO MILL.

with sand, thus keeping at a minimum the amount of sand discharged.

The slime overflow from the duplex classifier at the batteries joins the product from the 20-mesh screens in a spitzkasten. The underflow is classified and concentrated, yielding lead concentrate, iron concentrate, and a coarse product going to the tube-mill.

Heating the Solutions

The spitzkasten overflow goes through a thickener to the Dorr agitator. The overflow from the tube-mill classifier is also thickened and sent to the Dorr agitator. The success of the mill is largely due to the condition of the agitator charge. Made up, as it is, of the many different ores coming into the mill, it is impossible to manipulate it to the best advantage for each individual ore. A temperature of 90°F. might profitably better the extraction on some ores, especially on silver ores, but with this temperature on other ores, the cyanide consumption is excessive. At this temperature the rate of settling is increased on some ores, but diminished on others. Tests on some ores have shown that a temperature of 90 to 100 F. disengages a gelatinous substance extremely difficult to settle. With some ores, cupriferous ores especially, the cyanide consumption is excessive, if the strength of solution exceeds 1.7 lb. cyanide per ton. A stronger solution would probably increase the silver extraction, but not sufficiently to compensate for the cyanide loss. It has been found the best practice to keep the agitator at 60 to 64°F., with the solution at 1.7 lb. cyanide per ton. Lime is kept at 0.8 lb. per ton, this strength having been found the most effective for settling, and more ample for cyanide protection. The consistence of the charge is kept at 2 to 1.

To maintain the solution at the desired temperature, steam coils and live steam are both used. Heating the solution in the summer time is a matter of ease, but in winter it is the same problem as at other mills in zero weather. To conserve the heat due to surface radiation at the thickeners, a thick layer of foam is allowed to encrust the whole of the surface. An uninterrupted overflow of clear solution is maintained by encircling the foam with No. 16 sheet iron spaced ½ in. from the periphery of the vat and extending a few inches below the foam. To ascertain the condition of the thickener, a drop light is lowered through a small casing in the foam.

From the Dorr agitator the slime is concentrated on slime tables to remove as far as possible those sulphides escaping from the primary tables together with those liberated in the tube-mill circuit. This concentrate is sent to the iron bin. A liberal amount of silica (30 to 40%) is cut in with the iron, the intention being to make a division at that point where the assay value of the mineral-bearing silica equals the marketing costs on the concentrate. A penalty on silica of 10c. per unit on all over 15% is avoided by properly mixing this concentrate with that low in silica from the primary tables.

After concentration, the slime goes to the first of a series of three Dorr thickeners to be washed by the counter-current system. In this system the solution advances from 3 to 2 to 1 by gravity, while the pulp is advanced from 1 to 2 to 3 by means of diaphragm pumps. Diaphragm pumps are excellent for forwarding pulp. On some ores the pump will deliver pulp at 33% moisture. Freshly made diaphragms last about 10 weeks, but those from stock puncture within 10 or 12 days. The wash for the third thickener is a mixture of barren solution and the wash water from the third stage of the sand wash.

From the third thickener the pulp at about 1½ to 1 is sent to the Portland filter, where the cyanide solution with a small amount of dissolved gold is displaced in the cake by sprays of water. The cake is then discharged to waste.

Filtration Introduced

The mill was designed to operate without a filter. This system of treatment probably was decided upon without an adequate knowledge of the character of the ores to be treated. Many of the ores for which the mill was designed have low settling rates, rendering continuous decantation without filtration impracticable. At times ores are received of such low rates of settling that with half the normal thickener feed the overflow is muddy while the underflow is carrying 50% moisture.

Solution for precipitation is taken from the overflow of the first thickener after agitation, or from either thickener before agitation. It is clarified by upward percolation through a vat of excelsior, followed by a sand filter, and precipitated on zinc shavings. Two boxes, each of three compartments, handle the 200 tons of solution precipitated daily. Each compartment is 30 in. on a side and charged with zinc at the rate of 10 lb. per cubic foot. Little difficulty is experienced in precipitation, provided the solution is properly clarified.

The boxes are cleaned up twice a month, the product acid treated, dried, and melted in a Donaldson tilting furnace. Copper in the precipitate, unless especially treated, gives an undesirable matte and a poor grade of bullion.

Besides the sampling plant the mill maintains an exceptionally well appointed assay office. With a two-muffle low-pressure fuel-oil furnace, one assayer completes from 50 to 75 assays per day. The most interesting feature of the office is the monolithic, reinforced concrete, balance stand designed by O. F. Heizer, the manager. It was designed to overcome vibrations due to passing trains, and although trains pass within a few yards of the office, no vibratory effect is produced.

It will be noticed that no effort is being made to save zinc or copper. Although both are of value, this mill is not equipped to save them. The zinc is buried in the iron to escape penalty, while the copper is lost in the slime and in the iron.

A small amount of lead is recovered, which is valued no more for the amount received for the lead itself than for the reduction in working costs it insures at the refinery. The maximum price paid for gold by the smelt-

ing company is $20 per ounce, and this is on condition that the concentrate contains 5 oz. or more of gold per ton. Unless it is a lead concentrate (5% lead or more), the working costs are excessive. Cutting enough iron into the lead to bring the gold content down to 5 oz., the lead still remains above 5%. In this manner, although a small loss is suffered in the price of lead, due to the lower lead content, a substantial gain is made in getting a maximum price for a maximum quantity of gold with a minimum treatment charge.

The ores treated at the mill are valued principally for the gold and silver. Of the combined content of these two metals, slightly over 90% is saved. A 90% extraction may not seem a high standard of mill practice, but it should be remembered that this is a custom mill, and that metallurgically and financially there is a considerable difference between a custom mill and a mine mill. Generally speaking, a mill operating for the benefit of a mine is assured a constant supply of ore. Whether the supply is great or small, it is dependable, and plans are laid accordingly. With a custom mill, especially with one in competition with other mills as well as smelters, the supply is not so dependable. When the supply is not sufficient to keep the mill running to capacity the overhead, labor, and power costs per ton rise quickly. If the mill be closed down pending the accumulation of ore, the mill crew scatters, the shippers, unable to get timely settlements, dispose of their ores elsewhere, and trade is lost.

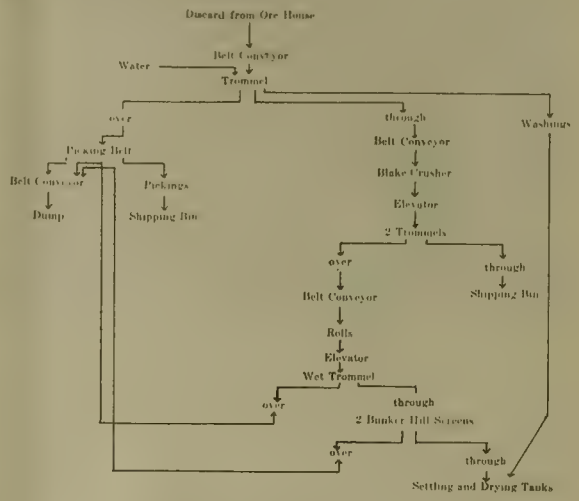
The mill at the mine, as a rule has ore of a definite character to treat, even though it may be a difficult one. The mill may be constructed or altered to the best advantage for that ore. It then becomes a pleasant and encouraging occupation to better the extraction, or to reduce the working costs, even to a slight extent, knowing the results will be continuous. With a custom mill, especially with one within a district in which ores of so many different characters are found, the treatment is much more difficult.

There is also a difference in the margin of profit. According to the schedule of treatment charges of the Argo mill, an ore assaying $15 per ton calls for a $5.50 treatment charge. This $5.50 corresponds to the mill head in a mine mill. It covers the cost of operation, maintenance, depreciation, and insurance, as well as mill loss and profit, as would be true of a $5.50 ore at a mine mill. However, viewing both in the light of percentage extraction, this difference may be noted. A 90% extraction on a $15 ore ($5.50 mill head for a custom mill) is a loss of $1.50 in the tailing. This loss on the $5.50 mill head of the mine mill represents an extraction of only 73%. Or, a 90% extraction on each ore means a loss of $1.50 on the one, but only 55 cents on the other—the appreciable difference of 95 cents per ton. Of course, the mine mill is also expected to pay for the mine and the mining of the ore. This is largely balanced in the custom mill by the extra cost of sampling, resampling, of controls and umpires, and other added expenses of purchasing ores.

The Vindicator Mill

By HORACE F. LUNT

The common method of handling ore in the Cripple Creek district is to dump it from the mine cars over screens of from 1½-in. to 1¼-in. mesh, and to hand-sort all that passes over the screens. The screenings are usually a shipping product. In some parts of the district the gold is found mainly in the coarse rock; in others, in the fine. The latter is the case at the Vindicator. In order to save that part of the gold which is ordinarily lost in the rock discarded by the ore sorters, the Vindicator company, which is one of the largest producers of the district, after considerable preliminary experimenting, is just completing a plant for the treatment of this material. The mill is a washing and sorting plant, rather than a concentrator in the ordinary sense of that term. Plants of a similar kind have already been built at neighboring mines, but none of them are so complete as this.



FLOW-SHEET, VINDICATOR MILL.

In the Vindicator ore house all the ore from the mine is broken by hand to pass screens having 6-in. square holes, and goes thence over the regular screens, the oversize going to the sorting tables and the screenings to shipping bins, as in nearly all Cripple Creek ore houses. The rock discarded by the ore sorters, instead of going directly to the dump as is the common practice, is thrown on a belt-conveyor and carried to the new mill which adjoins the ore house. This belt-conveyor discharges into a trommel having 2-in. round holes, where the rock is washed by sprays and all the fine dust removed from it. The oversize goes to a picking belt, from which the first shipping product is obtained. The picking belt discharges upon a belt-conveyor, which in turn discharges on the dump. The undersize from the trommel is carried by belt-conveyor to a Blake crusher, the product of which is elevated to two trommels, from which the undersize goes to shipping bins and the oversize to rolls for further crushing. The product of the

rolls is elevated to a wet trommel, from which the undersize goes to two Bunker Hill screens and the oversize to the belt-conveyor to the dump. The undersize from these screens, together with the washings from the first trommel, goes to settling and drying tanks from which another shipping product is obtained; the oversize goes to the dump.

The building is of structural steel, covered with galvanized iron over asbestos board. It is unusually roomy and well lighted. The machinery is driven by individual electric motors. The shipping bins discharge directly into railroad cars. The plant has a nominal capacity of 300 tons per day, but it is not expected that it will be run at full capacity for some time.

Mine Taxation and the Conference of Tax Officials

By H. A. E. CHANDLER

The taxation of mines in the United States was chosen as one of the principal topics to be given important place in the annual conference of tax officials that was held in the Brown Palace hotel, Denver, Colorado, in September. In view of recent increased interest in mine taxation, as well as the convenient situation of the meeting place, it had been expected that the mining men especially of the West would attend in considerable numbers. The one surprising thing about the conference, however, was the almost total absence of mining men or their representatives. Here in the very centre of the mining territory were assembled those who levy upon the mining industry millions in taxes every year, and who, from repeated expressions, give the impression that they intend to impose still higher taxes upon the mines as soon as means to that end can be found. The best opportunity that the mining men have ever had to meet the tax experts and the tax commissioners of the United States, and to present the case for the mining industry, was offered at Denver. Yet this opportunity, the like of which seldom occurs under such favorable circumstances, was apparently totally ignored.

The mining industry is the one great industry that needed representation most, and yet it was almost the only one which was not represented. The other important industries of the country, including the transportation systems, the telephone and telegraph systems, the express companies, Wall Street and the money interests, and public service corporations, were all represented. These have learned that the surest way to obtain a square deal in the matter of taxation is to meet, upon the cordial basis offered by the tax conference, those tax experts and public officials who exercise such a large influence in forming and administering present tax systems.

A great gulf, seemingly unbridgable, in the matter of taxation exists between the mining men and the tax men. The mining men of Arizona, Colorado, California, West Virginia, and other great states in the East and West feel strongly that they are overtaxed. The tax commissioners of many states, on the other hand, believe that the mining industry had never paid and is not now paying its just proportion of taxes. At the present time this statement may not apply to Michigan, Minnesota, and Wisconsin, but it does apply to many other states.

Without conferences between the officials and the mining men, how can this ever-widening gulf be bridged? If the mining men were in the majority in the several states, or even in a large minority, they might hope to control the policy of the states in regard to the taxation of mineral land. The ever-increasing influence of the agrarian party, plus the increasing influence of conservative representatives of the transportation, industrial, and other financial interests, prevent the shifting of the growing tax burdens from the mining men.

In the United States there exists today one body of men that is coming to exercise an almost preponderating influence in shaping the fiscal policies of many of the progressive states, and that is the National Tax Association. The influence of this organization has grown so rapidly that it now includes most of the principal tax authorities and tax experts as well as many of the tax commissioners and members of the boards of equalization. Among its members are many of those who have been largely responsible for the creation of tax commissions as well as for much of the tax legislation that has been enacted in the past ten years. At the annual conferences the mining interests ought to be represented by some of their ablest talent. And so long as the mining operators continue to fail in doing this they must not be surprised when their taxes go skyward.

Publicists and financial experts foresee no hope of any substantial reduction in taxes. In fact, all reliable indications seem to point to a continued increase in the cost of government, both federal and state. To meet this growing demand for more revenue, tax officials are now racking their brains. It is only reasonable that the state officials should look to the mining interests for part of this increase; and to the end that this increase should not be disproportionate, the mining interests should be prepared to argue their case when it again comes before the great tax court of North America—the annual meeting of the National Tax Association.

The next annual conference will probably be held in San Francisco, September 1915. At this conference the committee on the taxation of mines will give in its report, the results of three years' investigation. The conclusions of this report will undoubtedly have considerable weight with the delegates to that conference, and also exercise influence upon subsequent tax legislation pertaining to mines.

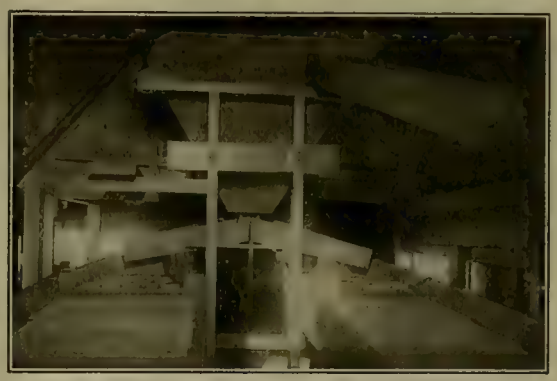
Application of Jigs to Gold Dredging

By J. W. NEIL

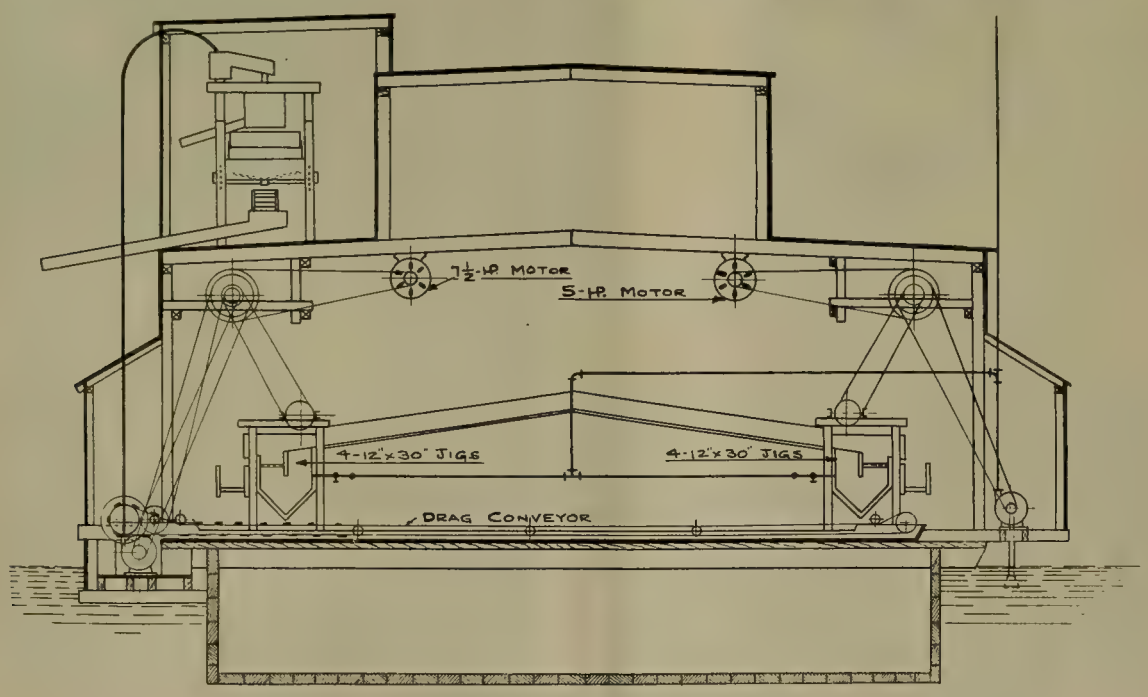
During the summer of 1912, the Yosemite Dredging & Mining Co., operating a 3½-cu. ft. close-connected bucket dredge on the Merced river, made a series of tests to determine what gold, if any, was being lost. These tests were made by securing samples from the fine material passing over the tables and also by driving pipes through the 'fines' to bedrock at close intervals across the pond. These various samples were sent to the laboratory of the General Engineering Co. at Salt Lake City, and the tests were made there on machines of working size. These tests revealed the presence of from eight to ten pounds of black sand per yard of gravel dug, and that this black sand was a 'detainer' and not a 'container' of the gold. These tests further checked closely the difference between the values shown by the drill and the actual recovery, and showed the fine tailing to carry about three-quarters as much per cubic yard as the recovery showed per yard dug; that is, say the drill value is 12½c. and the saving 10c. (or approximately 80%), leaving 2½c. loss per yard dug. This, contained in the 'fine,' which is only one-third of the gravel, would make this run 7½c., and such values were usually found. The gold is for the most part free and recoverable by concentration and amalgamation.

In view of the apparent losses as shown by these tests, it was decided to attempt further recovery, and to this end a small jig equipment was planned, and, in the fall of 1912, placed on the dredge. This dredge was equipped with a shaking-screen, distributers of old type, eight tables with riffles on each side, discharging into one side sluice inside the boat. The total riffle area, including the side sluice, was 980 sq. ft. The distribution was always poor, too much of the fine material being delivered on the first two tables on each side. The records of many clean-ups showed that 90 to 92% of the gold was taken from the upper four tables on each side. Otherwise, conditions were excellent for gold saving, the gravel being a clean river wash, containing no clay and such top soil as existed being a light sandy loam which did not foul the water.

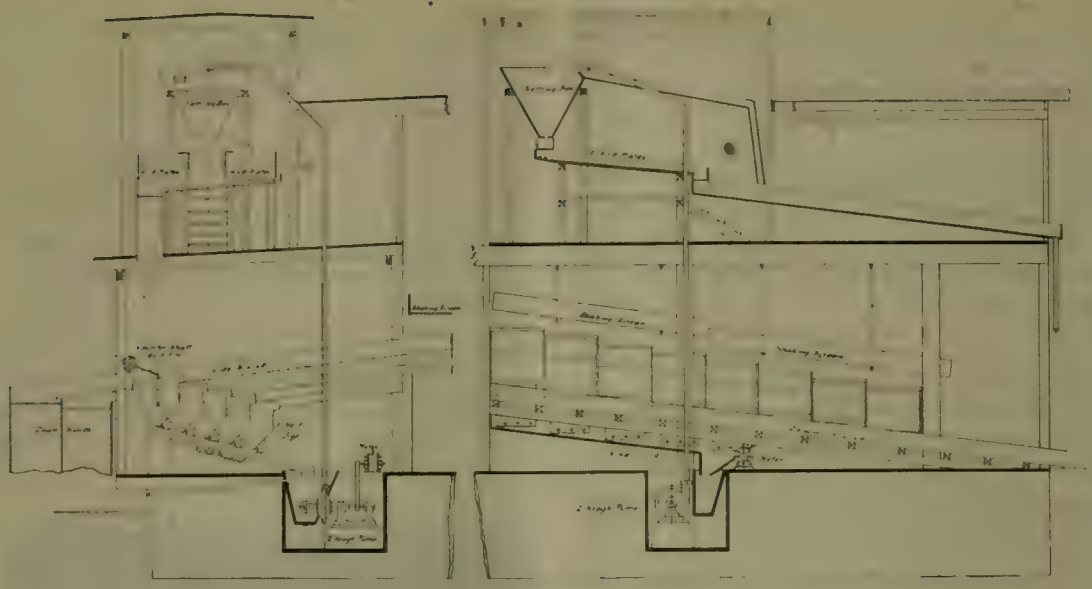
The first jig placed on the dredge was only 4 in. wide



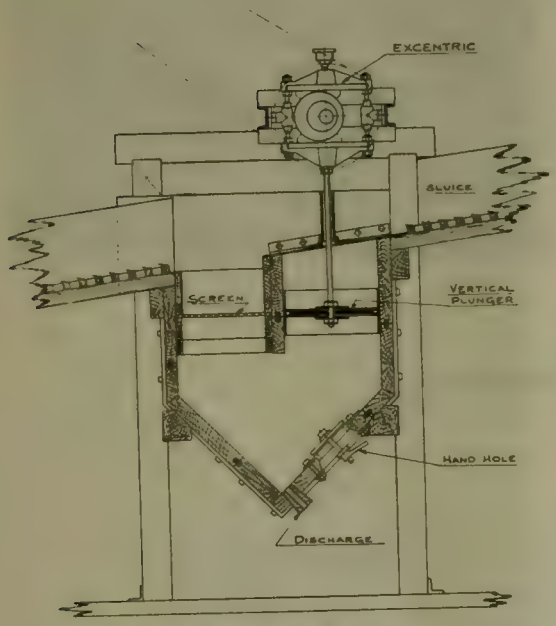
SETTLING BOX AND PLATES.



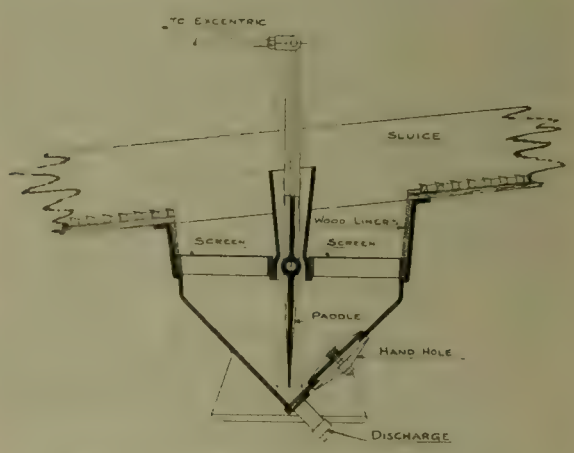
GENERAL ARRANGEMENT OF PLUNGER JIGS.



HALF SECTIONAL END ELEVATION SECTIONAL SIDE ELEVATION



THE WOODBURY TYPE PLUNGER JIG.



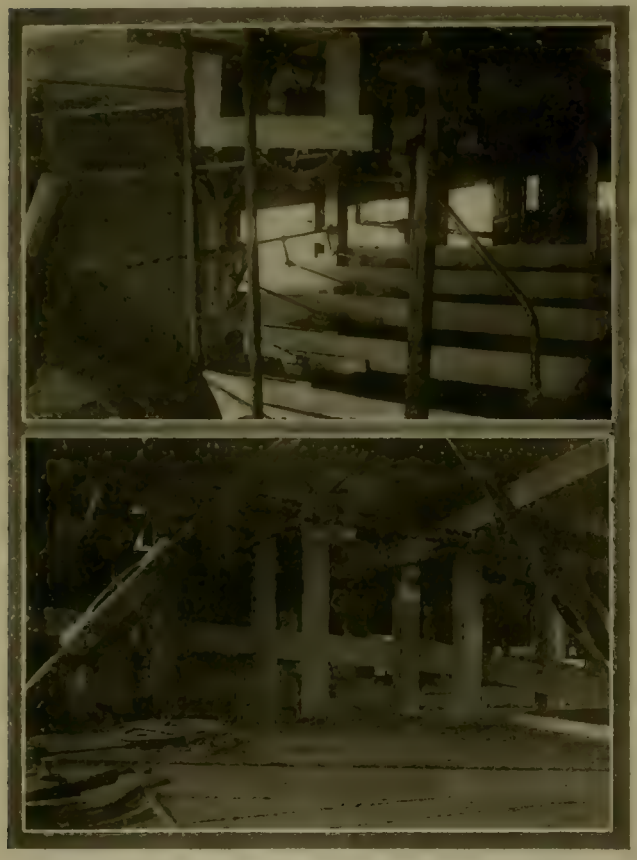
NEIL JIG (PATENTS ALLOWED AND APPLIED FOR).

by 30 in. long, and the pulsations were first obtained by water pressure by means of a rotating cock on the Richards' system. The jig was placed in the side sluice just below the discharge of the fourth table; thus it had to handle all the fine material from four tables, representing the losses from 90% of the output of the dredge. This first jig did not have pulsations strong enough to keep the bed free. When sufficient water was admitted to keep it free, there was so much of it that the object was not attained, as the upward flow was so strong that it carried away all of the light gold and the concentrate made did not show any value. The jig was therefore altered, placing an ordinary plunger in the water compartment and running by eccentrics about 180 r.p.m. With this jig, concentrate was made at will, either quite clean black sand or half and half, according to stroke, under-water supply, etc. With this jig about two tons of concentrate was made on which to make further tests. Average samples of these concentrates were sent to the Salt Lake firm and exhaustive tests were made to prove the metallurgy of the concentrates, and of tailing from the jig and from the pond. These tests demonstrated satisfactorily that by using ordinary amalgamated copper plates with a Pierce amalgamator following, over 95% of the gold could be saved.

The average value of the concentrate shipped was $15.58 per ton in gold, but to our surprise it contained no platinum. Eight pounds of concentrate per yard on 3000 yd. at $15.58 per ton looked like an asset, and although all of the black sand was not expected to run

as well as this small amount saved, still it looked like a good venture, and eight large jigs were ordered. These were of the Woodbury type with plunger compartment in line with the flow of the material, ahead of the screen compartment, so that the materials in the sluice passed over the covered plunger compartment. Each screen was 12 by 28 in., the plunger the same, and the stroke made variable by adjusting the eccentrics, which were of the Evans type, giving a true vertical motion.

These eight jigs were placed at the ends of the first four tables on either side, the tailing being dis-



NEIL JIG, VIEWS ABOVE AND BELOW.

charged into the side sluices as before. The concentrate made was discharged through plugs in the hutch. This was caught in the launders leading to a cross-conveying launder, which discharged into the suction of a 2-in. centrifugal pump. This pump elevated the material to the upper deck into a pointed settling box, from which the concentrate was drawn off and run over 24 sq. ft. of amalgamated plates. The concentrate, after passing over the plates, was run through a small Pierce amalgamator and the discharge from this emptied into the pond. An outline of the arrangement is shown in the illustration on page 840.

Bedding the Jigs

No granulated cast iron for the bedding of the jigs being available, they were finally started with a bed of steel punchings mixed with lead shot. This made a lot of trouble, and consequently the adjustments were necessarily very slow, as stoppage of a jig was not allowed to interfere with the running of the dredge, and only at oiling time, or when it was necessary to stop the dredge for other purposes, could any adjustments be made to the jigs. Thus it took a long time to get the apparatus in good working order. Troubles arose mostly from screens breaking or from loose bolts on the plunger rods, etc. I think it would be safe to say that the entire eight jigs did not run, as a unit, over 50% of the time.

For three months, experiments were made with burlap, canvas, etc., instead of amalgamated copper plates, but it was found that these materials did not work well at all, and the net saving of these three months was only about $12.50 total. During the year of experimental work the entire saving amounted to $1764.12, which was estimated to have been derived from approximately one-half the yardage, or 448,000 yd., representing a saving of 0.38c. per yard of gravel jigged. The upkeep costs during the year totaled $376. Numerous tests made during this period showed that the jigs were delivering about 12,000 to 15,000 lb. of sand over the plates. This concentrate was about 25% black sand. Therefore, it was plain that only about 25% of the black sand, as shown in the preliminary tests, was being saved by the jigs, and further tests on the tailing behind the boat showed no appreciable diminution in value.

It was decided to build a new dredge on another piece of ground, and, desiring to give the jigs more screen area on this new boat, but at the same time to avoid the nuisance of overhead pulleys and shafting, search was made for some more suitable type of jig. Not finding one suitable for the requirements, I worked out a design to suit our special conditions. This new jig, instead of having a plunger operating in a separate compartment, has both compartments alike fitted with screens, and the pulsations are produced by the oscillations of a paddle which hangs from a shaft placed between the two screens and is rocked back and forth by means of a lever which projects through the partition between the screens, and is there attached to and operated by an eccentric on a conveniently located shaft. A line sketch of this scheme in its simplest form is shown in the cut on page 840, also a cut of the old style Woodbury type jig for comparison. The pulsations of this type of jig are positive, and may be adjusted by change of stroke. The screen area is practically doubled, and the jig fits into the usual dredge sluice, as shown in the cuts of the arrangement on the Yosemite No. 2 dredge. The jig frame or box is made of a single iron casting, as are the paddles. The screens are now made of Monel metal, specially woven for this use. This material gives excellent satisfaction, neither rusting nor amalgamating, and does not blind at all.

The new dredge has been equipped with ten of these jigs, set at the lower ends of the first five tables on each side and operated by eccentrics running on shafts

at the side of the boat. These are driven by special motors on the upper floor. There is one centrifugal pump for each side, and also separate settling-boxes and double sets of amalgamated plates, 96 sq. ft. in all. When these jigs are in operation, tests have shown from 25,000 to 30,000 lb. of sand per day passing over the plates, and a sample of this sand taken during the several shifts at regular intervals of 15 minutes showed a content of 22.8% of black sand, 63% of which is magnetic. A sample taken during this same period from the tailing material passing off from the two uppermost jigs, showed only 0.23% black sand, thus showing a ratio of concentration of 100 to 1. Even this comparison is not quite fair to the jigs, as the sample of jig tailing was taken from the two jigs which carry the most sand, while the tailing from the plates came from all ten jigs. The tailing from the lower three jigs does not show any black sand at all.

It is too early to speak of recoveries in this new plant. They will not be as large as the old one, as the gold in this ground is coarser, and consequently does not travel. There is also a much improved system of distribution, so that the upper sluices receive their proportion of sand and water. It must be understood that unusually good conditions obtain here on the Merced river; that is, no clay, a clean wash, the water is relatively clear, and the gold is clean and easily amalgamated. In other localities, where the gold is fine, rusty, or greasy, or where the distribution is not good, such a jigging plant will undoubtedly greatly improve the saving, and is certainly a splendid insurance against losses. Naturally, in cases where the black sand contains the gold, or in tin dredging where all of the value is in the concentrate, this system would afford relief from the need of constant clean-ups and should also greatly improve the recovery.

Application to Tin Dredging

In the case of tin dredging, it would undoubtedly be wise to place several jigs in sequence, so that the failure of any one jig or screen would not cause loss of metal; in other words, a tin dredge of this type would be a floating concentrator, fed by digging buckets, screening its product more perfectly, and possibly to two or several sizes as required, jigging the screened sands and delivering the jig products to Wilfley tables or other tables for final clean-up; or the usual sluice could be installed with riffles, say through the first 40 or 50 ft., and then the jigs set to save the fine product; the riffles or other methods being used to catch the heavier concentrate and the jigs being relied upon to make the final recovery of fine mineral. Either one of these methods would undoubtedly greatly improve the recovery on tin dredges and with a great reduction in the amount of manual labor required.

On gold dredges, where greasy or rusty gold is present in considerable amount, it would be necessary to follow the jigs with table work, so as to get a concentrate of sufficiently high value to make its treatment easy. In this way we produced a concentrate, using the Wilfley table, assaying 44 oz. of gold per ton and representing a concentration ratio of 899 into 1. I specifically mention the Wilfley type, as with this table it is possible to divide the product, making a concentrate, middling, and tailing, and in this way to make cleaner tailing. In our tests on sands from the Merced river, the pure black sand carrying 69.4% iron assayed only 12 to 16c. per ton, and I have had similar results from black sands from other sources, so that I am of the belief, as already stated, that in most cases the black sand will be found to be only a 'detainer' of the gold, but in that rôle may be used as a collector of the precious metal, as copper or lead is used in smelting operations.

As to the cost of the operation of these jigs, they should require no special attendant, the regular dredge crew taking care of the oiling, etc., and the dredgemaster giving whatever other attention is required. As previously stated, we have never stopped the dredge on account of the jigs, any repairing that was necessary was so done when the dredge was shut down for other purposes.

Power Requirements

The actual power required for each jig is less than ½ hp., and the total motors used in operating the 10 jigs we now have in use is 16 hp. This includes underwater supply and sand pumps for elevating the concentrate. On a dredge where the tables are sufficiently high above the deck, this sand pump would not be necessary, as the material could be passed directly over the plates and into the pond. The jigs themselves are of sturdy construction, and the first cost is not great. They may readily be set in a space cut in the table on any running dredge and the products taken care of as conditions demand. Our experience is such as to lead us to believe that recovery on most dredges now operating can be improved by this method.

The Homestake mine, Lead, South Dakota, in four years and seven months, from June 1, 1909, to December 31, 1913, produced 6,663,585 tons of ore yielding $26,138,962, an average of $3.912 per ton. Dividends paid during this time amounted to $6,514,242. During four months of the period the property was idle on account of labor troubles, both production and dividends being suspended.

The South American Copper Syndicate realized $305,000 from ore produced during the year ended June 30, 1914. The net profit was $49,000. A dividend of 75%, equal to $43,000, was paid last December. Smelting operations were handicapped by numerous difficulties. Work was suspended on account of the war.

Gold output of the Raub mine, Federated Malay States, was $19,000 from 7881 tons of ore during the four weeks ended September 12.

Metal production of Broken Hill in July was valued at £440,360, and in September, £150,806, a large decrease due to the war.

Machine Drilling Efficiency

By THOMAS M. BAINS, Jr.

During recent years there has been an increase in drilling speed and improved efficiency, which has principally been due to the improvements in machine drills, better ventilation, and improved facilities for removing broken rock from the face. There is one other factor, to which little attention has been paid by mine operators, and on which speed and efficiency of rock drilling depends to a great extent. This article is written with the idea of calling attention to this other step toward greater speed and efficiency.

Factors in Efficiency

The factors that control the speed of machine drilling may be classed under the following heads: (1) geological, (2) human, (3) mechanical devices, and (4) drill steel. The geological factor covers the character and structure of the rock, the underground water conditions, emanations of gases, etc. In most cases these have to be taken as they occur. The second factor, the human equation, deals with the men running the machines and the bosses over them, and is one of the variables in the drilling equation that may be improved only by securing better and more skilled men. The third factor has had great thought bestowed upon it by both mine operators and manufacturers. The mechanical devices for drilling, ventilation, 'mucking,' handling water, etc., have been perfected along many lines. The result today is high mechanical efficiency in these lines. The recent bulletin of the Bureau of Mines on 'Safety and Efficiency in Mine Tunneling' covers this ground thoroughly, but the fourth factor, that of drill steel, is not mentioned except in connection with drill-sharpening machines.

Sufficient attention has not been paid to the fourth factor. With adequate steel, properly sharpened and heat treated, a machine man can drill twice the depth of hole that the same man under similar conditions can with too few drills or with plenty of steel which has been subjected to improper heat treatment. The process of sharpening and gaging has been worked out mechanically, by means of drill-sharpening machines.

Sufficient Steel at Each Working Face

The purchase of sufficient steel and turning it over to the blacksmith does not mean that sufficient steel will be at each working face. In cases where contractors and company men work in the same mine, the contractors will 'corner' the steel and the company men will be short. Few mines in this country seem able to get steel to the machine men so that they will have a sufficient supply. It is generally left for each 'shifter' to secure steel for his shift or else each individual must 'rustle' his own steel.

In one of the largest of the Eastern mines, the steel was lowered down the shaft to the station once each shift. The machine men or helpers waited for it like a pack of wolves. Before the cage was within two feet of the level of the station, a rush like a football scrimmage took place. Men with seven or eight 'starters' would exultantly dash away from the cage, while others secured all long drills. Some would not secure any at all. In one case, two men had a four-foot and two six-foot drills with which to drill a complete round.

The same conditions hold in Western states. A case similar to the above occurred in one of the large Mother Lode mines of California. The company operating the mine had from 100 to 200 men on its payroll. The mine finally shut down, having a deficit of $90,000 for the year. The company then leased the different levels to some miners who had previously worked for it. Thirty-four lessees produced nearly the tonnage that the average 150 company men had. The mine finally closed down when the shaft swelled and closed the skipway. The lessees in most of the cases made good 'stakes' from the leases. The company had poor steel conditions; not only insufficient steel, but the heat treatment was very poor. The lessees had one of the best men on steel to be found. There are hundreds of cases of this kind in the country, where the cause of loss is due to neglect of the fourth factor alone.

Before considering the remedy for this state of affairs, the question of the loss of steel in the mine should be considered. This decides the quality of steel in some cases. Managers will often state that they use cheap instead of high-grade steel because the financial loss due to the losing of steel underground is greater than the saving made by the use of high-grade steel. In one mine in California, 600 new drills were sent underground and within six months only 150 were left. By searching the mine thoroughly, about the same number were found hidden or thrown in obscure places. So in six months half of this new steel was lost.

A Good Way to Distribute Steel

To secure the highest efficiency in drilling, each machine man should have, on arriving at his working place, a complete set of drills, properly sharpened and heat treated. This could be accomplished in many mines by having the mine carpenter build a rack for each working place, or else iron racks could be made in quantities. Each should have two compartments with different locks. The rack should be kept as close to the working face as practicable. When the machine man comes on shift in the morning, he finds his complete set of drills near his work. On finishing his round, he replaces all the drills, dull ones 'bit' upward. The night men also find a complete set of sharp drills in their compartments of the racks. During the night shift, the

'nippers' would take out all the dull steel from the day shift's compartments and return sharp drills later on. The 'day nippers' would handle the night shift's drills. The steel for stoping machines should be near the manways into the stopes. Keys to the racks should be turned in at the end of each shift, and the shift bosses should see that each machine man, on coming on shift, is given a key to his rack. 'Nippers' should have master keys to the compartments holding steel of the *opposite* shift, while shift bosses should have the master keys to the compartments holding steel for *their* shift.

By the use of this system the best quality of steel could be purchased, as the loss from missing steel would be cut down to the minimum.

Heat Treatment of Drill Steel

The heat treatment of drill steel has a more important bearing on drilling efficiency than any other one factor. The effects on drill steel due to improper heat treatment may be classed under the following heads: (1) dulling of the cutting edge of the bit; (2) breaking of the bit, due to 'checking'; (3) loss of gage.

The first entails loss of power due to the crushing of the rock, instead of its being chipped. This means less footage or else necessity for more drills. Breaking of the bit due to imperfect cooling, causing the drill to 'check,' may mean the loss of a hole, decreasing the effective footage drilled. The last effect, however, is the one that causes the greatest losses in efficiency. Drills that lose their gage rapidly may cause loss of holes, due to the fact that the next longer drill will not follow. In attempting to make a bit follow one that has lost its gage, much time and energy is wasted. The psychical effect on the miner is of great importance also. Often the machine will have to take the punishment, a sledge being used to loosen the bit and sometimes the blows fall on the piston rod or other vulnerable parts of the machine.

The loss of gage is due to the corners of the bits being too hard or soft. In the first place, the corners chip off and in the latter they rapidly wear, especially if drilling in abrasive rock. The heat treatment, in most mines today, depends on the eye of the blacksmith or helper. As it is impractical to draw temper on large drill steel, the heat treatment is generally conducted as follows: After sharpening, the steel is allowed to cool below the 'cherry red' temperature and then is given a 'short' heat. This means that only the extreme end of the drill, for a fraction of an inch, is heated to 'cherry red.' It is then 'quenched' thoroughly. The cutting edge is therefore of hard, untempered steel (fine grained, porcelainic texture), cushioned by a large mass of soft steel behind it. If the 'heat' at quenching is too short, the hardened portion will also be too short, and in drilling hard rock, will be driven back into the cushion, deforming the shape of the drill. If the heat is too 'long,' the cushioning effect is not sufficient and the corners chip off. Should the length of the heat be correct, the drill will stand up satisfactorily against the hardest rock, provided high-grade steel is used. As the color of the heated bit varies under different conditions of sunlight or artificial light, it is difficult to find a man who is able to heat and quench at the proper point.

The following method might be used in eliminating the human equation: The steel to be treated could be placed in a bath, heated by gas, gasoline, distillate, or electricity. This method of refining and tempering is used in automobile and tool steel manufacturing. A bath of $BaCl_2$ and KCl mixed in proportion of two to one would give a mixture that melts at 670°C. As the proper heat for refining steel is about 720°C., this bath would be all right. The control of the heat must at present be by hand, as there is no automatic device on the market that will stand up under working conditions. A pyrometer, with a galvanometer, would be necessary, so that each bath could be maintained at a certain temperature. A stirring device also would be needed to keep the bath at a uniform temperature. The steel could be placed on an iron rack, suspended at each corner by an iron rod. Horizontal side and end rods, sliding on the vertical corner rods, would hold the steel vertically in place and also allow each piece to be placed in and taken out readily. The rack could be raised or lowered into the molten bath to any desired depth. By holding the temperature at 720°C. for ordinary drill steel, and then quenching thoroughly, the cutting edge would be refined and uniformly hardened. The drills would not be really tempered, as in case of 'drawing temper' in hand steel, for no 'temper' is drawn after the quenching at 'cherry red' heat.

If more attention were paid to the questions of sufficient steel at the working face and proper heat treatment of the steel, higher efficiency and lower costs would result. Several of the largest mines are going into the question of heat treatment, but the great majority of the mines are leaving this important factor to the blacksmith.

State aid to the mining industry in New Zealand includes subsidies to prospecting associations, loans for development of promising mines, grants for construction of roads and tracks on goldfields, free use of diamond and Keystone drills for prospecting coal and alluvial gold, supply of water for hydraulicking at certain rates from government water systems, subsidized schools of mines at six centres, gold-miners' relief fund, work of the geological survey, and considerable help to prospect the deep levels of the old Thames goldfield in the North Island.

Plumbago stocks in Ceylon are small, and the war has affected prices considerably. Dealers who are forced to sell accept $65, and those who can afford to hold their stock want $114 per ton.

Tin and tin-ore exports from the Federated Malay States in 1913 amounted to 50,131 tons of metal valued at £9,758,422, compared with 48,421 tons worth £9,814,437 in 1912.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Stabilization of the Copper Market

The Editor:

Sir—Mr. Burton was, apparently, not thoroughly familiar with the safeguards which have existed in the international copper markets prior to the war. An active metal exchange trading in copper existed in London and in Hamburg and large commitments were made on both of these exchanges. Both exchanges were closed at the outbreak of the war. There is some talk and a probability that the London Metal Exchange will open next week. The Hamburg Metal Exchange has been liquidated by order of the German government and will remain closed during the war. Even if there were an exchange in New York with free trading in copper, this exchange would have had to be closed at the outbreak of war—just as the stock exchange, the coffee exchange, and the cotton exchange had to be closed. I do not believe that the method suggested by Mr. Burton would be a protection in a case of such extraordinary emergency as has been experienced during the past few months.

The only possibility of protecting the copper industry of this country against demoralization would have been co-operation on the part of the producers. Such co-operation, however, was not feasible on account of the stringent laws which have been enacted in this country against any combination in restraint of trade. It is perfectly clear that with the termination of war, copper will be much more valuable than it is now, and this was recognized from the very beginning by the individual producers; and it was also recognized that it would be much better in the interest of everybody concerned if the price of copper could be maintained on a fairly reasonable level, but in spite of all this, we have witnessed an extreme demoralization of the market; the closing down of a large percentage of the producing capacity of this country; great distress among the laboring classes and dissatisfaction among the stockholders of the various mining companies which had to forego the usual dividend payments.

L. Vogelstein.

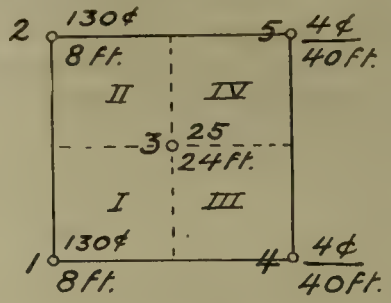
New York, November 6.

Valuing Placer Ground

The Editor:

Sir—The weight which should be given to the result of a prospect hole is obviously proportional to the volume represented by the hole, multiplied by the value per unit volume. In the particular case under discussion a correct method of procedure is illustrated by Mr. Herrick.

Mr. Hohl would have arrived at the same result had he given the interior, side, and corner holes their proper respective weights. That would have required his dividing the area into equal triangles instead of into triangles and squares, and would have given him a ratio of 4:2:1 instead of 4:3:2 as used.



Mr. Jennings has assumed that the average value of each of his eight subdivisions is represented by the arithmetical mean of the two holes on opposite corners. His results approximate those of Mr. Herrick in this instance, and consequently the error in the method is not sufficiently emphasized. It will be more apparent if the method be applied to the following hypothetical case where the average value for the block 1, 2, 5, 4 is 25c., and the result of Jennings' method is 35.5c.

$$\begin{aligned}
&\text{Hole } 1 — 130 \times (\ 8 \times 0.25 = \ 2) = 260\\
&\qquad 2 — 130 \times (\ 8 \times 0.25 = \ 2) = 260\\
&\qquad 3 — \ 25 \times \ 24 = 600\\
&\qquad 4 — \ 4 \times (40 \times 0.25 = 10) = \ 40\\
&\qquad 5 — \ 4 \times (40 \times 0.25 = 10) = \ 40\\
&\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad 48\ )\ 1200\\
&\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{Average value} \quad 25\text{c.}
\end{aligned}$$

Jennings' Method

$$\begin{aligned}
\text{Area I.}\quad & \frac{130+25}{2} \times \frac{24+8}{2} = 77.5 \times 16 = 1240\\
\text{II.}\quad & \frac{130+25}{2} \times \frac{24+8}{2} = 77.5 \times 16 = 1240\\
\text{III.}\quad & \frac{25+4}{2} \times \frac{40+24}{2} = 14.5 \times 32 = \ 464\\
\text{IV.}\quad & \frac{25+4}{2} \times \frac{40+24}{2} = 14.5 \times 32 = \ 464\\
& \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad 96\ )\ 3408\\
& \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad 35.5\text{c.}
\end{aligned}$$

Where the drill holes are placed at equal intervals over the area prospected, it will ordinarily be sufficiently

accurate to add all of the products of 'depth by value' and divide by the sum of the depths. It is not probable that there would be a sufficient number of holes at the extreme edges and corners of the area to warrant special consideration.

DONALD STEEL.

Palo Alto, California, October 16.

Design of the Plymouth Mill*

The Editor:

Sir—Mr. Caetani is to be congratulated on his courage in designing the Plymouth mill as he did, and still further congratulated upon giving such an excellent description of it to the profession. Undoubtedly the next mill he builds will have no stamps, they being replaced by either rolls or ball-mills. Still, however, it is wise not to make changes too radical to begin with.

His deductions in regard to the effect of fine crushing increasing the amount of colloids does not agree with our experience at Miami. We are inclined to believe that the colloid in an ore is a fixed amount and that no grinding produces of itself colloid material. Apparently the colloid is in the fine cracks and seams in the rock, and is simply liberated by crushing, and not produced by it.

J. PARKE CHANNING.

New York, November 12.

The Editor:

Sir—Referring to Mr. Caetani's article appearing in your issue of October 31, I note that Mr. Caetani has experienced some trouble with his elevators. If a few suggestions are not amiss, permit me to offer them. It may relieve him of some of the trials and tribulations pertaining thereto. It is agreed that all elevator work is a bugbear to mill-men.

In the first place the head pulley comes loose on the shaft. The shaft he describes seems to be of sufficient size for those elevators. Now why not shrink the pulley on the shaft by having the pulley bored and the shaft turned down so as to make a 25 or 30-ton fit, and have two keys fitted in and set-screwed? Then I think the head pulley will entirely wear out.

Belt slipping and sliding off the head pulley is due to the fact that the head pulley shaft is not level and in line with the boot pulley, or the belt is too loose and needs to be shortened. The head pulley need not be lagged, not even to put an extra crown to it. Personally, I think a lagged pulley is a detriment, because if it be lagged with another belt and this becomes soaking wet and slimy, then you do not have the same friction that you would have on a bare pulley. This is one cause of elevator belts slipping. If everything is all right and the belt starts to slip, shorten it as soon as convenient. It will save the belt considerably.

By all means have a good grade of elevator belting. It will save in operating time and also in labor. An inferior belt will continually stretch, and if it does not stretch uniformly, some of the plies of rubber or canvas will be cracked and broken, or one side may stretch more than the other, thereby causing the belt to run crooked.

About once a week or so, it would be well to shut the elevators down for an examination of buckets and splices, also for loose bolts around head-pulley shaft and boot-pulley shaft-bearings. The boot-pulley bearings described are good as far as they go, but if at the open end they were made so that a couple of rings of flax packing could be inserted, tightened, and drawn in place by means of a gland, it would help to keep out some of the sand, minimize the oil consumption, and prolong the life of the shaft.

In all elevators I think it best to have the feed enter the 'pit' or 'boot' on that side of the belt which is going up. There is then but one duty to be performed—that of elevating only. If the feed enters the pit on the opposite side, the buckets are compelled first to scrape all the feed from under the pulley and then elevate it, incidentally increasing the amount of power consumed.

I cannot agree with Mr. Caetani regarding the use of rubber washers between the belt and bucket. It is true that it reduces the wear between the bucket and belt due to attrition of fine sand, but on the other hand the bucket is not as firmly fastened to the belt when washers are used as when it is put on without them or even with a pad in between. When there are washers used, there is more of a hinge effect when the buckets go over the head pulley than there is when they are not used, hinging on the row of bolt holes. Consequently the fibre of the belt is injured to a greater extent and the belt is considerably weakened. Fasten the buckets on a belt both ways and see if the one does not offer less resistance than the other. The best practice, I find, is to use a pad made of an old belt, one that has been discarded is best; make it as wide as the bucket is deep and as long as the elevator belt is wide. The wear by attrition will be just as much on the pad as on the belt itself, which is not so very much. Any further thoughts or suggestions by others, in this connection, will be interesting.

J. H. LEWIS.

McGill, Nevada, November 16.

[Anyone who has run a mill remembers troubles with elevator belts and buckets, and such practical suggestions as Mr. Lewis makes will be widely welcome.—EDITOR.]

*'Design of the Plymouth Mill,' by Gelasio Caetani, *Mining and Scientific Press*, October 31, 1914.

ANTIMONY is used in the following alloys: Britannia metal, Sb, 10%; and Sn, 90%. Pewter, Sb, 7.1%; Bi, 1.8%; and Sn, 89.3%. Hard babbitt, Sn, 100 lb.; Sb, 10 lb.; and Cu, 10 lb. Softer babbitt, Pb, 80 lb.; Sb, 15 lb.; and Sn, 5 lb. Linotype metal, Pb, 83 lb.; Sb, 12 lb.; and Sn, 5 lb. Electrotype metal, Pb, 100 lb.; Sb, 10 lb.; and Sn, 5 pounds.

GOLD OUTPUT of the Ouro Preto mine, Brazil, in September was $41,200 from 6050 tons of ore.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

CYANOGEN occurs in coal gas as free cyanogen, CN_2, and hydrocyanic acid, HCN, both of which are gases. It is formed by the combination of a small percentage of nitrogen contained in the coal, with the necessary amount of carbon. The amount occurring in the gas is dependent on the temperature of distillation. A temperature of about 1735° F. is about the most favorable, according to C. C. Tutwiler in the October *Journal* of the Franklin Institute. The yield of HCN will then be 2 to 3 oz. per 1000 cu. ft. of gas. The Knubbauch system is the basis of the Feld, Stavorinus, Bueb, and British cyanide processes of manufacture.

BOULDERS weighing up to 50 tons each are lifted by the 15-cu. yd. Bucyrus dipper dredges *Gamboa* and *Paraiso* at the Culebra Cut, Panama, and the method of handling these large rocks is interesting. Instead of drilling and shooting them, as is the usual custom on contracting jobs, the Panama engineers 'mud-cap' them on the dipper. In the former instance 1 to 1½ hours is consumed, in the latter a space of about 3 minutes. As a general rule, long boulders, with dimensions of about 12 ft. long by 15 to 20 ft. in circumference, are thrown back in the water and an attempt made to catch them endwise in the dipper, so that they may pass through when the dipper is tripped. This also offers a chance that the rock may be broken in two by the dipper. If this method fails, the boulder is laid across the dipper and mud-capped. As a rule, a charge of from 2 to 4 lb. of dynamite is used, and as high as 6 lb. as a maximum. Round and egg-shaped boulders which are too big to pass through the dipper are mud-capped. As a general rule, where mud-capping is necessary, the boulder is lowered a few feet below the surface of the water so as to prevent the flying of rock. The dipper door is kept open when this operation is going on.

MINE INSPECTION in Western Australia, as in other states and New Zealand, is strict, and in the western state, including the state mining engineer, there are 13 inspectors for the various goldfields and mineral areas. These fields cover an area of 329,828 square miles, scattered through which are 1464 leases or properties with an area of 21,382 acres. There are nearly 15,000 men employed at these mines. The inspectors have a wide scope of power in maintaining the government mining regulations, and during 1913 there were 103 charges brought against various persons for breaches of the act. Fines were imposed in 97 cases, against men from general managers down to prospectors. Inspectors are appointed on their merits as mining men, for life, being chosen by suggestions of the Chamber of Mines at Kalgoorlie, the mining engineer, A. Montgomery, and others. No elections or politics enter into placing these responsible men in their positions. In addition to the mining inspectors, there are a superintendent and an inspector of the 37 government-owned custom mills and treatment plants, in charge of 17 managers; and eight inspectors of machinery, including the chief inspector, who made 3988 inspections in 1913, covering 2980 useful boilers and 3422 different classes of machinery, the total value of all mining machinery being approximately $18,300,000. The last named inspectors are strict and secured convictions in several cases for non-compliance with the regulations. There is also an inspector of explosives, who is the government analyst and chief chemist. All inspectors' reports are published in the annual report of the State Department of Mines.

ANTIMONY is used in comparatively small quantities in a great variety of ways, in the form of its numerous compounds. The impure trioxide is used to some extent in making glass, especially for that variety known as 'strass,' from which imitation jewels are made. It is also used as a substitute for tin oxide in the making of enamels, and the Enamel Company of America, with a plant at Elyria, Ohio, is using a quantity of antimony for this purpose. Enamels containing antimony are prohibited by law in Europe, and there is a possibility, of course, that similar legislation may sometime be passed in the United States. The oxide is also used in the making of lithopone, and to a small extent as a pigment in paints. It cannot be regarded as in any sense a substitute for lead or zinc pigment, but is merely used for mixing with them, as it is now generally recognized that mixtures of various pigments are more satisfactory for many uses than any single one. Tartar emetic is used in medicine. There is a tendency now to replace that by the use of the double fluoride of antimony and ammonium, and also by the double salt of ammonium sulphate and antimony fluoride. The pentoxide of antimony is also used in the manufacture of aniline red and aniline yellow. The trisulphide of antimony occurs in several isomorphic forms. The red form is known as antimony cinnabar, which is used as a pigment in oil painting. Antimony yellow has some uses. The sulphide of antimony is used to a certain extent in the making of matches, glass, and also for lithopone, where it is treated with barium carbonate. The double fluorides of antimony are used to a certain extent as mordants. The total amount of antimony thus consumed is not great.

MINING IN THE FAR NORTH

The Klondike, the Treadgold Placers, and Outlying Districts

By EMIL EDWARD HURJA

DITCH BETWEEN CARIBOU AND NEVADA CREEKS; PIPE-LINE AND WASH FLUME FROM DITCH ON GRANVILLE CREEK.

Over $180,000,000 in gold is credited to the Klondike as the production since gold mining first started in the Yukon. The greatest single year's production was $22,275,000 in 1900. The 1913 production was $5,500,000, and indications are that the 1914 production will be about the same. Gold mining in the Klondike has settled down to a steady annual grind, without the uncertainties of the earlier days. Mining is a business there now, not a gamble.

Early History

In 1894, Robert Henderson and two other miners prospected the gravels at the mouth of Pelly river, where they rocked out $54 in fine gold. They came down to the mouth of Indian river, which Henderson ascended alone and prospected on Quartz and Gold Bottom creeks. In the spring of 1895 Henderson and a party of five men returned to Gold Bottom to conduct a further search for gold. Encouraging prospects had been found the summer before by Henderson. Henderson told George W. Carmack of the discovery that summer and invited him to stake on Gold Bottom creek. This Carmack did, but as he was returning from there, he did some prospecting on Bonanza creek and found rich prospects. The claims were recorded and a stampede of miners from the Fortymile district started. Soon Bonanza creek was staked from end to end. When news of the rich discoveries penetrated to the outer world, thousands of people immediately started for the Klondike. Perhaps the Klondike stampede was the greatest in history of gold mining camps in the world. At any rate, the route to the fabled diggings led over a rugged mountain chain, down lakes and rivers over five hundred miles to Dawson, the camp which grew about Klondike's sands, and this route was black with people. The outlying creeks were staked soon and millions started to pour out in gold. Bonanza and its tributaries was probably the richest creek in the Klondike. Creek Claim No. 16 on Eldorado, a Bonanza tributary, produced $1,500,000, while the claim next to it produced $1,300,000.

Primitive placer mining was with the pan; then came the rocker. The ground was thawed with a succession of wood fires, found to be the cheapest and most effective means of taking the frost from the gravels. The hand windlass, used in hoisting the dirt from the bottom of the hole to the surface, soon was replaced by a steam hoist. Steam, led through pipes from the boiler, replaced the wood-fire method of thawing. The dump was first made near the shaft, but the carrier was evolved, and it became possible to dump the gravel farther away. Sluice-boxes and running water did away with the rocking.

Then came the open-cut method, where the overburden of waste was removed and the gold-bearing gravels were thawed by the sun, to be scraped into the sluice-boxes in wholesale fashion. Dredge machinery then was brought into the Klondike. At first the dredges were operated by steam, now all are driven by electricity. Ground is thawed ahead of the dredges by steam points driven down from the surface. Now even the thawing process is being eliminated. The ground is scraped off, the 'muck' and waste gravel removed, and the sun does the rest.

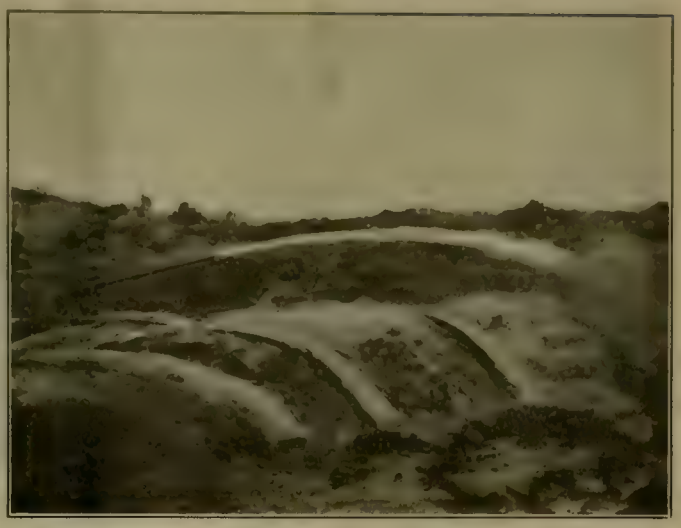
The big companies operating in the Klondike are the Yukon Gold Co., owned by the Guggenheims, the Canadian-Klondike, and the North West Corporation, Ltd., controlling the Granville Mining Co., Ltd. and the Treadgold holdings. Two

of these have been described. There are some individual plants yet, but they are confined to the outlying districts. There is some quartz mining, but that development has been slow.

Treadgold Placers

In preparation for the arrival of a Lubecker link-belt set excavator, part of the ground comprising the holdings of A. N. C. Treadgold and associates is being cleared. The work is in progress on the 3 streams, Dominion, Granville, and Quartz creeks, and because of the large scale method of clearing the frozen 'muck' and overburden from the claims, comparatively low costs have been attained.

Under the supervision of Gus Bredenberg, manager, three stretches about a mile long and from 125 to 300 ft. in width have been prepared. The scrub timber first is removed, then the 'muck' and some waste gravel. It has been demonstrated that the covering of 'muck' keeps the frost in the ground and prevents natural thawing. It is the plan of the Treadgold engineers to open sufficient ground ahead of the excavators to give it ample time to thaw without the use of steam. Measurements are being taken to show the rate of thaw in the gravel, and what little work of this nature has been done is promising.



SEAMS OF ICE AFTER THE THAWED 'MUCK' HAS BEEN HYDRAULICKED OFF.

Water for the ground-sluicing operations is being obtained through a system of ditches 21 miles long. The capacity of the ditch is 600 in. per minute. From an intake at Burnham creek, the ditch runs up the left limit of Dominion valley a distance of eight miles to Jensen, where a dam has been built. The ditch crosses Dominion there and follows the right limit of Dominion valley, crossing Gold Run creek, to 245 Below discovery, Dominion creek, where the pipe-line starts. Another ditch eight miles long has an intake below the mouth of Caribou creek, a tributary to Dominion on the right limit. The ditch follows the left limit of Dominion creek, catching all the water from the smaller side streams. At the lower end of the ditch, there is a head of 207 ft. Water for hydraulicking is used through two 3-in. nozzles. After being used, the water flows into Dominion creek, to be caught at Jensen and used again in the lower ditch.

The object of the hydraulicking is to expose the gravel or solid bottom below the ice belt of the 'muck.' Considerable ice in layers and sheets has been found in the 'muck,' giving trouble in the ground-sluicing. The 'muck' has a thickness, determined from the work accomplished this year, of from 12 to 17 ft. Sluiced from the claims, it has a tendency to lodge in the old stream bed, but no difficulty has been experienced as yet from this source. The first heavy rain usually is effectual in cleaning out the channel. Where the original channel of the creek is tortuous, in some instances it has been straightened, thus giving the stream a better grade to carry off the refuse 'muck.'

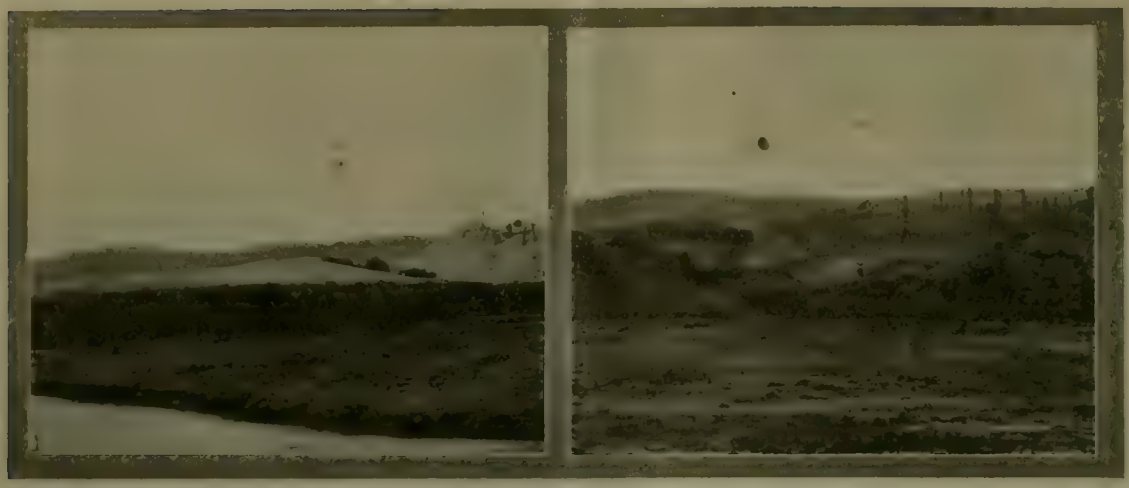
To July 1, on Dominion creek, a total of 774,294 yd. had been cleaned; on Granville creek, 790,173 yd.; and on Quartz creek, a total of 1,027,070 cu. yd. The monthly rate of disposal of 'muck' has been, on Granville, 191,666 cu. yd.; on Quartz, 143,362 yd. This has been accomplished with an average daily capacity of about 500 in. of water. Once removed, the 'muck' is never handled again in the mining operations. The daily thawing rate of the frozen 'muck' has varied from two to three inches. The nozzles are moved from three to five times a day, in order to take as wide advantage of the thawing as possible.

Actual work on the ground-sluicing started in May 1913, although no determined attempt was made until the present summer. The three creeks have been opened for a length of one mile, and the work is being directed toward widening the strips of cleared ground. Thirty men have been employed on each of the three creeks. The monthly payroll has been between $5000 and $5500. The power-line is partly constructed from the north fork of the Klondike. Work on it will be completed this year, it is expected.

MONITOR AT WORK ON 35 BELOW DISCOVERY, LEFT LIMIT, DOMINION CREEK.

Mr. Bredenberg estimates the cost of removing the 'muck' to be about three cents per yard, although monthly balances early during the progress of the work have shown costs as high as 7.7c. The 1914 costs on Granville creek have been 4.6c. per yard; on Quartz, 5c. per yard; and on Dominion, 6c. per yard. These costs will decrease still more, it is the claim of Mr. Bredenberg, as the overhead cost becomes less.

The Lubecker excavator which Mr. Treadgold plans to use on the properties, runs on two sets of rails, laid along the ground a distance of a mile. Eight-foot buckets travel at the rate of eight feet per minute, scraping off from two to four inches of gravel each trip, according to the rate of thawing. It takes the bucket line 12 hours to



GRANVILLE GROUND CLEANED FOR THAWING, WITH OLD TAILING DUMPS IN THE BACKGROUND.

GRAVEL IN FOREGROUND READY FOR THAWING; 'MUCK' IN BACKGROUND.

travel the mile stretch of ground. It is said that Lubecker excavators are in successful use in the Amur district (of Siberia) for the Upper Amur company. Mr. Treadgold has options, running mainly for one year, on considerable other ground in the district.

Outlying Districts

On the Sixtymile, above Dawson, mining is in progress on Tenmile creek, a tributary. Some rich ground is reported to have been found there during the past year. The bulk of Sixtymile river is optioned to the Yukon Gold Co., at $3000 per claim. Keystone drills have been used in prospecting, and it is likely that more will be done during the coming winter.

Stewart river, south of Dawson, is the scene of considerable mining activity. In the upper Stewart, on Minto lake, Kastner & Scougle have spent $40,000 to prepare for their hydraulic operations. Seven miles of ditch has been built, which will give unlimited water for their work. They have a fall of 225 ft. in one mile. On Highet creek, Elmer Middlecroft, of Seattle, is hydraulicking. Three thousand dollars was cleaned up late in the summer after a 10-day run with seven men at work. On Haggert creek, several placer outfits are at work. Abbott & Portlock employ 14 men. They have a ditch and a 1500-ft. pipe-line. One small company is prospecting hydraulic ground on Secret creek, a tributary to Haggert. On Scroggie creek, there are 20 outfits at work. More will work this winter. A government road has been built to the upper Stewart district.

On Dublin gulch, a tributary of Haggert, Catto & Stewart have a group of eight quartz claims. Five hundred feet of adit has been driven. The vein is eight inches wide. The ore is said to be free-milling. Robert Fisher, on Olive creek, has had ore that assayed well. Frank Carscallen is prospecting.

The most recent excitement in the district was the silver-lead find of Harry McWhorter on Galena creek, a tributary of McQuesten river. The new government road to that area follows the Mayo road to Minto bridge. From there, the new Haggert Creek road is followed for six miles. The government has just completed the new stretch of road from that point to Galena creek, a 12-mile stretch. On the Galena claim, the discovery claim staked by McWhorter, the vein has been cross-cut on both sides of a narrow cañon which cuts the lead. The bottom of the cañon shows a depth of 55 ft. on the vein. An adit has been driven along it 65 ft., and 60 tons of ore mined and shipped. This summer a shaft was started on the upper outcrop to intersect the adit. The shaft is 95 ft. deep, 40 ft. below the adit level. The vein varies from 2 ft. to 2 ft. 8 inches in width. With depth, ruby silver is more abundant. Specks of native silver have been found in the ore.

Eighty claims have been staked in the district. Seventy-five men are at work there. Active development is under way on only four other claims. The mineralized belt of which the McWhorter lead is a part has been traced across country for three miles, according to F. H. Kitto, former director of surveys of Yukon Territory, who recently came out of the district. McWhorter is asking for tenders on freighting out a shipment of 1000 tons of ore. He is building winter quarters at the claim and intends to carry on development all the year round. McWhorter first found galena float in the district 12 years ago, but he did not think it warranted further effort until a year ago, when he decided to go in and prospect.

The MacKinnon Brothers own a group of 20 claims 30 miles from Dawson on MacKinnon creek, a tributary of Indian river. A deposit of limestone conglomerate has been found on the claims and is being developed slowly. On the Britannia claim, a 20-ft. adit and a 60-ft. shaft comprise the development work. The conglomerate pans well.

Other quartz properties in the vicinity of the Klondike are the Lone Star, at the head of Victoria gulch, where a six-stamp mill is operating under the management of E. H. Searle, and the Bear Creek Mining Co., operating a small mill on Bear creek. Murray Eads is manager of the latter concern.

The Gold Commissioner at Dawson reported that in August, Dan Cadzow, the trader at Rampart House, on the upper Porcupine, came down for supplies and while there asked that Sergeant Dempster, of the R. N. W. M. P., be appointed an agent to the mining recorder and be supplied with the necessary blanks for recording mining claims staked in the upper Porcupine district. Cadzow said that prospects had been found, but nothing that would justify even the slightest kind of a rush.

The Fortymile district, though lying on the American side of the boundary, has been tributary to Dawson ever since that place was founded. There is considerable mining work in progress in the Fortymile, although most of it is on a small scale. William Obermuller and Paul Denhart have uncovered encouraging prospects on the middle fork, but because of trouble from water, have been forced to postpone prospecting it until this winter. On Gold creek, a tributary to Slate creek, which empties into the north fork of the Fortymile, two outfits were working this summer. Three outfits, owned by John McLain, E. M. Webster, and Ostergaard & Kirkpatrick, were at work on Hutchinson creek.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

BUTTE, MONTANA

General Situation of the District.—Labor Discussion.—Electrical Workers Hold Up Important Construction.—Pittsburgh and Gilmore Railroad.

Butte is holding up under the general business depression, caused by war and the price of copper, much better than had been expected. No business failures of importance have occurred as yet, and with characteristic optimism the community is hoping for better things, and making the best of the situation.

The only additional mine to close down recently was the Butte & Superior. This was unfortunate because of the number of men affected at both mine and mill, but was not due to the price of spelter. The cause of the shut-down was an accident to the working shaft, which has been in bad shape for some time. As the shaft in question is the only one available for hoisting ore, and is depended on for hoisting over 30,000 tons of ore per month, it was considered necessary to close the mine and mill entirely until the shaft could be put in first-class condition. This work is now under way and should be completed by the first of the year, when it is expected that the property will start at full blast again. Nearly 1000 men were thrown out of employment by the closing of this property. The last quarterly report of the Company is given on page 861 of this issue.

Some of the large companies are trying to keep their technical staffs intact in spite of shut-downs. They are accomplishing this by offering the men reduced pay during the dull times. Some of the heads of departments have voluntarily reduced their salaries, as much as one-half in some instances.

No disorder and no increase in crime seem to have resulted from the enforced idleness of so many men. In fact, the number of idle men in Butte does not seem to have greatly increased. Apparently many of the men thrown out of employment have considered it useless to wait about for a return of conditions to normal, and have left the city in search of employment elsewhere.

This centre has apparently weathered a most important labor crisis with little damage. In fact, no one would have predicted such a peaceable outcome for such a great change. It is possible that our perspective is sufficiently good now to review in substance the events leading up to the present situation:

Last spring considerable dissatisfaction began to be openly expressed by the miners over the management of Butte Miners

GENERAL VIEW OF BUTTE & SUPERIOR PROPERTY.

1. Carpenter and Timber Framing Shops. 2. Machine Shop. 3. Head-Frame. 4. Miners' Change-House. 5. Secondary Crushing Plant. 6. Mill Building. 7. Assay Office. 8. North Butte Extension Property.

Union No. 1 of the Western Federation. Complaints were made against excessive taxation, mismanagement of funds, suppression of free speech at meetings, unfair judging at elections, and tyrannical action of union officers. These allegations finally resulted in open dissatisfaction against the union, personal threats and attacks on the officers, and the final, violent destruction of the records, property, and building of the union. The next move was the organization of a rival union and for a time the two organizations strove peaceably for the support of the miners. Finally the new organization began to use violent means for the suppression of the older one, and began to deport its supporters. Up to this time the operators had succeeded in keeping out of the controversy, but one night late in August the employment office of the Anaconda Copper Mining Co. was dynamited by persons who apparently wanted to show their disapproval of this method of employing men. This was the 'straw that broke the long suffering back of the Company's camel'; the militia was called in to keep order, and the mine operators announced that they had enough of such tactics, and would refuse to recognize any union at the present time. In other words, open shop was declared for the Butte mines, and men can now work in Butte as miners without showing allegiance to the Western Federation of Miners, or any other union. The militia had little work to perform, as the miners remained peaceable, so that it has been dismissed recently, and the community is again controlled by the civil authorities. About the only change compared to conditions before the trouble is that street oratory is tabooed by the sheriff, and I. W. W. agitators are unceremoniously advised to keep moving. In view of the uncertain financial outlook for the community at best, the citizens do not intend to be imposed upon by soapbox orators, and their disturbances may be expected to be summarily dealt with. The mining companies are taking no chances on future events, however, and have enclosed their properties with high board fences, and other means of protection. Searchlights are in use at night so placed as to illuminate any part of the properties.

The work of electrifying a Montana division of the Chicago, Milwaukee & St. Paul railway is to be resumed forthwith. The Electrical Workers' Union caused the cessation of this work some months ago by demanding that the laborers who erected the poles, on which the electric wires were to be strung, should be classified as electricians and receive electricians' pay. This action, however, 'killed the goose that laid the golden egg,' for the Milwaukee officials refused to yield to such absurd dictation, and stopped all work on the electrification. Fortunately for all concerned, the union has been given an opportunity to back down gracefully. The Montana Power Co. has taken a contract from the railroad company to install the apparatus, and the union has condescended to let the power company employ whom it pleases to dig post holes and set up posts. The power company is naturally very much interested in having the electrification of the line pushed to completion, as it has a large and important contract with the concern for furnishing power, and is building large hydroelectric plants at Great Falls and Thompson Falls to supply the power. It would hardly appear as if our 'great and glorious democracy' is working to best advantage, when a handful of greedy mechanics can hold up for months an enterprize involving the expenditure of millions of dollars to the advantage of the community.

The puzzle has at last been solved, and the Northern Pacific Railroad Co. openly avows ownership of the Pittsburgh & Gilmore line. Several years ago this branch was built into the Salmon River country of Idaho, and joined the Oregon Short Line at Armstead, Montana. The traffic rates were high and the service poor, although everyone had to confess that the railroad was a great improvement over the old stage days. Some mines profited by the railroad and other prospects were developed because of it, but complaint was general that the service was inadequate and the rates exorbitant. Speculation was rife as to who owned the road, all the western railways being mentioned at one time or another, but it is very probable that none of them were guilty. The road was apparently built as a speculation by some Pennsylvania capital that was interested in mines tributary to the railroad. The burden of operating the road was apparently a heavy and profitless one, so that everyone is probably benefited by the passing of ownership to the Northern Pacific interests. It is not improbable that this concern may in time extend the road on down the Salmon river to Lewiston, Idaho, and thereby open a mineral country which has long needed transportation facilities.

DEADWOOD, SOUTH DAKOTA

HOMESTAKE COMPANY'S CONSTRUCTION WORK.—MONUMENT TO THE LATE SUPERINTENDENT.—MINE INSPECTOR'S REPORT.—GOLDEN REWARD, HEIDELBERG, ECHO, AND OTHER COMPANIES' WORK.

New construction work at the Homestake is proceeding rapidly. At the B. & M. shaft the brickwork for the walls of the engine-house has been completed, and the steel roof girders erected; and in a short time the roof will be covered. All of the machinery has been delivered. The great engine is ready for erection as soon as the building is complete, and work on the steel head-frame and shaft-house will soon be started. In the meantime the shaft is being used every day, the old hoisting engine, in its day the finest in the Black Hills, being employed in hoisting ore. The new engine will hoist in balance eight-ton skips of rock. Its capacity is rated at 3000 ft. At the electric generating station, work of erecting the building is well under way. All foundations and retaining walls are finished. Machinery is also on the ground for the equipment of this plant. At the boiler plant, where steam will be generated for the hoist and electric plant, foundation work is being completed. Here it has been necessary to sink 20 to 30 ft. to hardpan, on which to rest the concrete carrying the heaviest bearing portions of the superstructure and equipment. On these three structures, with their various equipments, at least $250,000 will be spent before completion. They will form important units in the Company's extensive surface plant.

In memory of the late superintendent, T. J. Grier, the Homestake Veterans' Association has decided to erect a monument or other suitable memorial, on grounds between Recreation Hall and Christ Church, at Lead. That all interested may have an opportunity to contribute to the construction fund, the maximum of donations to the fund has been placed at $1. So far, employees of the Company have raised a little over $1500. It has not yet been stated how much has been received from other sources, but it is known that this also amounts to a considerable sum. It is proposed to erect a monument of substantial proportions, with inscriptions commemorating the history of Lead's greatest citizen, who was the friend of all and loved by all.

The state mine inspector, O. Ellerman, in his report for the year ended October 31, states that the gold production of the Black Hills for that period was $7,325,510. This is a decrease of $171,589 compared with the previous year. A large proportion of the ores handled in the state are worth less than $4 per ton, although there are considerable shipments of smelting grades. The average value of the ores treated during the year is given at $3.68 per ton. Various mines produced as follows: Homestake, $6,046,000; Golden Reward, $369,182; Trojan, $357,229; Wasp No. 2, $229,390; Mogul, $141,298; Bismarck, $83,919; New Reliance, $69,532; Deadwood Standard, $7238; Placer mines, $1800; and miscellaneous, $19,920. Other minerals than gold were produced, chiefly in Pennington and Custer

counties, as follows: mica, $6150; gypsum, $59,000; tungsten ores, $400; lithia ores, $1150; lead, $811; and beryl, $538; a total of $68,049. The report shows 3040 employees in the mining industry in the Black Hills, of which 1344 are underground workers, the lowest wage scale for any of them being $3 per day of 8 hours. There were 4 fatal accidents and 10 non-fatal accidents during the year.

During the past summer the Golden Reward cyanide plant, at Deadwood, has been improved and enlarged by the addition of a tube-mill, a 24 by 16 ft. Trent replacing tank, 2 agitators, 1 Akin, and 1 Dorr classifier, and several secondary machines. The plant is now equipped to handle ore as received from the Astoria roaster. This material is slimed in the tube-mill, and although it is extremely hard, a satisfactory tonnage is being treated.

Now that a depth of 58 ft. has been reached in the shaft being sunk at the end of the adit at the Heidelberg, plans are maturing for the installation of a steam plant, work to date having been done with a windlass. It is proposed to raise to the surface a distance of about 100 ft., and there to erect machinery suitable for continuing work to quartzite, a distance variously estimated but probably less than 500 ft. It is interesting to note that the 'ore vertical' followed by the shaft has maintained its size and gold content for the entire distance sunk.

Machinery has been ordered by the Echo Gold Mining Co. to be erected at the shaft site, and sinking started. Equipment to be installed will include an electrically-driven hoist and compressor, air-hammer sinking-drills, drill sharpener, assay office, etc. The Company plans to sink several hundred feet. The property is stated to be on the northerly extension of the Homestake lodes, and is favorably regarded in local circles.

V. R. Hodges and associates, who, during the summer operated the Deadwood Standard property under lease, have suspended work for the winter. They had a satisfactory season, but shut down rather than go to the expense of making needed extensive repairs to the mill building.

Mills & McNish have in operation the only tin mill in the Black Hills, and probably the only one in the United States at the present time. The plant is equipped to pulverize the ores dry, with rolls; the pulp is later agitated with water and fed to Wilfley tables. No slime tables have been installed. The best grades of tin ore are being handled, and the plant is stated to be making money. It is situated four miles from Hill City, in Pennington county.

A small stamp-mill is being erected at the Liston property, near Keystone. The property shows a considerable tonnage of free-milling ore, a large portion of which can be mined in an open-cut.

The Hill City Mining & Development Co., operating near Hill City, is preparing to install a steam mining plant, consisting of hoist, compressor, pumps, etc. Development so far shows a good vein.

The Anaconda company, at Roubaix, is moving its hoisting plant to a situation 500 ft. north of the present 500-ft. shaft, and as soon as erected work of sinking several hundred feet will be started.

KALGOORLIE, WESTERN AUSTRALIA

LABOR UNIONS WANT MORE WAGES IN CERTAIN DISTRICTS.—GREAT BOULDER COMPANY'S OPTION ON MINES IN VICTORIA.—CHAFFERS MILL STARTED.—MOUNTAIN QUEEN MINE, AND REFRACTORY ORE IN THE TRANSVAAL PROPERTY.—HORSE-SHOE DEVELOPMENT.

In spite of the disturbance of business caused by the war, and the increased cost of all mine stores by 25 to 30%, the miners' unions of Leonora and Menzies have cited a case to the Arbitration Court for an increase in wages. On the Chamber of Mines appealing to J. Scaddan, the labor premier of the state, to use his influence to get the unions to allow the matter to stand over till a more propitious occasion, the Chamber received the surprising reply that the request could not be complied with. In retaliation, the Chamber has cited a case to the Arbitration Court for a reduction of wages at Comet Vale and Ora Banda, where it is considered that the wages paid for some years have been excessive. With regard to the districts mentioned, the only capitalized mine in the Leonora district is the Sons of Gwalia, which has treated 2,317,300 tons of ore for a return of $20,513,250, and paid $4,986,810 in dividends. In the past two years the Company has been earning monthly profits of $25,000 to $30,000, of which half has been absorbed in thoroughly overhauling and adding to the treatment plant. This mine employs 300 men. As regards Menzies, only one English company is operating in the district, the Menzies Consols. During its 19 years existence the mine has produced $3,889,000 from 295,800 tons of ore, and, during this time, the shareholders have never received any return on their capital, and it looks as if they would never receive any. In addition to the proceeds of gold mined, an amount of $370,000 of cash, subscribed by British shareholders, has also gone in equipment and development. There are 90 men employed at the mine. At Comet Vale there are only three producing mines at work, all privately owned. Of these, only one, the Sand Queen, is a regular producer and dividend earner. Its record to date is $1,112,500 from 67,400 tons, and $352,500 has been paid in dividends. This mine employs 80 men. At Ora Banda the only company operating is the Associated Northern, which is working the Victorious leases. Owing to the grade of the available ore in the oxidized zone not being profitable, the mill was closed down in January, and since then $98,700 has been spent in development and equipment of a sulphide treatment plant, the engine for which has only just arrived. During the time the mill ran, 129,200 tons was treated for $698,800. When the mill was at work, 150 men were employed. Developments in the sulphide zone in this mine have, so far, proved unsatisfactory, and unless a great improvement takes place, there will be very little margin over working costs.

SANDSTONE, WESTERN AUSTRALIA. A TYPICAL MINING TOWN OF THAT STATE. PEPPER TREES IN CENTRE OF MAIN STREET. BUILDINGS PAINTED WHITE TO LESSEN HEAT IN SUMMER. ALTITUDE ABOUT 1500 FEET.

The combined labor unions are at present holding a prolonged conference at Kalgoorlie, and no less than 54 subjects are to be debated. Among others is the abolition of contract and bonus work; the abolition of night shift; the reduction of a week's work to 44 hours; that overtime be paid for at the rate of time and a quarter, and Sunday work at the rate of double time; and that shifts in rises consist of 4 hours only. The meeting has already carried resolutions referring the question of contract and bonus work to the state parliament,

and as Mr. Scaddan, the premier, has already stated in his election speeches that if his party is returned to power on October 21 he will re-introduce the Mines Regulation Act Amending Bill, which includes all the questions at stake, the object of the present conference does not appear at all obvious. If the bill is forced through in its entirety, many of the mines, which are merely making expenses, may be forced to close down, and a number of men will be out of work.

Richard Hamilton, manager of the Great Boulder, has just returned from a visit to the MoonNght-Magdala group of mines in Victoria, over which the Company holds an option. After unwatering the mine to 1200 ft., and sampling and diamond-drilling during six months, Mr. Hamilton has found the ore too poor to show a reasonable profit. Owing to the Victorian government offering to subsidize the prospecting work to the extent of dollar for dollar up to $50,000, or more if necessary, Mr. Hamilton has agreed to unwater the mine to 1400 ft. and further test it. The lode in the upper levels of the group was very rich, and $7,500,000 was paid in dividends, but the returns for 1912 totaled 14,350 tons for $65,970 or $4.59 per ton. The deepest shaft on the property is 2425 ft., but the lode was tested by a drill to 2700 ft. by the old owners with poor results. Mr. Hamilton promised, when taking the option, that if he was satisfied he would install a plant similar to that on the Great Boulder at Kalgoorlie and find employment for 600 men. As the Boulder's costs are $5 per ton, exclusive of depreciation, and London office expenses and directors' fees, the proposition seems hopeless.

The new treatment plant at the Chaffers mine at Kalgoorlie started operations on September 29, on a dump of 2000 tons raised during development work. This ore is estimated to be worth $9 per ton, and, after it is treated, ore from the mine will be stoped and treated. The ore reserves, at the time that the Company was reconstructed, amounted to 104,900 tons, worth $6.18 per ton, and on this grade it is estimated there will be a profit of 60c. per ton, or $3600 per month on an output of 6000 tons. Since the reconstruction, 1290 ft. of cross-cutting, 1155 ft. of driving, and 750 ft. of winzing has been done. The bulk of the ore developed assays from $6 to $7.20 per ton, but at No. 16 level No. 3 west branch lode assays $26.52 over a width of 6 ft. and a length of 181 ft. This lode is not developed at No. 15 and 17 levels. A month ago the Company came to the end of its cash resources, and the manager, Boyd Aarons, had to appeal to the men to continue working and await payment out of proceeds of first gold won. With few exceptions, the men agreed to this.

The Mountain Queen mine, at Marvel Loch, near Southern Cross, is practically worked out, as the oxidized zone is depleted and the sulphide is too poor to pay. The Company's other mine, the Transvaal, is shut down, as no known process can treat the ore successfully, owing to the presence of abnormal quantities of arsenical pyrite in it. Anyone discovering an economical way of overcoming this difficulty would find a wide field for such a process in this state, as several otherwise promising mines have had to be abandoned owing to the presence of arsenic and copper in the ore.

Since it was proved, three years ago, that the Great Boulder main lode had reëntered the Golden Horse-Shoe ground, the main shaft of the latter has been sunk 700 ft., and levels opened up at 2480, 2630, 2780, and 2900 ft. At each of these levels, at or near where the lode was penetrated by cross-cutting, free gold and telluride are showing, and assays are abnormal. At 2480 ft. the lode assays $306 per ton for 48 in., and at 2900 ft., where it has just been cut, the lode is 15 ft. wide and worth $18.36 per ton. In addition to these developments, a practically new mine is being opened up in the southern section of the lease. This section was worthless down to 1200 ft., but below that the ore-shoot has gradually lengthened and proved profitable as far as Chaffers boundary, 1100 ft. south of the main shaft, or 600 ft. farther than in the upper levels. The ore in this section is much richer than has been milled during the past three or four years, and bids well for the future of the mine. At No. 14 level the last 200 ft. of No. 3 lode before reaching Chaffers boundary assays $26.52 per ton for the full width of the drift. At No. 18 level No. 3 lode from 500 to 800 ft. south of the main shaft assays $15.30 over a width of 6 ft., and good values still continue south. Owing to these developments, No. 2 shaft, 730 ft. south of the main shaft, which was only 1291 ft. on December 31, 1911, reached 1552 ft. on that date in 1912, 1879 ft. at the end of 1913, and 1924 ft. shortly after. Next year's returns from the mill should show a considerable improvement.

Ore reserves of the Ivanhoe mine at Kalgoorlie on June 30 totaled 986,873 tons averaging $9.10 per ton. In the September issue of the *Monthly Journal* of the Chamber of Mines, L. R. Benjamin discusses the subject 'Dissolved Gold in Slime Residue.' The assay using cuprous chloride is described.

The gold output of the state in August totaled $2,175,800, and dividends $206,500, making the total to date $591,674,600 and $123,639,800 respectively.

NEW YORK

BUTTE & SUPERIOR EARNINGS.—PORCUPINE MILLS.—CYANIDE MANUFACTURE.—COBALT COMPANIES.—SCHEME TO SELL COPPER IN EUROPE.

The Butte & Superior Copper Co., which does not produce any copper, but does produce large amounts of zinc, shows in its report for the third quarter of the year, as published on page 861 of this issue, that the estimated net earnings for 1914 will be $1,265,000, or $4.75, against $3.50 per share last year.

Gold mining companies at Porcupine continue to increase their output. The Hollinger is adding another 40 stamps to the 60 now at work, and the Dome is also increasing its capacity through changes in the mill practice. Shipments of cyanide have been received, and P. A. Robbins of the Hollinger is quoted as saying that there is now enough in the district to last a year.

The American Cyanamid Co. has secured the machinery which it ordered in Germany some time ago and will at once proceed to manufacture low-grade cyanide, or surrogate, at its plant on the Canadian shore of Niagara Falls. There are not sufficient quantities of this material yet available in this country to make a conclusive test as to whether it will be satisfactory for cyanide work, but several of the large users have made arrangements to test it as soon as it can be supplied. One shipment of cyanide has come through from Germany to New York, but it is not yet certain that regular shipments can be depended on.

The announcement that the Crown Reserve would cut its dividend to 3c. per share after December 1 caused a sharp decline in the quotations. Crown Reserve did not benefit as much as some of the other companies through the draining of Kerr lake, since it was found that at that point there was a thick layer of mud on the lake bottom, and no prospecting can be done without deep trenching.——It is reported that Mr. Hay, president of the Trethewey, and Mr. Rogers, superintendent of the Coniagas, have agreed to serve on the board of directors of the reorganized Bailey Cobalt, and good progress is being made in straightening out an unpleasant situation.

Last week a representative of Henry R. Merton & Co., who had been in this country on a mysterious mission, returned to London, and it is now reported that the arrangement he had been trying to make was for his firm to act as the general sales agent for American copper in Europe. As Great Britain is already exhibiting an undesirable amount of control over shipments from this country, the scheme naturally met with but little favor, and he was obliged to return without accomplishing anything.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

Fairbanks

Reports differ somewhat regarding the new gold discovery in the Tolovana district. One party returning to Fairbanks stated that the original stakers had not reached bedrock on November 2. Some prospects were good. Others state that the area may prove to be a fair producer, but only as a dredging district.

Samples of quartz containing gold, silver, copper, antimony, lead, and pyrite, gathered from 60 different properties in the district, have been on view in Fairbanks before shipment to the Panama-Pacific Exposition at San Francisco.

Juneau

Dividends of 20c., $1, and 20c. per share respectively will be paid by the Alaska Mexican, Treadwell, and United companies on November 28. October returns from the first two mines were as follows:

Results.	Alaska Mexican.	Alaska Treadwell.
Development, feet	108	701
Stock of broken ore, tons	—2,329	—44,155
Stamps working	120	540
Ore crushed, tons	19,705	79,233
Concentrate treated, tons	403	1,769
Total realizable value of gold	$45,391	$154,742
Yield per ton	2.33	1.97
Operating expenses	25,252	83,844
Construction expenses	6,368	21,833
Estimated net profit	13,771	49,065

Valdez

Two weeks' run at the Granite mill recently yielded gold worth $13,000. The mine is opening satisfactorily under the management of W. R. Millard.

ARIZONA

Greenlee County

The Arizona Copper Co. produced 2,694,720 lb. of metal in October.

Maricopa County

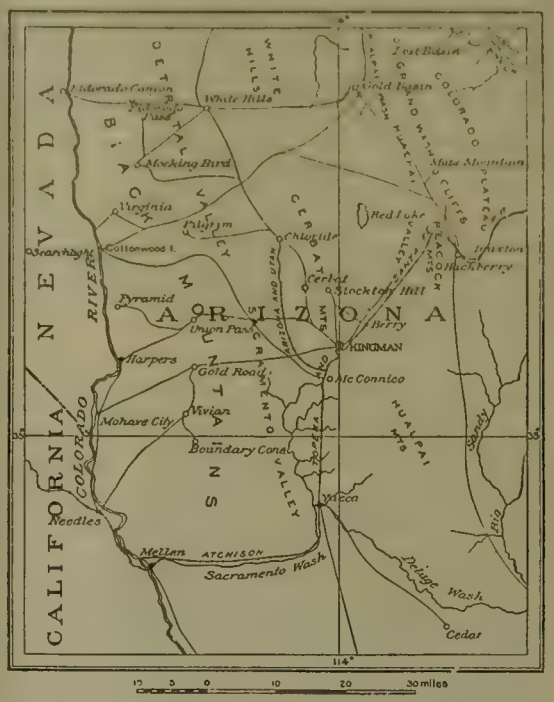
In a contest of first-aid and mine-rescue teams at Phoenix last week, results were as follows: first-aid, Old Dominion first and second, and Detroit third; helmet contest, Copper Queen, Detroit, and Old Dominion. The prizes won were as follows: Old Dominion, $150; Detroit, $150; and Copper Queen, $100 and a cup. U. S. Bureau of Mines and Arizona officials were in charge of the contests, which were considered very evenly matched.

Mohave County

At 500 ft. in the Gold Road mine, in the east end, 4 ft. of high-grade ore has been opened. D. R. Muir is manager.——A winze from the 900-ft. level of the Tennessee is down 160 ft. ——Four feet of ore assaying 4.5% zinc has been cut in the Golconda mine.——Los Angeles officials of the Tom Reed have been visiting the property.

Yavapai County

A syndicate headed by W. S. Wilhelm, of Long Beach, California, has secured control of the New State claims in the Hassayampa district. Some good gold ore has been opened in the Shamrock claim. A mill containing Nissen stamps and cyanide plant is to be erected.——Development in the Emporia and Yellow Jacket mines, near Prescott, is so satisfactory that a 5-stamp mill will be installed in the former.



MOHAVE COUNTY MINING DISTRICTS, ARIZONA.

CALIFORNIA

The oil output of the state in October was 282,152 bbl. per day, a decrease of 8000 bbl. compared with September. Shipments from the field totaled 7,749,136 bbl., and the surplus at the end of the month was 56,024,899 barrels.

The University of California announces that at the recent state elections it was decided by a majority of over 140,000 to issue bonds amounting to $1,800,000 for construction of new buildings on the campus. Work will be started early in 1915, steel and stone to be used in construction.

Amador County

The Plymouth gold output in October was $44,100 from 9000 tons of ore.

Butte County

An old gravel mine on Big Kinshew creek, near Ramsay Bar, is to be worked this winter by H. B. Scott, J. Proctor, G. La Febre, and J. Jenson.

Imperial County

(Special Correspondence.)—During the second week of November a cloudburst broke near the Imperial Reduction Co.'s property at Ogilby, and water flowed through an abandoned portion and completely filled the present workings of the mine. The oxidized ores of this American Girl mine were worked years ago, and many of the old workings do not show on the

old inaccurate maps. There was not much rain in the immediate vicinity of the mine, as the heavy fall of water occurred at the head of a gulch which crosses the vein near its mouth. This big rush of water broke through into an old caved stope which did not show on the surface, and poured into the mine for about three hours, there being no way to stop it. This came on through the No. 3 level to the incline shaft, down which it poured so the men barely had time to escape from the lower level. The shaft is now caved in slightly below the water-level, and the superintendent's report states that about four months will be required to unwater the mine and open the shaft. These dry desert mines are not prepared to handle quantities of water on short notice, so a special 75-cu. ft. water-skip was built in Los Angeles and shipped to the mine, so that the work of unwatering will soon start with three shifts. In the meantime all other work had to stop, and the mill was closed down. The damage to the mine cannot be estimated until the water is out. As it was a dry mine, with a 'ravely' hanging, and dry clay seams on the foot-wall, much caving can be expected, so six months work can be reckoned on before the mine is in shape to start the mill. This is not the only damage in a case of this kind.

Pasadena, November 21.

NEVADA COUNTY

Four miles below Grass Valley is the Deadman Flat district, an increased activity is noticeable of late. Work has been resumed at the Gold Mound, West Point, and California claims, and when litigation is completed, the Kenosha will be reopened.

The Whiskey vein of the Golden Center of Grass Valley, which has yielded $17,000 from 5000 tons at 500 ft., shows 16 in. of ore on the 700-ft. level. Good returns are expected from this shoot. At 500 ft. depth, the north drift is in 375 ft., and within 60 ft. of the Garage vein. In order to cope with water, another pump of 500-gal. capacity has been ordered. The present flow is 340 gal. per minute. So far this Company has spent $125,222 in the mine and equipment.——Between the Brunswick and Empire mines is the Le Duc, and after driving 3000 ft., and cutting two veins, $12 to $50 ore containing galena and other minerals has been opened.

PLUMAS COUNTY

As soon as litigation between the owners of the well known Droege mine and others in the district is settled, there is a chance of extensive development being done and the 25-stamp mill started.

SHASTA COUNTY

Fifty tons of ore and minerals is ready at the Redding railway station to be forwarded to the Panama-Pacific Exposition, and five tons for the fair at San Diego. M. E. Dittmar is in charge of the collection.

Curtailment of copper production has stimulated prospecting and working old gold producers in this county. San Francisco people have reopened the Niagara near French Gulch, with Jesse Peters in charge.——The Midas mine, at Harrison gulch, has been unwatered after several months' work. The mill and cyanide plant are working, and 60 men are employed on the property. The Gladstone shaft is being sunk and 20 stamps are working.——Six feet of ore is showing in the American.

SISKIYOU COUNTY

(Special Correspondence.)—A 5-ft. shoot of $50 to $200 ore has been opened in the Homestake mine, Salmon River district. Specimens are on display in Yreka. The Homestake is owned by R. S. Taylor of Yreka.——The small prospecting mill recently installed at the Big Cliff mine is running on rich ore. Development of a large body of mill ore is under way, and a larger mill may be installed next spring. H. B. Wintering is superintendent.——A small force is working at the Highland, under the management of John Mattern.——The Siskiyou Syndicate is vigorously prosecuting work at its Cub Bear and Blue Jeans mines. At the Blue Jeans, on Russian creek, an adit is being extended on a large vein of mill ore, 6 to 30 in. of which contains rich quartz. Several shoots of good ore have been uncovered lately at the Cub Bear, on Cow creek. About 500 tons of ore are on the dump, and arrangements have been made for steady work all winter. The management contemplates installing a mill next summer. Charles Ritz is superintendent.——The Siskiyou Mines Co. is working two giants at the Williams Point placer property, and is handling good gravel. Sufficient water is available for a long run. H. W. Payne is superintendent.——The Highland quartz mine, in the Trail Creek field, has been purchased from the Denny-Bar Co. by John F. Bellman, of Oakland, and Richard Werst, of Trail Creek. The mill is being moved to a more convenient point, and a sawmill will be erected in the spring. The property has been a good producer.

Yreka, November 9.

The Victor Mining Co., of Los Angeles, is prospecting its claims on south Russian creek.——Rich ore has been cut in the Hickey mine by the lessees, Meand and Neilon. A mill is in operation.

SONOMA COUNTY

A graphite deposit has been discovered near Healdsburg.

TRINITY COUNTY

A mill is being erected at the old Democrat mine, three miles from Weaverville, by E. E. Harrigan.

COLORADO

LAKE COUNTY (LEADVILLE)

There is generally a shortage of ore cars during the winter in the district, but this will not happen this season, as the D. & R. G. railroad has added a long siding at the Ibex and Garbutt properties, with room enough to hold 50 cars.—Rich gold ore continues to be mined from the Jonny claim.——The outlook of the Twin Lakes and Lackawanna districts is good, and three properties are yielding high-grade ore.——The Lake Park area is attracting attention again by reason of lessees opening rich gold ore in an adit of the Laplander.

SUMMIT COUNTY

Gold sent to the Denver mint from the Breckenridge dredging companies, during the first three days of November, was worth $63,000. This was part of the October clean-up from the Tonopah placers and French Gulch ground.

TELLER COUNTY (CRIPPLE CREEK)

Three carloads, or over 100 tons, per week of ore is being shipped from the El Paso dumps by the lessee, John Sharpe. Concentrators are being installed to handle the poorer material, when the output will be considerably increased.

The 150-ton mill and cyanide plant for the Cripple Creek Cyanide Milling & Mining Co. will be built by the Colorado Iron Works of Denver. The cost is estimated at $70,500.

IDAHO

SHOSHONE COUNTY

The Sunset mine at Wallace was inspected by W. A. Clark, of Montana, two weeks ago. Large reserves of low-grade ore have been opened. Tests on the ore are being made in the new Elm Orlu mine at Butte, Montana. Eight feet of 40% zinc ore is showing in the silver table mine, east of Mullan.

The annual meeting of the Hypotheek Mining & Milling Co. was held at Wallace on November 17. The new shaft is 900 ft. deep, and the vein should be cut 85 ft. from the station just finished. Arrangements have been made to secure a millsite and right-of-way for a tramway from the mine.

In a rise in the Black Bear mine near Wallace there is 7 ft. of ore which assays up to 59% zinc, there being also some lead ore in the rise. According to the manager, Peter Bernier, a mill will be erected next spring.——In the Coeur d'Alene

company's claims, adjoining the Silver Cable, above Mullan, lead-silver ore is being opened.——Development in the Sonora is quite encouraging as the deeper ground is opened.

MICHIGAN

Houghton County

The Superior mine compressor house was burned on November 16. Boilers and other machinery were not damaged much. A blizzard was blowing at the time. The plant will be reconstructed and the mine closed for about a month.

The Mutual Line steamer *North Sea* is loading 5300 tons of copper at Lake Linden, or 600 tons more than that taken by the *North Star* last week. This cargo is worth about $1,245,000. The *North Lake* will load about 4000 tons of metal on November 30. The total movement for the season will amount to about 35,000 tons.

MISSOURI

Jasper County

In anticipation of better prices for their products, operators in the Missouri-Kansas-Oklahoma district are more active of late in prospecting by drilling and by other methods. Instances are the Lone Elm Development Co.'s claims northwest of Joplin, Rex Mining & Smelting Co. east of Joplin, the Continental Zinc Co., Twin Cities Mining Co., Granby Mining & Smelting Co., and the Cornfield Mining Co., at Miami, Oklahoma.

The American Zinc, Lead & Smelting Co. has ordered several water drills for use in its No. 3 mine at Carterville. This action results from the agitation against dust in the mines, while inspection of the district mines was started last week by E. Higgins, an engineer with the U. S. Bureau of Mines; A. J. Lanza, of the U. S. Public Health Service; and deputy mine inspectors, W. W. Holmes of Webb City, I. L. Burch of Joplin, and C. M. Harlan of Carterville. They are assisted by officials of the various cities in which mining operations are conducted and by officers of the Jasper County Tuberculosis Society.

MONTANA

Silverbow County

According to W. A. Clark, interviewed at Salt Lake City, the Timber Butte mill at Butte is giving excellent results. The recovery is over 93% and the concentrate averages 52% zinc. The suit between the Elm Orlu and Butte & Superior is to be heard on January 28, 1915, and Mr. Clark states that the ore-bodies are being studied by engineers for both sides.——In spite of difficulties in the Butte & Superior main shaft, retimbering is proceeding at a satisfactory rate. Four shifts of six hours each are employed, eight-hour wages being paid. Some changes are being made in the flotation plant in the mill.

NEVADA

The University of Nevada is discussing the problem of extending its work and opening about six schools of mines in the state, one of which would be at Tonopah, if the necessary legislation and money is obtainable.

Elko County

At a depth of 77 ft. in the Flaxie mine at Jarbidge, high-grade gold ore has been cut. There is said to be 250,000 tons of ore blocked out throughout the mine.——A 10-stamp mill is to be erected on the Bluster mine nearby. Also a 3500-ft. tramway and a sawmill of 5000-ft. capacity per day. The mine shows from 40,000 to 50,000 tons of ore. The General Engineering Co. of Salt Lake City states that 70 to 80% of the gold is recoverable by amalgamation. T. B. Beele is president at Salt Lake City.

Esmeralda County

A meeting of the Goldfield Merger Mines Co. was held at Goldfield on November 20. Future operations of the Company largely depend on results obtained by the Atlanta in proving the 1750-ft. level. The new pumps in the Merger are now working well. A. I. D'Arcy is general manager of both properties.——Developments in the Silver Pick are quite encouraging of late.——A 150-ft. winze is to be sunk from 700 ft. in the Keewenas, near the boundary of one of the Consolidated claims.——At the New Jersey mine, in the eastern part of the field, the main shaft is down 490 ft. It is to be sunk to 600 ft. At 400 ft., 500 ft. of work has been done, and 4 ft. of $5 ore cut. Harry Ernest is in charge.——Great interest centres in development in the Jumbo Extension.

Final returns of the Goldfield Consolidated mine for October are as follows, according to the assistant general manager, K. M. Simpson: mine development, 2874 ft. at a cost of $6.02 per foot; ore treated, 28,651 tons; net realization, $149,373; total costs, $6.66 per ton; lessees output, 1209 tons worth $20,262, of which the Company received $10,882, less transport and milling. In the Combination mine the 230-ft. level 292 Z sill was extended, and produced 275 tons of $53 ore. The M X sill at 245 ft. in the Mohawk gave 70 tons of $28 ore.

Nye County

Eight mines at Tonopah produced 46,954 tons of ore worth a total of $821,695 during October. The output last week was 10,428 tons valued at $203,664.——The Montana mill closed on November 21 for about 90 days.——A new melting furnace for gold precipitate is on its way to the Extension mill from the East. The West End Consolidated shipped 29 bars of silver, weighing 43,485 oz., on November 19.

WHOLESALE PRODUCTION OF SILVER AT TONOPAH. BULLION FROM THE WEST END MINE, 48,105 OZ. VALUED AT $35,581.

During the year ended September 30, the Jim Butler Tono-

pah Mining Co. produced 34,722 tons of ore valued at $744,799, or $21.45 per ton. The profit was $247,500, or $7.13 per ton, giving a cost of $12.18 per ton. The cash position at the end of the year was $185,780, loans on collateral, $230,780, and a large quantity of silver, making total cash resources of $325,000. Ore reserves consist of 33,000 tons blocked on four sides, also ore worth $500,000 in ground in dispute between the Company and the West End Consolidated.

The Round Mountain Mining Co., at Round Mountain, to operate its placer ground, is proceeding with the construction of a ditch. There will also be eight miles of pipe, costing about $50,000, the whole scheme to cost between $125,000 and $150,000. No contract has yet been let for the pipe. Ore worth from $20 to $40 per ton has been opened on the 800-ft. level of the mine. The main shaft is down 950 ft., showing $3 to $9 ore. James R. Davis is president.

At Manhattan, the Monitor-Belmont Mining Co. has ordered an all-sliming cyanide plant of 150-ton capacity. It will consist of the following: Blake jaw-crusher, ten 1550-lb. stamps, two 5 by 18-ft. tube-mills, and Dorr classifiers, thickeners, agitators, and continuous decantation, supplied by the Allis-Chalmers company.

UTAH

Utah mining men met in Salt Lake City last week to consider the scheme of sending a large delegation to the American Mining Congress at Phoenix, Arizona, on December 7 to 11. It is intended to try to have the 1915 meeting held at the Utah capital, also to make that city the permanent headquarters of the congress.

Beaver County

Placer land amounting to about 4000 acres is being transferred to a company backed by A. B. Shedd, W. D. Washburn, and C. C. Chapin of Chicago. Tests of the ground average $1 per cubic yard. Other large areas have been located, and Frederick Porter of Chicago has a three-year option on some claims for $100,000.

Juab County

The 1700-ft. level drift of the Eagle & Blue Bell has been started, and to reach the ore, about 300 ft. will have to be driven. The daily output is from 75 to 100 tons.——At the Yankee Consolidated, work during the current year has been mostly at 1700 ft. At 2000 ft. east of the shaft 12 to 40 ft. of quartz formation was opened by a rise to 230 ft. above this level, assaying 1 to 4% lead, 2 to 16 oz. silver, and some gold. It improves in value as development proceeds. Other prospecting is encouraging.

A statement of the situation of the Knight properties shows that the Iron Blossom company has a surplus of about $300,000; Colorado, $86,000; and Beck Tunnel, $27,000. Diamond-drilling is to be done from the 1900-ft. level of the Iron Blossom.——Twenty-six lessees are working in the Eureka Hill mine, in charge of the superintendent, Charles Baker.——The Utah Power Co. is making extensive improvements in Tintic.

Salt Lake County

The Ohio Copper Co.'s affairs are still the subject of considerable discussion. George Baglin, former general office manager of the Company, states that the property is being prepared for sale instead of reorganization, and labor claims for $110,000, as published, are less, being only $37,790. Supplies at the mine and mill are worth $56,099, and on September 17 there was on equity in copper with the American Smelting & Refining Co. on 3,872,475 lb. of metal, on which the advances, smelting, and other charges totaled nearly 8c. per pound, so the Company's equity would be whatever the copper was sold for in excess of this amount, which would be greatly in excess of the obligations of the Company.

Utah County

A rock asphalt deposit is being mined by J. W. Mellen at Thistle, south of Salt Lake City, the product used in paving streets in the latter city. The daily output is 75 tons, the material being extracted by adits. George Fuerman is superintendent of the mine.

WASHINGTON

Okanogan County

A 50-ton mill and other equipment, costing $25,000, are to be erected by the Rich Bar and Golden King companies at Oroville, according to J. W. Douglas of the former. Both properties are opening satisfactorily and others are promising.

Stevens County

A 4-drill compressor, 85-hp. boiler, 25-hp. mine hoist, and lighting system have been sent to the Hecla mine at Chewelah, controlled by Spokane people. Fred F. Foster is manager.

CANADA

Ontario

A three months' extension of time, from August 15 to November 15, in which to do assessment work was granted by the minister of lands, forests, and mines, and another six months' extension, to April 15, 1915, has also been allowed.

The Dominion Steel Corporation reports for the six months ended September 30 as follows: net earnings, $2,106,771; sinking funds, etc., $484,705; interest, etc., $927,981; preferred dividend, $210,000; preferred dividend on coal company, $105,000; surplus, $379,084; surplus on April 1, $796,907; and total surplus, $1,175,991.

The Dome mill in October treated 22,500 tons of ore averaging $4.70 per ton. This is the largest tonnage for a month.——It is expected that the McKinley-Darragh company will exercise its option on the Jupiter mine, as development has been satisfactory. Work is concentrated on the vein on the 400 and 475-ft. levels.

The Seneca vein in the Cart Lake lease has yielded about 125,000 oz. of silver, and has paid for the mine's development. The shoot is practically worked out. Six tons of 2000-oz. ore was extracted from the 335-ft. stope last week, and sent to the Nipissing mill.——The Seneca Superior company will pay a 10% dividend, equal to $47,638, on December 15. The total since 1913 is 135% and $643,218.

The Department of Mines of Ontario has published the following data covering nine months of 1914: gold, 196,934 oz.; silver, 19,448,018 oz.; copper, 11,585 tons; nickel, 18,085 tons; iron ore, 165,759 tons; pig iron, 495,161 tons; cobalt, 95 tons; and cobalt and nickel oxide, 852,014 pounds.

MEXICO

Sonora

At Nacozari the 2000-ton mill of the Moctezuma Copper Co.

MOCTEZUMA MILL, NACOZARI, SONORA.

is treating about 1600 tons per day. Experiments on flotation processes are being made.

PHILIPPINE ISLANDS

In *The Philippine Journal of Science* for June is a paper on 'The Iron Ores of Bulacan Province,' by F. A. Dalburg and Wallace E. Pratt. It is accompanied by one map, six plates, and six text figures. Besides the authors, some field work was done by Warren D. Smith and Feliciano Noble. The work was to make a study of the geology of the ore deposits, their extent, factors affecting mining and smelting, and the native smelting processes, with a view to improvement and expansion. The field work was very difficult on account of the heavily wooded, mountainous, and almost impassable region, and a lack of an accurate map. In their summary, the authors state that the ores are situated on the edge of the eastern cordillera of Luzon. The orebodies are not continuous, but are at intervals of about 15 kilometres (9 miles). They occur at the base of the Miocene sedimentary rocks. Intrusive rocks in the form of dikes are found in proximity to the deposits. The ores consist of magnetite and hematite in intimate mixture, quartz being the most abundant gangue mineral, while pyrite is common. Those mined at present average over 60% iron, and sulphur and phosphorus are not too high. There is probably over 1,000,000 tons in sight, but definite estimates could be made at little cost for exploration. Filipinos mine and smelt the ore at present for

TYPICAL FOREST-COVERED SLOPE IN IRON ORE REGION, MT. MAYAPO, PHILIPPINE ISLANDS.

agricultural implements. The industry dates back to 1664. These ores might be exploited on a larger scale by electric smelting, hydro-electric power, charcoal, and fluxes being available. The situation of the deposits in a difficultly accessible region makes them less readily available than other known ores in the Philippines. The smelting practice obtaining is fully described, and in 1913 there was 55 tons of ore treated, yielding 227 tons of cast iron. The output since 1664 is estimated as 13,960 tons of ore for 4617 tons of iron worth ₱754,949.

During October, two boats of the Philippine Dredges, Ltd., recovered 736 oz. gold, and one boat 39 oz. The latter was stopped for repairs to a boiler. No. 4 has started work.

THE ENGINEERING DEPARTMENT of the University of Idaho, at Moscow, entertained mining men of the Northwest on November 21. Co-operation in university research was discussed.

THE ILLUMINATING ENGINEERING SOCIETY, Chicago branch, met on November 24, when S. E. Doane gave an address on 'Electric Light—A Factor in Civilization.'

THE UNIVERSITY OF WASHINGTON COLLEGE OF MINES' quarterly *Bulletin* gives details of the faculty, courses, and other information for the 1914-15 year.

THE MACKAY SCHOOL OF MINES OF THE UNIVERSITY OF NEVADA has just added a Sperry filter-press and accessories to its cyanide plant.

PERSONAL

E. B. KIRBY is in New York.

S. H. HALL is back in New York.

H. C. BELLENGER is at Rancagua, Chile.

F. J. DENNIS has returned to San Francisco.

J. F. CALLBREATH has returned to Washington.

HENNEN JENNINGS was in New York last week.

E. P. MATHEWSON has been in San Francisco this week.

T. T. READ visited Baltimore and Washington this week.

D. C. JACKLING was in San Francisco last week and has gone to Ely.

THOMAS NORTON TURNER has returned to San Francisco from Nikolaievsk.

WILLIAM A. PRICHARD was in New York and will sail for London on November 28.

W. SPENCER HUTCHINSON has been studying the Sunflower quicksilver district of Arizona.

A. M. WALSH has recently taken charge of the Pioneer Gold Co.'s mines at Towle, Placer county, California.

R. B. LAMB has returned from Renfrew county, Ontario, after examining molybdenite deposits, and is now in Cobalt.

R. H. ERNEST, superintendent of the Round Mountain Mining Co., with headquarters at Round Mountain, is at Goldfield.

GEORGE A. GUESS was in New York recently, returning from Anyox, British Columbia, where he has been studying metallurgical problems.

ROBERT STICHT is in New York, and will speak before the New York section of the American Institute of Mining Engineers on December 2.

H. W. TURNER is expected in San Francisco before Christmas. When last heard from he was bound for London by way of Petrograd and Norway.

E. S. BARDWELL will be in San Francisco for the next year in connection with the exhibit of the Anaconda company at the Panama-Pacific International Exposition.

BERNARD MACDONALD is at Tombstone, Arizona, conducting experimental work in cyanidation on the ores of the mines recently purchased by Phelps, Dodge & Company.

JOHN A. SCHROEDER has resigned as general sales manager for the Hyatt Roller Bearing Co. of Chicago, Detroit, and Newark. His successor has not yet been appointed.

JAMES S. DOUGLAS has resigned as general manager for the Greene Cananea Copper Co. and it is understood that the active management of the property will again be under the direction of L. D. RICKETTS at the first of the year, when it is stated, operations at the property will be resumed.

Obituary

JAMES RAY WHIPPLE, who died of abdominal cancer, November 7, was one of those men who had in a peculiar degree the faculty of winning the affections of men. He was a famous football player while a student in the University of California, and a teammate of B. L. Thane, with whom he was later associated in mining in Alaska. Born in Alameda county, California, in 1873, he was educated in his native state and went from there to Alaska, where his whole professional career was passed. At the Eagle River and Kensington mines he showed marked ability, and it was natural that when Mr. Thane took hold of the Alaska Gastineau, Whipple should be made his assistant. He was an important factor in the rapid merging of individuals into a staff that was necessary in the work since accomplished at Juneau, and his death is keenly regretted.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

LOCAL METAL PRICES

San Francisco, November 25.

Antimony	15 —15¾
Electrolytic copper	13 —13¼
Pig lead	4.15— 5.10
Quicksilver (flask)	$55
Tin	34½—36
Spelter	6½— 6¾
Zinc dust, 100-kg. zinc-lined cases	10

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, November 25.—Prices today are as follows: copper, strong at 12.25 to 12.50c.; lead, firm at 3.90c.; and spelter, quiet at 5.10c. per pound.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59.32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58.52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The silver market has been steady and stronger during the past week. Prices were as follows: New York, 49.50, 49.12, 49.48, 48.87, and 49.37c.; and London, 22.87, 22.75, 22.62, and 22.81d. per ounce. The steamer 'Siberia' took silver worth $97,413 (say 200,000 oz.) to the Orient on November 21. Metal is being stored at many silver-producing centres. As an instance of this, the Jim Butler company of Tonopah had 275,456 oz. on hand on October 1, according to its annual report just published. In discussing the recent slump in silver prices, Samuel Montagu & Co. of London states that the regular decline was checked by a cessation of sales from America. This happened to coincide with a recrudescence of buying orders from the Indian Bazaars, which came on a limited market, making a sharp rise. A temporary contraction of supplies, however, only imparts artificial strength; it does not create a market. To be galvanized into life, the market requires a continuous and substantial revival of Eastern demand. The shortage of exports to the East, up to November 5, compared with last year is £5,032,000, or say 50,000,000 oz. This explains the heaviness of the market. Crops in South Manchuria have been poor, and the purchasing power of the Chinese is greatly lessened.

COPPER

Prices of electrolytic in New York, in cents per pound.

Average week ending

Nov. 19	11.75	Nov. 25	12.25 to 12.50

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

Buying was stronger last week, and the reduced output of the metal is now visible in refinery outputs. The price advanced throughout the week, being 12.50c. at the close. Export demand from England and France was good; and some orders from Italy have been booked, though no arrangements are ready for sending copper forward to that country. According to Henry R. Merton & Co., of London, European visible supplies on October 31 totaled 36,566 tons, an increase of 1972 tons. On November 15 these amounted to 30,482 tons. The average for electro in October was £53 3s. 5d. per ton, or 11.39c. per pound. Present prices are £58 5s. per ton. The Sulitjelma mine in Norway produced 1785 tons of copper concentrate in October.

CYANIDE

An interesting note on this salt appears in the New York letter of this issue.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Monthly averages.

Date.		Average week ending	
Nov. 19	3.90	Oct. 14	3.75
" 20	3.90	" 21	3.50
" 21	3.90	" 28	3.50
" 22 Sunday		Nov. 4	3.50
" 23	3.90	" 11	3.50
" 24	3.90	" 18	3.70
" 25	3.90	" 25	3.90

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.36	3.86	Oct.	4.37	3.60
May	4.34	3.90	Nov.	4.16	....
June	4.33	3.90	Dec.	4.02	....

Lead is firm at St. Louis at 3.80 to 3.82½c. per pound. London, £19 5s. per ton. Spot lead has commanded a good premium in England, owing to Russian demand absorbing stocks available for immediate shipment. The average price in October was £17 9s. 10.6d. per ton.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slighly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Monthly averages.

Week ending			
Oct. 29	50.00	Nov. 12	55.00
Nov. 5	55.00	" 19	55.00
		" 25	55.00

Monthly averages.

	1913.	1914		1913.	1914
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mar.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	53.00
May	40.25	39.00	Nov.	39.40	....
June	41.00	38.60	Dec.	40.00	....

The quicksilver market is strong at $55. In London quotations have eased from £11 to £10 5s. and £10 10s. per flask.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36.10	Oct.	40.61	30.40
May	49.10	33.29	Nov.	39.77	....
June	45.10	30.72	Dec.	37.57	....

A good deal of business has been done in this metal, and wholesale lots are about 32.60c. per pound. Up to November 20, arrivals of tin in New York totaled 1395 tons, and a further 2580 tons was due by the last day of the month. London prices are £138 10s. to £140 per ton. Tin mills in West Virginia have been resuming work lately.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound

Monthly averages.

Date.		Average week ending	
Nov. 19	5.10	Oct. 14	4.55
" 20	5.10	" 21	4.73
" 21	5.10	" 28	4.90
" 22 Sunday		Nov. 4	4.90
" 23	5.10	" 11	4.85
" 24	5.10	" 18	5.00
" 25	5.10	" 25	5.10

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	4.75
May	5.23	4.91	Nov.	5.09	....
June	5.00	4.84	Dec.	5.07	....

Spelter is firm at St. Louis at 5.15c. per pound. London, £25 5s. per ton. The English market has been quiet. Average price for October was £23 13s.6.3d. per ton.

COMPANY REPORTS

BUTTE & SUPERIOR COPPER COMPANY, LTD.

The third quarterly report of this great zinc producer at Butte, Montana, shows the following results.

Details of operation.	Third quarter of 1914.	Second quarter of 1914.
Development, feet	5,309	4,885
Ore milled, tons	100,600	95,500
Average zinc content, per cent	18.582	18.282
Average silver content, oz. per ton	8.636	9.847
Concentrate produced, pounds	60,974,968	57,824,296
Average zinc content, per cent	54.32	53.24
Average silver content, oz. per ton	24.15	26.36
Metal in concentrate, pounds	33,121,312	30,786,658
Extraction, per cent	89.14	88.17
Cost of mining, per ton	$3.201	$3.138
Cost of milling, per ton	$2.049	$2.023
Net value of all products, etc.	$1,027,576	$805,866
Profits, including metal inventories, $50,000 and $60,000	$554,136	$372,984
Average price of spelter, cents per lb.	5.11	4.94

After paying the quarterly dividend of 75c. per share the cash on hand at the end of the quarter was $808,761, and the net current and working assets, including products in transit, $1,327,153. The mine and mill are at present closed, owing to repairs to the main shaft between the 300 and 700-ft. levels, as has been mentioned in the *Press* of a previous issue.

MASCOT COPPER COMPANY

This Company operates at Dos Cabezos, in Cochise county, Arizona, and the report of the general superintendent, F. L. Sizer, to the general manager, Charles V. Weston, covers the year ended September 30, 1914.

Development in the mine totaled 4681 ft., also 662 ft. assessment work on unpatented claims. With a reduced force, the past six months has averaged 500 ft. per month underground. Diamond-drilling amounted to 8019 ft. at $2.11 per foot. Twenty-six holes were drilled, of which eleven cut vein formation or ore, and showed the proper direction for drifts and cross-cuts which opened large orebodies. Only one drill was worked during the past seven months.

The Iron Tower orebody has been blocked out for a vertical height of 280 ft. above and below the 200-ft. level, and on four different levels. It is estimated that there is 500,000 tons of ore in this shoot, and additional ore should be proved above the 100-ft. level. This level has been connected with the Oregon shaft, and from this level rises will be driven to the limit of the sulphide ore zone. Levels from these rises will determine the lateral extent of the orebody.

No. 1 and 2 shafts were sunk from the Consolidated adit late in January, since which time work has been done at 600 and 800 ft. resulting in the following discovery: From the 600 and 800-ft. levels, besides opening ore, suitable stations will be available for diamond-drilling. Water-level should be near the 800-ft. level. The total ore reserves are estimated at about 750,000 tons, and before long the mine will be able to produce 100 tons per day, to be increased shortly after to 200 tons. Improvements to equipment include 900 ft. of 4-in. air-pipe, and a large hoist and pump for No. 2 shaft. On the 600-ft. level of No. 2 shaft, No. 1 vein was cut, showing 10 ft. of mixed chalcopyrite and bornite assaying 9.6% copper and $3 per ton in gold and silver, also 16 ft. of formation containing a little copper.

MINERAL STATISTICS

The production of metals and metallic ores in 1912 and 1913, as compiled by J. P. Dunlop, has been published by the U. S. Geological Survey. The following table shows the ores extracted from domestic mines during the past three years:

Ores.	Short tons. 1911.	1912.	1913.
Iron	46,023,540	63,859,728	66,800,270
Manganese	2,752	1,864	4,533
Manganiferous iron	3,006	3,247	10,808
Chromium	134	225	286
Tungsten	16,500	34,000	34,400
Titanium	.....	6,900	7,600
Aluminum	174,292	179,049	235,470
Gold	9,884,684	9,736,203	9,403,622
Silver	739,200	848,574	1,253,116
Quicksilver	138,525	155,693	136,278
Tin	42,200	3,000	7,500
Vanadium and uranium	8,468	18,000	27,900
Antimony	.....	.....	116
Copper ores:			
Western states	18,207,566	23,431,301	28,427,543
Central states	10,978,827	11,411,941	7,016,831
Eastern states	801,842	830,089	892,308
Total	29,988,235	35,673,331	36,336,682
Copper-lead ores	6,923	14,614	24,399
Lead ores:			
Western states	2,157,817	2,388,598	2,563,904
Central states	3,794,712	4,064,366	4,250,800
Total	5,952,529	6,452,964	6,814,704
Zinc and zinc-lead ores:			
Western states	1,356,781	1,344,222	1,658,486
Central states	10,629,269	11,899,185	10,767,340
Eastern states	413,332	497,832	692,348
Total	12,399,382	13,741,239	13,118,174
Grand total	105,380,370	130,728,622	134,215,858

The total value of metals reduced from these ores in 1913 was $855,351,064, compared with $834,520,702 in 1912.

If the degree of activity of the building industry is taken as an index to prosperity, figures gathered by the Survey, of building operations in 1913, show that prosperity is sporadic. In 48 of the largest cities of the country, the total cost of building operations in 1913 was $659,515,746, compared with $738,989,710 in 1912. The greatest decrease was in New York City, $56,414,655. The largest increase was in Chicago, $6,492,527. New York City is the leading city in the cost of building operations, notwithstanding its large decrease in 1913. Last year the building operations of that city cost $107,104,707. The maximum annual cost of building operations in New York City was reached in 1909, when it was $186,047,477. Efforts were made to obtain detailed information for all cities of 35,000 or more inhabitants—157 in number. Information was obtained from 147 of these cities in sufficient detail to permit the compilation of statistics. In these building operations in 1913 cost $859,657,250. In 108 of these cities the new wooden buildings erected in 1913 cost $174,197,886 and new brick buildings cost $226,478,584. All other new buildings cost $115,894,022. The cost of all additions, alterations, and repairs was $78,483,933. New concrete buildings were reported by 71 cities, of which Philadelphia was the leader, reporting a cost of $4,634,855, and San Francisco was second, with $3,745,389.

RECENT PATENTS

1,114,055.—Metal Alloy. Edward Smith, London, England. A white metal alloy consisting of copper, 40; nickel, 8½; zinc, 5; tin, 2½; and lead, 1 part.

1,115,263.—Metallurgical Furnace. Utley Wedge, Ardmore, Pennsylvania. A metallurgical furnace having a central shaft and an outer casing, one rotatable in respect to the other, overlapping hearths carried respectively by said central shaft and outer casing, and rabbles depending from said hearths and serving to move the material over the same.

1,114,224.—Filter-Leaf. Newton A. Burgess, New York, N. Y., assignor to Butters Patent, Vacuum Filter Co., Inc., a corporation of Nevada. A filter-leaf comprising a frame, a filter medium mounted thereon and a pipe having a substantially straight portion adjacent to said medium and open at the bottom, said pipe being arranged so that the opening therein is beneath the surface of a cake formed on said medium.

1,115,531.—Apparatus for Grinding Ores and Other Materials. Harry W. Hardinge, New York, assignor to Hardinge Conical Mill Co., New York, a corporation of New York. In a mill for the purpose described, the combination with a drum provided with inlet and outlet openings, and means for rotating the drum about its longitudinal axis, of continuously operating automatic means for raising the outlet above the inlet opening and also lowering the former while the drum is revolving.

1,114,096.—Miner's Blasting Box. Joseph Benneck, Nanticoke, Pennsylvania. A blasting box, including a casing, a battery by the casing, wires forming a circuit connected to the battery, said circuit being broken at two points, a circuit closer adapted to close the circuit at one of said points, a lock having a bolt projectable to close the circuit at the other of said points, and said bolt acting as a conductor, and a key for operating the bolt, said key being withdrawable from the lock only in the open circuit position of the bolt.

1,114,935.—Process and Apparatus for Sizing or Classifying Comminuted Materials. Henry M. Sutton, Walter L. Steele, and Edwin G. Steele, Dallas, Texas. The process of sizing a mass of pulverulent material, consisting in feeding the material dry upon a continuously moving tranversely inclined roughened supporting surface, imparting to said mass an accelerated movement in the direction of its travel by gravity, causing the components of said mass to deviate from the line of normal movement contiguously at angles proportionate to their sizes, and separately collecting the sized particles.

1,114,036.—Metallurgy of Zinc. Augustin Leon Jean Queneau, Torresdale, Pennsylvania, assignor to Queneau Electric Zinc Furnace Co., Philadelphia, Pennsylvania, a corporation of Delaware. Extracting and recovering zinc from zinc ore, which consists in preheating said zinc ore, separately charging into a reducing furnace the ore in the preheated state and a reducing agent, intimately mixing them within the furnace, subjecting the mixture to a reducing atmosphere and a reducing temperature with exclusion of air, thereby releasing the zinc in the form of zinc vapor and condensing said vapor to the metallic state.

1,115,521 and 1,115,522.—Process of Extracting Copper from Carbonate and Oxide Ores. Henry R. Ellis, Salt Lake City, Utah. The process of extracting and recovering copper from its carbonate or oxide ores or from materials containing the carbonates or oxides of copper, which consists in subjecting such ores or materials to the action of a solution containing an alkaline carbonate or bicarbonate as described, separating the copper charged solution from such ores or materials and precipitating the copper from such solution by means of metallic lead; or by subjecting the same to the action of a cathode, consisting of mercury in combination with an insoluble anode.

1,113,323.—Treatment of Refractory Ores. John Foye, Henry Egbert Moore, and Robert Boyle, Johannesburg, Transvaal, South Africa, assignors to Refractory Ores, Ltd., Johannesburg. The process of treating refractory ore for the purpose of rendering it amenable to ordinary extraction methods, which consist in subjecting the ore in admixture with a solution of the salt of an alkaline metal which is substantially a non-solvent of gold, to the passage of an electric current, whereby the acid component of the solution separates in proximity to the ore and the alkaline component away therefrom, and subsequently separating the ore and solution.

MINING DECISIONS

Oil Lease—Improvements Made Under

Where lessees went into possession of oil land with actual notice of the adverse claims thereto of another, and, notwithstanding such knowledge, proceeded to expend considerable sums of money in boring wells and developing the property, they are not entitled to recover the value of such improvements made on the asserted ground even if they had made them in good faith without notice.

Loeb *v.* Conley (Kentucky), 169 Southwestern, 575. October 6, 1914.

Merchantable and Minable Coal

In an action on a contract for minimum royalty on coal not mined, where the contract provided that all 'merchantable and minable' coal should be mined, it was held that the defendant was entitled to show in defense of its contention that the coal left in the mine was neither 'merchantable nor minable' the condition of the coal, its distance from means of transportation, overhead and administrative charges, and the market price obtainable, as factors to be considered in arriving at the determination of the question.

Ellis *v.* Cricket Coal Co. (Iowa), 148 Northwestern, 887. September 30, 1914.

Coal Mining Lease—Construction

Where a corporation, which succeeded to the rights of the lessee in a coal mining lease, resisted a suit by the lessor for a forfeiture of the lease, obtained and acquiesced in a decree denying a forfeiture, referring the case to a master to compute the amount due the lessor under the terms of the lease and making it a lien, and continued to mine and remove coal for two years with as full knowledge as the lessor as to the conditions and extent of the coal underlying the property, and until it became hopelessly insolvent through no fault of the lessor or failure of the mine, it is estopped to ask a cancellation of the lease or an abatement of the bonus agreed to be paid for the mining right, on the alleged ground that the quantity of coal was misrepresented by the lessor.

Browning *v.* Boswell (Virginia), 215 Federal, 826. June 9, 1914.

New Machines and Devices

Small Stamp-Mills

The prospector and small mine operator in his efforts to mine at a profit in out of the way places has troubles which are real when handicapped by lack of funds for development work and elaborate milling equipment. To meet this requirement, miniature but practical milling plants have been designed which can be transported on mule-back, erected, operated, and moved to another locality if occasion demands, at small cost. The illustrations presented are of two such plants of the one-man variety which are being profitably operated. Both of the mills shown were made after patented designs of E. H. Moyle and supplied by the E. H. Moyle Engineering & Equipment Co. of Los Angeles. The mill shown in the left of the halftone is in the Wickenburg district of Arizona and will be seen to be not much larger than the operator.

TWO MINIATURE STAMP-MILLS OF THE 'ONE-MAN' VARIETY.

In the design of a miniature mill which will be both practical and efficient and at the same time cheap and easily transported, special construction is necessary in order that the mill may not shake to pieces and will crush fine a sufficient tonnage to make it a profitable investment. While the principle is the same as in the 1800-lb. stamp, there are many features which make it a distinct machine. The mills shown are one-stamp mills with steel frame, self contained, with an automatic ore-feeder attached, and are so simple in construction and operation that one man can operate them. One of the features of the miniature stamp-mill that is of special interest is the method of feeding the ore, it being fed by a patent arrangement on the entire periphery of the solid die as commonly used and not entering the mortar from one side as is the common practice. The ore is fed evenly around the stamp as the stamp rises, and the discharge is also on all sides of the stamp through the circular screens about the mortar. This is for the purpose of increasing the mill capacity and reducing the losses due to sliming. The frame, it will be seen, is of steel and carries both stamp and feeder. A heavy spring arrangement is fastened on the stem which materially accelerates the dropping force of the stamp. The stamp drops from 150 to 175 times per minute. High speed in the small mills has been found desirable from both a capacity and efficiency standpoint. Difficulty was experienced in the operation of the mill at Wickenburg due to the lack of water, which had to be hauled to the property at a cost of $1.50 per barrel. The operator has overcome this by collecting the surplus water and pumping it back with a small centrifugal pump which is driven by the 2-hp. engine which drives the mill. The ore treated is a hand-picked ore averaging $87, and the extraction inside the mill and on the plates is $79, while the operating expenses, except labor, total 65c. per day, including fuel for engine, shoes, dies, screens, and other expenses.

The illustration on the right of the halftone is of a portable mill of a larger size of the same design, which has been erected on a waste dump in San Diego county, California. The practice here is first to screen the material over a grizzly, after which the fine material is delivered to the automatic feeder of the mill, one man being easily able to operate this mill. The capacity of the mill crushing fine is from 4 to 8 tons per day. The construction of this mill is similar in every respect to that at Wickenburg and it was also built by the E. H. Moyle company.

The mills are especially designed for prospectors and operators of small means, as the total cost of the mill is most insignificant compared to the cost of the average mining plant. They have proved in many instances to be both practical and profitable for the small operator. They are also recommended as a help in enabling the owner of small means to raise funds for development work and a larger plant.

Commercial Paragraphs

STANDARD GAS ENGINE Co., San Francisco, California, has issued Catalogue No. 12, which is most attractively printed and devoted to the various products of this Company, which include marine, stationary, hoisting, and portable engines.

NATIONAL TUBE Co., Pittsburgh, Pennsylvania, is distributing a new folder descriptive of the Kewanee union. The following advantages are claimed for this union: one nipple, time required for making one less joint, one gasket, time required for cutting and fitting gasket, and cost of one malleable union, or in other words an average net saving of 16 cents.

STEVENS FIREARMS & TOOL Co., Chicopee Falls, Massachusetts, in Catalogue No. 53 describes in a general way with illustrations the different firearm products of this Company. The aim of the Company has been to present a catalogue that will concisely show the large line of sporting firearms and specifications of each model, and to eliminate lengthy descriptions and detailed information.

THE HOLT MANUFACTURING Co., Stockton, California, has published a catalogue devoted to the 'Baby Caterpillar' tractor machine manufactured by this Company. While the 'Baby' tractor is used largely for small farms, orchards, and vineyards, it also has a wide application in the field of hauling. The 'Baby' is a 30-hp. machine which is proving itself a valuable asset in various industries where heavy work is demanded.

SULLIVAN MACHINERY Co., Chicago, Illinois, has published Bulletin 58-M, which is devoted to the Sullivan cross-compound power-driven air-compressor. These high-duty air-compressors may be driven by belt pulley, by an electric motor mounted on the crank shaft, or by an impulse water wheel. They are built to displace capacities ranging from 1200 to 3000 cu. ft. of free air per minute, in a variety of cylinder size combinations for terminal pressures from 60 to 150 lb. per square inch.

MARK MANUFACTURING Co., Chicago, Illinois. 'The Mark Cold-Drawn Steel Union' is the title of a new publication of this Company. This union is composed of the three usual parts, the bottom, the thread end, and the coupling nut. All of the parts of the Mark union are made by the same process, that is, drawn and pressed from cold flat steel, by a series of operations performed in powerful presses. The publication is fully illustrated, showing the process of manufacture of these unions.

The TRAYLOR ENGINEERING & MANUFACTURING Co., Allentown, Pennsylvania, has entered into a contract with the Knight-Christensen Metallurgical Co. for the exclusive manufacture and sale of the patented apparatus owned by the Company and used in the Knight-Christensen process. The Pennsylvania company is extensively engaged in the manufacture of smelting and milling apparatus and the taking over of the manufacture of the Knight-Christensen machinery by this Company adds another line to the Company's many products.

The CLEVELAND ROCK DRILL Co., Cleveland, Ohio, has for distribution Bulletin No. 33, which is devoted to a discussion of Cleveland hand rotated hammer drills. These drills are made in three sizes and adapted to mining, quarrying, and construction work. The material used in their manufacture is selected with special reference to the service required. The forgings are made in the shops of the Company and are heat treated as soon as made and again after being partly machined. Each of the machines is designed to give the best service when operated at an air pressure of 80 lb. at the drill. The Company maintains an engineering service which is available to the users of drills.

The BUCYRUS Co., Milwaukee, has in operation two dredges, the *Gamboa* and *Paraiso* at Culebra cut, Panama, which are described in *The Excavating Engineer* for November. These dredges are the most powerful in the world. The pontoons were towed to Colon and the gear assembled there. Each boat has a displacement of 1500 tons. The boom with its machinery weighed 66.5 tons and the dipper handle 40.5 tons. Since the dredges started work they have been digging an outcrop dike of trap rock, and during the 30-day test the *Paraiso* lifted several 10 to 30-ton boulders each day, and one of 50 tons weight. The capacity of the dredges is now up to 125,000 cu. yd. per month, the work being of the severest character.

ALLIS-CHALMERS MANUFACTURING Co., Milwaukee, Wisconsin, has just issued Bulletin No. 1088, which is devoted to distributing transformers. In these transformers there are three cooling surfaces, instead of one as is the common practice, together with a continuous natural circulation of the oil. The transformers are of the so-called core type, having a single magnetic circuit with the coils wound on the two longer legs of the rectangular shaped core. The Company also has for distribution a new bulletin, No. 1089, which is devoted to reversing motor planer drives. The motor and control equipment are designed as one operating unit and the apparatus has been designed to give the best service both mechanically and electrically for the precise character of the work to be performed.

PELTON WATER WHEEL Co., San Francisco, California, tiennes para distribucion un boletin 'La Rueda Hidráulica Pelton' de las que hay millares en uso en todos partes del mundo, proporciona la fuerza motriz mas barata y segura. Su formacion es muy sencilla y sus partes de trabajo consisten de una rueda á cuyo borde se han unido tazas ó cubos de patente. Un chorro de agua saliendo de un boquerel y dando en el centro de los cubos produce el movimiento de rotacion el que á su vez es trasmitido por medio de correas y poleas á la maquinaria que se desea mover. Las Plantas de fuerza motriz hidráulica consisten generalmente de tres partes separadas: (1) la acequia ó canal para llevar el agua desde la fuente de abastecimiento á la toma; (2) la tubería de acero que lleva el agua cuesta abajo desde la toma á la rueda hidráulica; (3) el edificio dónde se instala la rueda hidráulica y la maquinaria que se ha de mover con ella. En muchos casos no hace falta acequia ó canal, siendo la tubería solamente la que lleva el agua desde la fuente de abastecimiento á la rueda. Tampoco es siempre necesario que el edificio dónde se tiene la rueda hidráulica contenga tambien la maquinaria que esta mueve. Cuando por cualquier razon se desee colocar la rueda hidráulica en un edificio separado del de la maquinaria que esta mueve, la fuerza motriz puede trasmitirse ya sea por medio de correaje, cable de alambre, ó Manila, ó bien por medio de trasmisión eléctrica. Los factores que deben considerarse para determinar el método mas apropiado para trasmitir la fuerza motriz son muchos y asi las personas que deseen comprar ruedas hidráulicas deben dirijirse pidiendo información á la Pelton Water Wheel Co. de San Francisco, California, ó Nueva York, E. U.

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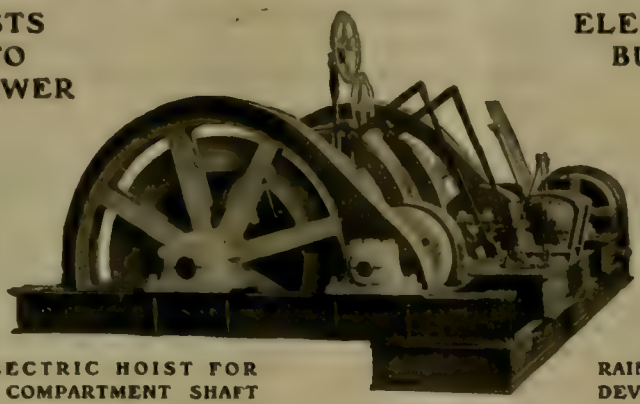

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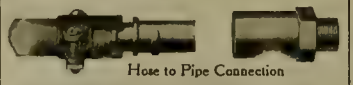

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EDITORIAL

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MERIT rating is being applied slowly to workmen's compensation as well as to fire insurance. In whatever insurance plans the California mine operators adopt, the merit system will have large place. This is as it should be. The operator who protects his workings has a smaller risk and should have a lower rate.

PROMPT results have followed the conference of the Industrial Accident Commission and California mine operators. The Commission has submitted a proposal to furnish insurance, practically at cost, whenever the mine operators shall combine to furnish a business amounting to $100,000 per year in premiums. The amount now paid is several times that sum, so it would seem that such a combination is possible.

SUGGESTIONS as to possible oil and gas territory in northwestern Missouri and northeastern Kansas are made in a recent report of the United States and the Missouri Geological Surveys. While the prospects are not thought to be especially brilliant, the more favorable areas are noted. Many years ago Mr. J. E. Todd pointed out the presence of anticlines along the Missouri, and later Mr. W. H. Norton, of the Iowa Geological Survey, discussed the structure of the region. A deep well at Glenwood, Iowa, gave negative results, and one drilled at Nebraska City in 1906 was unfortunately located in the middle of a syncline. Other attempts were equally unsuccessful. The territory is worthy of a test, but needs more care and knowledge than has yet been developed.

GRADUATES of the College of Mines of the University of California have played a notable part in development and management of the world's great mines, and in many countries news of the death of S. B. Christy, dean of the college since 1879, will come with the shock of the loss of a personal friend. In these days of quick change it is rarely that a man stays so long in one position, but when he does the cumulative force of his years of work becomes overwhelming. Christy used this power which the years brought to him for the school and the profession rather than for himself. Indeed, his whole life was devoted to the school over which he so long presided. At another time we shall present a more detailed account of his career. Now we extend our sympathy, and express that of the mining profession, to his widow and children.

RIGHT-OF-WAY through New Keystone ground for a tunnel was refused the Inspiration Copper Company by the Supreme Court of Arizona, on the ground that the proposed use was private and not public.

A MODIFIED decree regarding smelter smoke has been issued, by stipulation, by the United States District Court at Salt Lake City. The most noticeable feature of the new decree is that definite provision is made for an inspecting committee with expert service. It is believed that the new decree will permit more activity at the lead plants and will also protect the farmers. The report of the Selby commission has been formulated and will be presented to the court next week. Judge Van Fleet, of the District Court at San Francisco has adjourned the hearing on the Shasta County fume cases until he can investigate conditions on the ground.

IN a recent address by Mr. M. W. Mix, president of the Dodge Manufacturing Company, on the subject of the development of trade with South America, Mr. Mix points out that there is a right and a wrong end at which to begin, and urges that buyers rather than sellers be sent out as the commercial missionaries into those countries south of us. Mr. Mix said in part: "Our business affairs have been considerably upset by the European war, but its effects have been far more severe upon South America. What would be our local situation today if every Chicago bank were owned by English, French, and especially German, capitalists, and if our industries were mainly based on such investments? That is largely the situation of Latin America. Her people wish to buy, but the markets in which they have been accustomed to sell are closed or greatly narrowed. The sources on which they have depended for fluid capital and for credit have failed for the time. Latin America's present need, therefore, is not for salesmen asking her to buy. It is for buyers of what she has to sell. If we find uses for her products—if we open a market for her goods to replace the market she had in Europe—then we establish credit on which she can buy our goods. The problem is not merely one of rushing salesmen and samples to people ready to buy and able to pay. It is one of organizing broader trade relations and reciprocal exchange of commodities. In the end, all trade is barter. It is exchange of surplus products. We are too apt to think of trade in terms of money only.

The sum of the matter is that if we buy from South America then she can buy from us. We must buy as well as sell, and in this particular case it is practically necessary for us to buy first, or extend credit, which is the same thing."

WORK FOR MINING LAW REVISION

On another page we present the report of the committee on mining law revision, as submitted by the chairman, Mr. E. B. Kirby, for consideration of the American Mining Congress at its meeting at Phoenix, next week. The report should be read and taken to heart by all interested in the development of mines on the public domain. It is apparent that another and a stronger effort must be made if revision is to be accomplished in any near future. Despite the widely recognized need of changing the laws to meet changed conditions, it has so far proved impossible to get Congress to provide even a commission to consider the matter and to make recommendations upon which Congress itself may act. There have been intimations, in which our own Washington correspondent has joined, that there is secret opposition from those who profit from the present jumble of misfit statutes and contradictory decisions that passes for a code of mining laws. If so, the opposition has been carefully concealed, since no one has, seemingly, been willing to come out in the open and maintain that no revision is needed. Dissatisfaction with the present laws is too widespread and too well founded to permit such a position to be maintained in public debate, and, while there are differences of opinion as to what changes should be made, and how revision should be accomplished, we have yet to find anyone who does not favor some change. What the mining men are now asking is merely that these widespread evidences of dissatisfaction be considered by a competent and friendly tribunal. Mr. Kirby has elsewhere summarized most excellently the demands of the mining men. These are:

1. That the revision be general.

2. That the membership of the commission be restricted to men whose qualifications for the work are known to the mining industry.

3. That the commission shall hold its public hearings within reach of the mining communities and give the public full opportunity to express its views.

4. That the commission shall have some reasonable time limit set upon its task.

This is all that is being asked. If the proponents of any particular modification of law can not make out a satisfactory case before a competent and informed commission, the change ought not to be made; it is certainly not unfair to ask that the men acting in this responsible position, one potent for so much to all phases of mining, should be men "whose qualifications for the work are known to the mining industry"; that the revision be general is necessary if it is to be satisfactory, since the whole structure of the law must be taken into account if a workable system is to be evolved—the proverbial blue patch on a red background is not more out of place than some amendments that have been made; and that the commission hear all sides and report within a reasonable period is in the interest of economy and efficiency. It is difficult to see how less could be asked if any good is to be accomplished. Details as to payment or non-payment of the commission are not of sufficient importance to warrant defeating the legislation. It is ridiculous that the United States government can not afford to study the rules under which it sells millions of dollars' worth of land, but there are patriots among mining men as in other ranks, and if the 'pork barrel' is really more important than the public interest, men can be found who will do the work without pay. Who, however, wants to take the responsibility of saying this is necessary?

Failure to pass on the bills providing for the proposed commission has so far been due, we believe, to lack of attention rather than to any real opposition to the measure. If there were no law against murder, some one would have to 'lobby' hard to get such a bill through any legislative body. It is not opposition that kills bills; it is lack of concentrated effort to make a particular bill stand out from the multitude. The mining men can force this through in a few weeks if each one will concentrate upon his own representatives at Washington and make clear that there is a real need for this legislation and an active demand for it.

We do not propose to re-state the grounds upon which revision is asked. The defects of the present laws, drawn with regard to conditions forty years ago and based upon wholly erroneous ideas as to the form and character of orebodies, are too well known to need repetition. The need is beyond argument. The practical point is what change is desirable and how to bring it about. To this we believe the correct answer is the proposed commission. This plan has already been adopted as most feasible, not only by the American Mining Congress, but by the Mining and Metallurgical Society. So far as such action is possible, the American Institute of Mining Engineers has also shown a disposition to favor the plan proposed. Unfortunately, the Institute also acts under laws adopted forty years ago and strenuous objections have been raised to its going upon record in any formal way. Mr. H. V. Winchell is serving as chairman of committees on mining law revision for both the Institute and the Society, and thanks to his active leadership, the Institute meeting of last February was notable for the interest expressed in this subject. While, for the present at least, he is estopped from any formal action on behalf of the Institute, the Society has both the machinery and the funds for an active campaign. With the co-operation of the Mining Congress, we believe that the matter can be so presented at Washington as to secure prompt passage of the necessary legislation. It is a large opportunity, and we hope the officers of the Society will rise to the occasion.

NATURAL GASEOUS FUEL

We have previously alluded to the peculiar fact that the production of certain mineral substances is generally looked upon as mining *par excellence*, while the production of others of equal or greater aggregate value is scarcely recognized as belonging to the mining industry, partly because the methods employed are not the traditional ones of the miner of digging shafts and excavating stopes, and partly for a variety of other reasons. Natural gas is one of the most important of these stepchildren of the mining industry, and it requires some mental adjustment to realize clearly that the annual production of this valuable fuel is worth about $90,000,000, or more than our lead and zinc output combined, considerably more than our silver output, and almost as much as the yearly production of gold. Every engineer knows that gaseous fuel can be utilized to better advantage than liquid fuel, and liquid fuel to better advantage than solid, yet the mining of coal is held in much higher regard than the production of either of the other two. This may be because coal mining is a very ancient art, while the production of gas and petroleum, except in China and parts of Asia Minor, is an industry with a history of little more than a half century. The petroleum industry, by reason of its importance and the vast addition it has made to the national wealth of this and other countries, has won a place for itself, but natural gas still is relegated to below the salt. For a long time, and still to a certain extent, gas was little more than a waste product accessory to the production of petroleum, and it was only gradually that local uses were developed for it. This brings us to the fundamental drawback of natural liquid and gaseous fuel; namely, their lack of transportability. Coal may be dug out in lumps, hauled about in any receptacle, and piled up in heaps until it is desired to use it. Liquid fuel can only be moved in carefully made tanks or pipelines, and if it is stored it is subject to loss by leakage and evaporation, besides being a continual fire risk. Gaseous fuel has all these drawbacks in an accentuated form, since it will escape through the tiniest hole, it can not be stored except at prohibitive cost, so that the user must be directly connected to the source of supply, and, furthermore, it is so tenuous that a pipe-line which will transport a large tonnage of petroleum will carry only a small weight of gas, and therefore the distances to which it can be economically transported are much less. The present high-water mark thus attained is the pipe-line, 120 miles long, which transports gas from the Midway field of California to the city of Los Angeles. It is reasonable to expect that the present tendency toward economy in use of fuel will lead to an accelerated rate of growth of its use.

The geographical development of natural gas is worth a passing note. Thirty years ago Pennsylvania was producing 4½ millions of dollars' worth, and a little was produced in New York and Ohio. Ten years later the Indiana fields had come in and were yielding more than Pennsylvania had a decade earlier, that state having meanwhile increased its yield somewhat, and the Ohio output having greatly increased. Kentucky, Tennessee, Kansas, Colorado, and California had all entered the arena with small yields. By 1904 West Virginia had developed so that it was the second state in value of output. Kansas had become one of the important states, and Oklahoma was just beginning. Last year the yield in West Virginia was valued at over $34,000,000, or more than one-third of the total for the United States; Oklahoma contributed $7,500,000 worth, while the value of the output of Kansas, which in the decade 1899-1909 had increased from $332,000 to $8,300,000, had declined to $3,288,000. California since 1910 has increased its yield from less than $500,000 to nearly $2,000,000. It must be remembered that these figures represent the value and not the quantity of the output, for the volume of natural gas which is yearly being wasted is almost unbelievable. Notable work in preventing waste has already been done by the Bureau of Mines, and during 1913 its representatives so supervised drilling in Oklahoma that two oil wells, which would have wasted 20,000,000 cubic feet of natural gas per day if drilled in the ordinary way, were prevented from causing any waste.

One of the most interesting features of the natural gas industry is the increasing use of gas for industrial purposes. The statistics prepared by Miss Belle Hill for the United States Geological Survey show that, although in 1913 there was a decrease in the use of natural gas for domestic purposes, there was a notable increase in the quantity used for industrial purposes, the price respectively of 27.33 and 9.4 cents per thousand feet having increased in both instances. Thus only one-third of the quantity of gas is used for domestic purposes, but it brings so much higher price that it corresponds to nearly two-thirds of the total value.

The importance of natural gaseous fuel in the zinc smelting industry is so well known as not to need reference. The production of gasoline from natural gas is a recent development, but already there are nearly 200 plants for its production, that in 1913 yielded 7,500,000 gallons of gasoline, valued at over $500,000. The light gasoline thus produced can be mixed with heavier distillates made in petroleum refining, so that the addition thus made to the national supply of this present-day necessity is even greater than the figures would indicate. West Virginia, Pennsylvania, Ohio, and Oklahoma are the principal producing states, and it is interesting to note that the average yield of 1000 cubic feet of gas is three gallons of gasoline. A less known use of natural gas is the production of carbon black, which is not a substitute for lampblack, but has its own uses, being better suited for making black ink, stove polish, and vulcanized rubber. The technology of the production of carbon black is still in process of development, and it is to be expected that an increased use of natural gas will be a characteristic of chemical engineering of the future.

As War Looks in London

By T. A. RICKARD

The Commission to aid the famishing Belgians is American in fact, although the inclusion of some Spanish officials makes it look international. The money so far is coming from Belgian, British, and American sources. Two shiploads of food have been delivered in Belgium, but it appears that the efforts of the Commission have been hampered and hindered by cross-currents of purpose. In the first place, the military problem cannot be ignored by the Allies. Now that the population is in dire distress and the German military administration is embarrassed thereby, comes the philanthropic proposal to furnish food from England and America. But Belgium is claimed to be a German province. Why should food be supplied from outside sources for the benefit not only of the poor Belgians but also of the Germans? It is true, the authorities at Berlin have guaranteed that the food sent by the Commission shall not suffer molestation from the military administration in Belgium, but any food sent to the country is, in effect, a gain to the German government now precariously established in that country. Another aspect of the problem is presented by the indemnities levied on various cities; for example, the $9,000,000 imposed upon a non-military and non-combatant city like Brussels. This levy in itself would pay for a good deal of food. These considerations cannot be overlooked, even if, as seems likely, they are put to one side just now in the desire to alleviate human suffering.

Two days ago I went to the Hotel Cecil to see the Sportsman's Battalion, which assembles at that famous hostelry. More particularly I went to see my friend J. H. Curle, the author of 'The Gold Mines of the World,' a writer well known on both sides of the Atlantic, and a former special contributor to the *Press*. The battalion consists of such men as himself, over age according to the recruiting requirements, but fit for military service and anxious to fight for their country. From 10 to 15 per cent of those now in the battalion are too old or otherwise unfit, but the rest are first-rate material. Curle tells me that they have come from every corner of the map. He himself had just returned from Guiana, another in his section hailed from Trinidad, another from the Argentine, a fourth from Singapore, and a fifth from the Gold Coast. Among those in this battalion, which is attached to the Royal Fusiliers, are several mining men: J. H. Curle, W. S. Holloway, F. P. Bray, A. G. Bevan, G. R. Nicolaus, and W. H. Rundall. They have now gone into camp at Romford, in Essex, to prepare for active service. Curle has a high opinion of his comrades; he says that he would go with them anywhere. They will give a good account of themselves, no doubt.

By the way, one of the London Scottish officers, writing home, explains that before going into action they had to spend several days getting used to the sight of the horrors of slaughter, which at first will nauseate and unnerve any man. The heaps of dead and dying, on both sides, on the battlefield in Flanders are such as to appall the average man. Another soldier tells me he had not believed the stories of mass attack until he was in the trenches facing one of these assaults. The Germans came onward bravely and so thickly that he felt sure that every shot he took must have gone through half a dozen of them. Then when our fellows used the bayonet they screamed like wounded hares. No wonder. "Did you ever cry?" I asked. "Yes," he said, "one day I had been firing fast when my rifle jammed. I blubbered. It was the worst thing that could happen. But I knew that the regimental armorer was in a cottage a couple of hundred yards to the rear, so I bolted across the shell-swept ground to reach him. Half way across I heard a roar and glanced over my shoulder to see that a shell had fallen in the trench just where I had been placed. A second later another shell smashed the roof of the armorer's cottage and killed him. I took cover behind the ruined wall and found a brick, with which I loosened the breech-block. Then I felt better."

London has been further darkened. The upper portions of street and railway station lamps have been blackened so that the light does not pass skyward. The use of powerful lamps on motor cars is forbidden. Orders have been given for the pulling down of the blinds in the railway carriages after dark, so that we go home in mysterious seclusion. When I go to the station, at six o'clock, the sky over the city is being swept by pencils of light from searchlight apparatus placed on various buildings. On others the air-craft guns are ready for the winged ships from across the sea. But we take it most calmly. A few bombs dropped on London would do more good than harm, from a military standpoint.

H. W. Turner, who has returned from Siberia, by way of Finland and Norway, says that the general prohibition against the selling of *vodka* has been accepted without serious protest and is working splendidly throughout Russia. He also informs me that the Russians are sending their prisoners of war to the Altai and other pleasant parts of Siberia. When I say 'pleasant,' I mean as beautiful and productive as the best parts of Colorado and New Mexico. The Altai is a fine country. Thousands of Austrians are now distributed along the Irtish, free to move about within a restricted territory, having given their parole. On the other hand, the German soldiers, who say that their military oath prohibits the giving of their word, are placed in concentration camps. The Austrians are finding employment and will correct the labor shortage, which, for example, is hindering work at the Riddersk and Zeranovsk mines. Undoubtedly some of these Austrians will remain in the country. War has often caused involuntary migrations that have enriched the country of exile. We shall keep a good many of the Belgians. You may get some of them in California.

November 5.

The American Mining Congress

The seventeenth annual session of the Congress will be held next week at Phoenix, Arizona. Below is printed the provisional program, followed by the report of the committee on the revision of the mining laws.

PROVISIONAL PROGRAM

MONDAY, DECEMBER 7, 1914

AFTERNOON SESSION

2:00 o'clock—Opening session, called to order by Joseph H. Kibbey, chairman of reception committee. Invocation. Address of welcome, R. E. Sloan, reception committee. Address of welcome, George W. P. Hunt, governor of Arizona. Address of welcome, George U. Young, mayor of Phoenix. Letter of greeting, Woodrow Wilson, president of the United States. Response by Carl Scholz, president. Five-minute responses by representatives from the several states. Selection of committee on resolutions.

EVENING SESSION

7:30 o'clock—President's annual address, Carl Scholz, of Chicago. Reception to the president and directors.

TUESDAY, DECEMBER 8, 1914

MORNING SESSION

9:30 o'clock—Report of the committee on taxation of metalliferous mines, D. L. Webb, chairman, Denver, Colorado. Address, H. A. E. Chandler, Phoenix, Arizona. Open discussion under five-minute rule of the general subject of mine taxation: (1) Should the taxes be so applied as to prevent the holding of mining claims, patented or unpatented, without substantial development work? (2) Should all unworked claims be assessed at a valuation equal to the price asked by the owner? (3) Should the state's power to tax be used to prevent the holding of mining claims for purely speculative purposes?

AFTERNOON SESSION

2:00 o'clock—Report of committee on mining investments, W. R. Allen, chairman, Butte, Montana. Address, 'Blue-Sky Laws,' John R. Burton, New York. Discussion under five-minute rule, led by E. G. Reinert, Denver, Colorado. Address, 'Why Optimism?' by George Otis Smith, director of the U. S. Geological Survey. 'The Needs of the Zinc Mining Industry,' Otto Ruhl, Joplin, Missouri. Address, 'Mining in New Mexico,' Fayette A. Jones, Socorro, New Mexico.

EVENING SESSION

7:30 o'clock—Annual meeting of members, followed by address by Joseph A. Holmes, director of U. S. Bureau of Mines.

WEDNESDAY, DECEMBER 9, 1914

MORNING SESSION

9:30 o'clock—Report of committee on prevention of mine accidents, W. R. Ingalls, chairman, New York City. Report of committee on general revision of mineral land laws, E. B. Kirby, chairman, St. Louis, Missouri. Address, H. V. Winchell, Minneapolis, Minnesota; David W. Brunton, Denver, Colorado. Address, 'The First Move,' W. G. Swart, Denver, Colorado. 'Legislation and the Mining Industry in Arizona,' Walter Douglas, Bisbee, Arizona. Paper, 'The Administration's Public Lands Policy,' John F. Shafroth, senator from Colorado. Paper, 'The Pending Federal Leasing Law,' T. J. Walsh, senator from Montana. Address, 'Conservation, State or National?' William P. Phillips, Austin, Texas. General discussion.

AFTERNOON SESSION

Visiting ladies will be entertained by auto drive and tea at the Country Club.

2:00 o'clock—Report of committee on electrical equipment in metal mines, H. S. Sands, chairman, Denver, Colorado. Report of committee on Alaskan legislation, Falcon Joslin, chairman, Fairbanks, Alaska. Paper, 'Federal Control of the Water Power of the West,' E. A. Wedgewood, Salt Lake City, Utah. Address, L. Bradford Prince, Sante Fe, New Mexico. Address, John Hays Hammond.

EVENING SESSION

8:00 o'clock—Smoker given by Phoenix Board of Trade.

THURSDAY, DECEMBER 10, 1914

MORNING SESSION

9:30 o'clock—Report of committee on workmen's compensation, Samuel A. Taylor, Pittsburgh, Pennsylvania. Report of committees. Paper, 'The Law and Compulsory Arbitration,' James A. Emery, Washington, D. C. Address, 'The Cost of Strikes,' Charles Piez, Chicago, Illinois. Address, 'Compulsory Arbitration,' Samuel O. Dunn, Chicago, Illinois; H. U. Mudge, Chicago, Illinois; Thomas L. Lewis, Columbus, Ohio; John A. Martin, Pueblo, Colorado.

AFTERNOON SESSION

2:00 o'clock—Report of committee on forestry relations, Robert S. Martin, Denver, Colorado. Address, 'Mining Rights on Indian Reservations.' Papers by M. A. Smith, Tucson, Arizona; Henry F. Ashhurst, Prescott, Arizona; Carl Hayden, Phoenix, Arizona. Address, 'The Mining Industry of Arizona,' Charles B. Clapp. General discussion under five-minute rule.

FRIDAY, DECEMBER 11, 1914

MORNING SESSION

9:30 o'clock—Final report of committee on resolutions. Unfinished business. Adjournment.

Automobile trips will be arranged for Friday afternoon and Saturday to various points of interest.

REPORT OF THE COMMITTEE ON REVISION OF THE MINERAL LAND LAWS

BY E. B. KIRBY, CHAIRMAN

Since the last annual convention, the American Mining Congress has taken every opportunity to press for the creation by the Congress of the United States of a commission which shall revise and codify the mineral land laws of the United States. Your committee takes pleasure in reporting that most encouraging progress toward the desired end has been made at Washington. A bill, No. 4373, providing for the appointment of the commission desired, was introduced in the Senate by Mr. Smoot and was approved by the Secretary of the Interior. The bill, after receiving some alterations, was favorably reported by the Committee on Mines and Mining, and was passed by the Senate on May 7. Meanwhile, on April 1, 1914, Mr. Taylor, of Colorado, introduced a similar measure (Bill 15288) in the House of Representatives which was likewise approved by the Secretary of the Interior and favorably reported back to the House by its Committee on Mines and Mining.

At that stage, Congress decided to restrict its legislative program for the remainder of the prolonged session to the trust bills and your representatives were in-

formed that no further progress with the revision bills would be possible until the next session. Later on, the administration measures relating to coal, oil, etc., were added to the legislative program, and it was understood that the revision bill would be included with these. This expectation was not fulfilled, and the House adjourned without action in the matter, so that nothing further can be done until the winter session.

Both the Senate and the House bills vary somewhat from the measure recommended by the American Mining Congress which provided for a commission of five members who should be selected by the President for their recognized knowledge and experience in the mining industry, as will be remembered. In the Senate bill, this was amended to create a commission of three members, two of whom should be lawyers and one a mining engineer. The House bill, on the other hand, permitted the commission to consist of five members, but provided that they should serve without compensation. While these alterations are unsatisfactory, it is believed that the best opportunity to make further efforts for their correction will be presented after the passage of the House bill and when it meets the Senate bill in conference.

Your committee believes that the most important qualification of the commission should be its ability to command the confidence of the mining communities, and that this end can be best attained by having at least five members and leaving the President free in making the selections. Moreover, the members should be properly paid so that the appointments may not be restricted to men of wealth and in order that the business may be undertaken in a serious way, befitting its importance. The House bill will shut out from any possibility of selection the vast majority of mining men, as it restricts the personnel of the commission to those who have the rare combination of a knowledge of the subject, a desire to work for it, and who, at the same time, possess such incomes and freedom from business duties that they can leave their own affairs for six months of arduous labor and bear the serious expenditures which cannot be included in government accounts.

At the proper time, further efforts will be made to have these difficulties considered by those who are in charge of the bills; but in any case, it is probable that a revision bill will be passed at the next session. In the meantime, public interest is growing and the forces massing back of the revision movement are steadily increasing. In the American Institute of Mining Engineers and the Mining and Metallurgical Society of America, no other matter of public policy has been commanding such interest as this. In both organizations, the sentiment in favor of a general revision is overwhelming, and each one has gone as far as it could in approving and aiding the movement. The American Institute of Mining Engineers has been specially restricted in its support by provisions in its constitution which bar it from taking up public questions, and an effort is now being made to have its sphere of activity enlarged.

In the meantime, the American Mining Congress remains as the only general organization of the great mining industry which is in a position to freely voice its wishes and act for its interests in any direction. There has certainly never been a time when these interests have needed co-operation and intelligent direction so much as they do now, and mining men cannot afford to have the activities of the Congress weakened through any lack of financial support. Practical experience has shown that to be effective, the recommendation of the congress upon any matter must be properly presented at Washington, and this requires steady persistent work by some one who can stay there. "At present, there is no way of securing this until the secretary of the American Mining Congress is given the means with which to carry on his work in the proper way." This is absolutely necessary to supplement the efforts of your various committees, who can only act through correspondence and the occasional visits of their members. The mining industry cannot hope that any of the afflictions from which it is suffering will disappear by chance. The only help in sight is self-help—the labor and money contributed by mining men to the work of the American Mining Congress.

Appendix

Preliminary draft suggested for a joint resolution of the senate and house

That Congress shall undertake a general revision of the laws relating to mineral-bearing lands and mineral rights within the United States and Alaska, and such revision shall cover mineral deposits of every kind except those of coal, oil, phosphates, and salines, which are set aside as the subjects of other and special legislation.

In view of the technical nature of the problems presented by the work, it is desired to secure first the results of the knowledge and experience which exist among those who are engaged in the mining industry.

To this end the President shall, within sixty days hereafter, appoint a commission of five members who shall be selected for their recognized knowledge and experience in the mining industry.

The commission shall consider the mining laws of this and other countries and shall hold public hearings in the principal mining centres of the Western states and Alaska, giving full opportunity for the expression of public opinion concerning the problems before it.

Its recommendations shall be presented in the form of a fully drafted mining code.

Within six months after the appointment of the commission, its report shall be delivered to the President, who shall within thirty days thereafter transmit it to Congress with his further recommendations, if there be any.

Members of the commission shall receive ———— per diem with expenses, and shall engage such clerical assistance as may be necessary for the work.

Clause providing for the necessary appropriation.

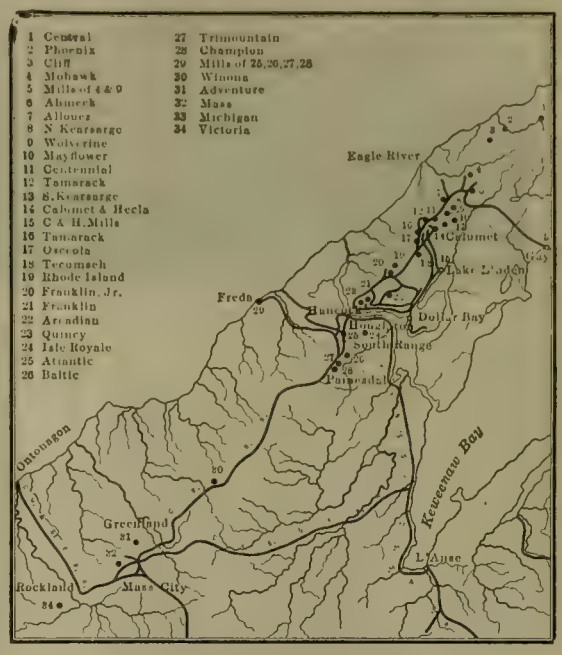
Lake Superior Copper Mining: Present and Future—I

By THOMAS T. READ

In 1872 the copper produced by the mines of the Keweenaw peninsula of Michigan represented over 95% of the total output of the United States. Year before last the output of the mines of that district only represented 15% of our total. The mines have penetrated to great depths, giving rise to many difficulties in working; the average copper content of the ore milled is now much lower than in former years; many mines are approaching the limit of their known ore reserves; and last year the operation of the mines was interrupted by a violent and protracted strike of the miners. It is not strange, therefore, that there is a growing public impression that the importance of the Lake Superior copper mining district, so concisely indicated in the name 'the copper country,' by which it is generally known, has already waned and that the region as a whole belongs to 'the eternal landscape of the past,' no longer deserving the amount of interest and attention it has so long enjoyed. It is my purpose to discuss, as briefly and lucidly as may be, what basis, if any, exists for such a belief, and to set forth what appear to me the most important factors on which any estimate of the probable production and life of these mines must be based.

It must at once be remarked that the decline in relative importance of the Lake Superior copper mining district is due to the rapid growth of the other districts and not to its own decline. Thus the production in 1872, which represented nearly the whole output of this country, was but 24,550,000 lb., while the production in 1912, which represented only 15%, was 216,609,000 lb. Up to 1910 (when the Western Federation of Miners began preparing for the strike of 1912 by cutting down the labor supply of the district), the yearly output of copper of the Lake mines had shown a steady growth, being in 1909, roughly ten times the production of 1872. Considered alone, therefore, the Lake Superior district has shown a steady growth over a long period of production, and the Quincy Mining Co., for example, has a longer record of continuous dividends than any other copper mine in the world, with the single exception of the Tharsis company, in Spain.

The mines of the Lake Superior district have been so often described that it is difficult for any writer to set forth much that is new. From the scientific standpoint the proper procedure would be to cite, in making points in the following discussion, all the previous articles dealing with them. Such a method of treatment is too often as tiresome to the reader as it is technically correct. The general reader is prepared to assume that a writer has made use of all the material available to his hand, following the precedent of Homer, as melodiously recited by Kipling, "whate'er 'e thought 'e might require, 'e went and took, the same as me." Those to whom a bibliography is a necessity will find an excellent one in 'The Keweenaw Series of Michigan,' by A. C. Lane, while a highly interesting account of the history of the district can be found in the most readable of all books upon it: 'The Copper Mines of Lake Superior,' by T. A. Rickard. It is my intention to use Mr. Rickard's book, published just ten years ago, for what military men would call a base of operations, as it is a well written, comprehensive, and accurate summary of conditions in



LAKE SUPERIOR COPPER REGION.

the district at the date of its publication. The changes which have taken place since then are highly significant and, avoiding repetition by presupposing a familiarity on the part of the reader with the book, I shall therefore attempt to discuss the present and probable future practice along the lines already indicated, including only so much of a general nature as is necessary to make my article intelligible when read by itself.

Geology

The copper deposits of the Keweenaw peninsula consist of native copper disseminated through vesicular flows of eruptive rock, chiefly of the diabase type, and interbedded sedimentaries, chiefly conglomerate. These deposits are remarkable for their size and persistence, but not as to their character, for the occurrence of small amounts of native copper associated with diabase flows and sills is not at all uncommon throughout the world. Elsewhere they are of low grade and of small extent, but in this region they have been worked along a length

AHMEEK 3 AND 4, ILLUSTRATING MODERN CONSTRUCTION AT THE LAKE SUPERIOR MINES.

of outcrop of nearly 100 miles, and at various horizons in a series of beds dipping 40°N.W. and exposed over a distance of, roughly, 5 miles at right angles to the strike. One of the beds has been productive for approximately 10,000 ft. on the dip. These are ore deposits on a truly magnificent scale, and the amount of attention they have attracted is quite justified by their significance. I have said above that the copper occurs disseminated through the beds. This is true as a general statement, but the copper also occurs in veins, as well as in masses of such size that they can scarcely be called disseminations. Curiously enough, the veins seem to be more important at the extremes of the district, both geographically and chronologically, for they are seen in their best development at the extreme northeast and southwest of the copper-bearing area (see map). They are worked in the former during the early days of the district, while the newest mine developed, the White Pine, a much faulted vein in sandstone, is so far to the southwest as to be beyond the edge of the map. The large masses of copper, one of which weighed as much as 130 tons, were the object of search during the early days; now they are less desirable, since they interfere somewhat with the routine of regular work, and also are less commonly found in the deeper levels. The most remarkable of the copper-bearing beds is a conglomerate, but this is not the rule, and the typical deposit of the region consists of native copper disseminated through the vesicular, usually the upper, portion of a lava flow, of the approximate composition of diabase.

The areal geology of the district, then, exhibits a series of flows and interbedded sedimentary deposits, dipping off to the northwest at an angle of from 30° to 70°, and with a general strike of N. 40°E., though it varies considerably from this in places, becoming almost east and west at the northern extremity of the area. These beds have an aggregate thickness at Portage lake of 22,680 ft., according to Lane, and are overlain to the west by the Freda sandstone. To the east they are cut off by the great Keweenaw fault, and abut against the Jacobsville sandstone. Within this large area workable deposits have been found at many points (as can at once be seen by a reference to the map), chiefly by the time-honored method of searching for outcrops, though in recent years the diamond drill is coming to be more and more employed for prospecting, as distinguished from development. This district has been glaciated, so that it is only in a portion of the area that the underlying rocks are exposed. In other places the glacial till extends to considerable depth, and these areas have not, in general, been so carefully prospected.

The Orebodies

In his interesting book, already cited, T. A. Rickard has related the story of the finding of one or more of the famous mines of this district. Practically all the older mines were found by detecting the outcrop of copper-bearing rock, or by trenching through the overburden in places where it was hoped to find the extension of lodes known to be productive elsewhere, for their persistence is remarkable. The Baltic, Isle Royale, Kearsarge, Osceola, Pewabic, and Allouez lodes can be traced for miles, showing workable amounts of copper in many places.

The copper is found either in conglomerate or in the amygdaloidal portion of lava flows. It is necessary to

put the conglomerate first because the most famous and richest lode of all is the Calumet & Hecla conglomerate. But the Calumet & Hecla is exceptional in many ways, and while there are other conglomerate lodes, the amygdaloids, as they are locally known, are the typical ore deposits of the district. These are of varying thickness, for the flows are not only of varying thickness as compared to each other, but they differ from point to point in the same flow, and, finally, the portion of the flow which is amygdaloidal, and consequently affords the pore spaces to receive the copper, is a variable part of the total thickness. The orebodies are therefore decidedly irregular in detail. A false impression of regularity may easily be derived as a result of the mining practice. A mine which yields large quantities of ore year after year, of a copper content, for example, of 25 lb. per ton, does not yield it from a lode averaging 25 lb. per ton; in fact no one may know what the average copper content of the lode actually is. The management having decided that 25 lb. per ton is the most profitable grade of ore to work, mining operations are so directed as to take out all the rich ore found and enough of the low grade to bring the average to 25 lb. The ore therefore often has no walls other than the arbitrary line of division between the ore which the mine captain considers good enough to mine and that which he considers too poor. This is scarcely true of the hanging wall, for the upper portion of a flow is apt to be more porous, and the ore is therefore likely to extend to the margin of the next overlying bed. Even this does not hold, however, for Charles D. Hohl has informed me that the top surface of the flows is characterized by irruptions of still liquid material through the partly solidified crust. The amygdaloidal structure transfers itself to the upper part of this irruption, and perhaps to the upper part of a second irruption; these outbursts being, of course, of limited extent. Thus, for example, the Osceola amygdaloid is, in the Calumet & Hecla ground, 35 to 40 ft. thick and about 15 ft. of the upper portion contains enough copper to average 15 to 16 lb. per ton.

Masses of copper of many pounds weight occur, and a single car may contain ore carrying 300 lb. per ton, while another might contain only 3 lb. per ton. I wish to emphasize this characteristic of regular irregularity, for it is the factor which above all determines and limits both mining and milling practice in the district. In order to see the district as it is today it is necessary to free the mind of its mental image of the Calumet & Hecla conglomerate, 15 ft. thick, all workable, carrying as much as 100 lb. copper per ton near the surface and 30 lb. per ton as worked in the deep levels today. The typical condition to be met in present and future mining is that described above. The important influence of this on mining methods is described later.

Another important characteristic which must be emphasized is the varying size of the copper particles. I have already referred to the mass of copper weighing 130 tons which was discovered. Masses of several hundred pounds weight are common, and the particles are of all sizes down to sheets of microscopic thickness and only 0.1 millimetre in diameter, occurring in the cleavage planes of the rock minerals. To make anything like complete recovery of the copper from the ore it is necessary to be prepared to handle pieces weighing a ton and also those weighing a hundredth of a milligram. This is indeed a difficult task to set a millman, and how

No. 6, THE NEWEST SHAFT OF THE MOHAWK MINING COMPANY.

remarkably well it is accomplished will be the subject of another chapter.

Persistence of the Orebodies

As a contrast to this characteristic irregularity of the orebodies their remarkable persistence must be equally emphasized. A half dozen lodes might be mentioned in which ore of workable copper content occurs for miles along the strike, while the Calumet & Hecla conglomerate has been worked to a distance of nearly 10,000 ft. below the outcrop on the dip and several lodes have been worked more than half as deep. These persistent irregular orebodies might perhaps be likened to the struggle for popular freedom in the world, which, while being marked by periods of lesser and greater activity, has nevertheless persisted through many centuries. However, as T. A. Rickard has said, even Methusaleh died. The boundaries of the workable portions of the orebodies have been determined in the upper workings, and it is only reasonable to expect that they will in every case, sooner or later, be encountered in depth. Thus, for example, the Allouez conglomerate was worked down to the twenty-first level in the Franklin, Jr., where it became too thin and too low in grade to yield any profit. The Calumet & Hecla conglomerate continues of good grade down to the thirty-first level of the Calumet & Hecla, or approximately to the boundary of the property, and is still workable in the depths beyond, where it has been exploited by the Tamarack. But it would appear that this remarkable orebody decreases in copper content with depth, for the ore taken out by the Calumet & Hecla in 1873 averaged 100 lb. copper per ton, the ore now being taken out by the same company averages 30 lb. per ton, and the ore mined in 1909 by the Tamarack averaged 19.6 lb. per ton. There is some danger of being misled by a comparison such as this, for the average of 100 lb. per ton in 1873 was undoubtedly maintained by leaving untouched blocks of ground that are now considered good ore, while the distinct rake of the oreshoot to the north may carry it over the boundary of the Tamarack ground. It must be understood that any comment on the Calumet & Hecla orebodies is largely a matter of inference, since the policy of that Company is not to permit visiting or resident geologists and engineers to go underground, while it is only within the past few months that C. D. Hohl has been appointed to act as geologist for the fifteen mining companies under the Calumet & Hecla control. The only present available evidence is the testimony of James MacNaughton before the congressional investigating committee in 1913, when he expressed the belief that the deposits decrease in copper content in depth.

It is equally hard to cite definite evidence from the other mines, for I have been unable to secure any records which would show whether a progressive decrease in depth can be noticed. It is easily seen from the records that the companies have from year to year produced ore of a steadily decreasing copper content, but, as already pointed out, this may be the direct result of lower working costs, thus making it profitable to extract ore that in preceding years would not yield a profit. This effect is cumulative, in that the ore produced this year not only contains many tons of material from the lower levels, that formerly would have been left standing, but also includes a considerable tonnage from the upper levels that was left standing in earlier years. Thus if the Company records show that a mine in 1900 produced ore averaging 20 lb. copper and now produces ore averaging 14 lb., it cannot justly be inferred that the upper workings averaged 20 lb. per ton and the lower workings 14 lb. per ton, for as a matter of fact the orebody might be just as good on the lower levels as in the upper workings. And with the failure of this means of determination practically the only means is lost, for in no case are the working faces in the mines sampled and no assay maps are available. It might be possible with great labor to compile from the mine maps and mill records, tables that would throw much light on this question of the persistence of the copper content of the lodes in depth, but no one has yet done so. It is indeed quite natural that the attitude of mind of the management of the various companies toward this question should resemble that of the colored pastor who was much annoyed by a leading parishioner who persisted in propounding questions dealing with the Darwinian theory, and like topics, in the weekly prayer meeting. Calling him aside one day he said, "Brudder Jackson, doan' do dat. Dem questions can all be answered, but de axin' of 'em in open meetin' will destroy all faith in 'ligion."

Development of Orebodies

No one familiar with the sampling of gold mines needs to be told that it is extremely difficult to determine by sampling the average metal content of orebodies such as those just described. Where a single piece of a few hundred pounds weight may contain as much copper as 25 tons of average material, the taking of a few samples would be merely misleading. And even if a ton sample were taken to represent the face of a drift, the cutting down and assaying of such a sample presents almost insuperable difficulties. The operators have met this difficulty very simply by not attempting to sample the orebodies. It must not be forgotten that what the miners first sought for were the masses of copper, easily distinguishable from their enclosing rock. There is much coarse copper in even the comparatively low-grade ore now worked. On a face which has been exposed two or three weeks even an amateur can at once distinguish the presence or absence of copper, for in the damp air the metal quickly acquires a surface film of oxide that reflects the light much like stove polish and can scarcely escape observation. In some way, too, the metal seems to multiply its visibility, and the back of a drift in ground that averages 50 lb. copper per ton appears to be literally full of copper. It is not difficult therefore for an experienced person to estimate the copper content of the ore in any exposed surface with fair accuracy, and it is very much easier and probably quite as accu-

rate to estimate that the ore will average 20 lb. per ton for the next six feet of advance as it is to determine with much effort that the exposed space averages 20.3 lb. and then be obliged to speculate whether it is likely to remain constant, increase, or decrease in copper content.

The Invisible Copper

Crude as it may seem to one who is in the habit of computing the average metal content of ore reserves by application of the method of least squares, the practice of directing not only exploratory work but also stoping, by the simple inspection of the ore seems therefore the only feasible way, under the circumstances. The method has obvious drawbacks. Along with the coarse copper there is always a certain amount of finely divided copper in particles too small to be detected by the naked eye, even were they not hidden within the cleavage planes of the minerals, just as the predatory insects of the night obscure themselves in the crevices of a bed. This was not important in earlier days, for this copper could not be saved by the then current milling methods, so no one cared whether 8 or 10 lb. per ton of invisible copper was present in the ore or absent. If the proposed leaching methods, discussed later, prove as successful as hoped, practically all the copper present in the ore can then be recovered and invisible copper will become quite another matter. One of the problems to be solved in the development of practice during the next few years will therefore be this difficult one of devising a method by which the total copper content of the ore can be easily ascertained.

The influence of old Cornish mining methods is still strong in the Lake Superior district, and in the earlier days they were the guiding ideal of practice. With ore deposits of a good stoping thickness, dipping at 45°, of such a character that their metal content could be easily estimated by inspection, and with Cornish miners to direct the work of exploration and development, it was inevitable that development should proceed by the ancient Cornish formula of sticking to the ore. Inclined shafts were sunk in the lode, drifts were turned off at hundred-foot intervals, pillars were left to guard the shaft, and as soon as stoping could be started it was at once begun. This is an excellent method of developing a small mine with minimum expense. If the mine is an unprofitable venture that fact can be ascertained before any great amount of capital has been spent, but if the mine proves a great success, the general plan of work thus laid out is a great handicap. In other words, the Calumet & Hecla, for example, is a huge mine which is laid out and operated like a small mine, and at no small disadvantage. This will be later discussed in connection with mining.

Because of the difficulty of ascertaining the average content of the ore of a lode, it sometimes happens that very large sums are expended on development work only to demonstrate that no operating profit can be made. The case of the Arcadian mine, on which nearly $2,000,000 was thus expended, has for many years been a classic example for professors of mining who wish to impress on their students the vital fact that it is highly desirable to be sure that ore is of workable grade before erecting a plant to treat it. In this case large lots of ore were treated in one of the neighboring mills. These large samples were supposed to represent the average of the mine, but it proved that the natural impulses of the miners had proved too strong, and instead of breaking the average material they had unconsciously selected that of better grade. In a more recent case one of the large companies spent $1,250,000 on the development and equipment of a property, only to demonstrate finally that it was an unprofitable venture. Diamond drilling costs $2 per foot, for the first 1000 ft., and increases 50c. per foot for each 500 ft. increase in depth thereafter. Hundreds of feet of drilling may be done without striking valuable orebodies, though a single hole may show a good core. It is commonly said that it takes a gold mine to make a coal mine, and these copper mines resemble coal mines in many respects, but with the drawback that although a coal seam, once found, can usually be depended on to persist over considerable areas, the copper of a promising lode may prove discouragingly patchy on further development.

Large Scale Operations Necessary

Of recent years trusts and monopolies have become bugaboos with which politicians and others scare their infants, the public, in order to incline them to their wishes. Nevertheless it has become abundantly evident to even the casual student of industrial progress that large aggregations of units have such valuable economic features that they have become an economic necessity, much in the same way that a dreadnaught, having demonstrated its value as an engine of war, has established itself as the standard vessel of every navy. The foregoing discussion has perhaps indicated that from now on the cost of discovering and developing new mines in this district is likely to be so great that only large companies can afford to take the risk necessary. It seems highly probable that many more workable deposits will be discovered by sufficiently courageous prospecting. The profits to be won are probably not nearly so great as in earlier days, while the expenditures and risks are certainly greater. The future of the district lies, therefore, in large scale development by a few large companies. This stage of its evolution is, indeed, already well advanced.

As already indicated, from now on the search for and exploration of orebodies must be conducted in a more ambitious and expensive manner than heretofore if much success is to be hoped for. All the easily discovered outcrops have been inspected, all the shallow overburden has been trenched. It now remains to search beneath the deep glacial drift, and to probe the beds in depth, in the hope that lodes which do not contain sufficient copper to be workable at the surface may prove richer in depth. A. C. Lane has frequently stated his belief that the ore deposits have no genetic relations with the

present topographic surface and that theoretically it is just as probable that a valuable ore-shoot will extend from 1000 ft. in depth down to 8000 ft., as that it will extend from the surface down to 7000 ft. in depth. Some recent evidence goes to support this belief. In the Franklin, Jr., the Allouez conglomerate was worked down to the twenty-first level, where it became so thin and low-grade that development work was stopped. Recently a cross-cut, driven on the thirty-second level, or more than 1000 ft. deeper on the dip, has cut the Allouez conglomerate at a point where it contains more copper than in the upper levels. Development work is now in progress to determine whether the ore so far uncovered is merely a rich spot in the lode or whether it is actually richer in depth than in the upper workings. Farther north, east of the Mohawk, the well directed and carefully studied diamond-drill work which has been done on the Mayflower and old Colony ground, under the direction of A. L. Dickerman, has disclosed deep-lying ore of good grade of which there is no indication on the surface. The drilling work has also disclosed the fact that faulting, to which little importance has so far been attached is in reality a significant feature of some at least of the orebodies. It is quite possible that if there had been careful and continuous geological study by trained observers, those ore-shoots which have already been worked out and abandoned in various parts of the district might now point to other ore-shoots in the same territory. This is, of course, only a possibility, but it indicates that it is highly desirable that exploration hereafter shall be done under the direction of trained geologists and not by rule of thumb. The difficulties are great enough in any event and should not be multiplied.

One feature of the new milling practice, later described, is that simple inspection of the ore taken out in development work no longer suffices to indicate whether it is workable or not. In some of the properties, notably the Winona, a considerable proportion of the copper is present in very fine particles. As already remarked, this copper was lost in the tailing in the old milling practice, and its presence was therefore a matter of no import. Now, by fine grinding and leaching, this metal can be recovered, and it is therefore necessary to know whether it is present or absent, as 3 or 4 lb. of invisible copper may often bridge the gap between operating loss and profit. The logical plan would be for one of the large groups to build a small test mill, capable of handling 25 to 50 tons per day, for its own use as well as for custom testing work. This method of sampling has already been adopted for the Ebner gold mine, in the Juneau district of Alaska, by the U. S. S. R. & M. Co., and the example might well be followed in the Lake Superior district.

COPPER OUTPUT of the Mt. Lyell mine, Tasmania, during the half-year ended September 30, was 3900 tons (8,736,000 lb.) from 171,000 tons of ore, 65,000 tons of which was from the North Mt. Lyell mine. Figures for the previous term are 3433 tons (7,689,920 lb.) from 163,500 tons of ore.

Comparative Drill Efficiencies

[We are indebted to William Hague for the following interesting comparisons between the work of several drills in the Champion mine. It will be noted that Mr. Hague finds that the character of the ground determines the first choice of a machine and that following that the character of the drill itself enters.—EDITOR.]

The Sullivan 'water piston' drill has been in use at the Champion mine, where the ground is comparatively soft. In one rise the following results were obtained, using first the Waugh 12-A: 44 drill shifts, 173 holes, 25 rounds, and 87 ft. advance. This is the equivalent of 2 ft. per drill shift; 3½ ft. per round; one man operating per drill shift.

Using the Sullivan water piston the results were: 81½ drill shifts, 468 holes, 78 rounds, 313 ft. advance, 2 men per drill shift. This is the equivalent of 3.84 ft. per drill shift, or 1.92 ft. per machine man; 4 ft. per round.

The reason this machine superseded the 12-A was that the water piston machine cleared itself more satisfactorily, giving a more rapid advance and at the same cost in labor.

In a drift, with soft ground, the following results were obtained with the Sullivan water piston: 6 drill shifts, 6 rounds, 49 holes, 21 ft. advance, 1 man per drill shift. In another drift the Sullivan ran: 116½ drill shifts, 65 rounds, 553 holes, 205 ft. advance, 1 man operating per drill shift.

It was found that with the Sullivan water piston in soft ground where the holes 'mud up' badly, the reciprocating motion is of great assistance in clearing the holes, as compared with a machine like the Leyner. In hard ground we have found the Leyner to be superior. We have no comparison between the Sullivan water piston and the Leyner at the North Star, because in the preliminary test the Sullivan water piston was unable to make a showing. As regards repairs on the Sullivan machine, two machines with a total of 810 drill shifts have cost nothing in repairs as yet, whereas the Leyner will average, at the Champion, about 25c. per drill shift.

THE Federated Engine-Drivers' and Firemen's Association of Australasia has caused a plaint to be served on 627 companies or individuals employing engine-drivers, firemen, motor attendants, boiler cleaners and others. A large number of these employers are in Western Australia, and are bound by industrial agreements which have a considerable time to run. A test will have to be made as to whether the Federal Arbitration Court has power to override the agreements and awards delivered and registered by the state courts.

NITRATE EXPORTS from Chile, South America, in August and September totaled 1,362,189 and 2,119,881 quintals (1 quintal = 101.61 lb.) respectively, against 4,313,476 and 4,118,906 quintals for those months of 1913.

Explosion Test at the Experimental Mine

By GEORGE S. RICE and L. M. JONES

One of the excursions arranged for the recent meeting of the American Institute of Mining Engineers at Pittsburgh, was a visit to the Bureau of Mines experimental mine, near Bruceton, Pennsylvania, which was made on the afternoon of October 9. Fortunately, it was a bright, clear day, and a large number of members of the Institute, accompanied by a delegation of the Pennsylvania State Inspectors, and other mining men, probably about 200 in all, went out to the mine by train and automobiles, and saw there a number of different kinds of demonstrations. They first entered the mine to inspect the arrangements for an explosion test and the 'barriers' that had been erected to limit the explosion, then saw, outside the mine, demonstrations with full size models of two of the rock-dust barriers, which had been set up in a way to show the cloud of rock dust discharged from them.

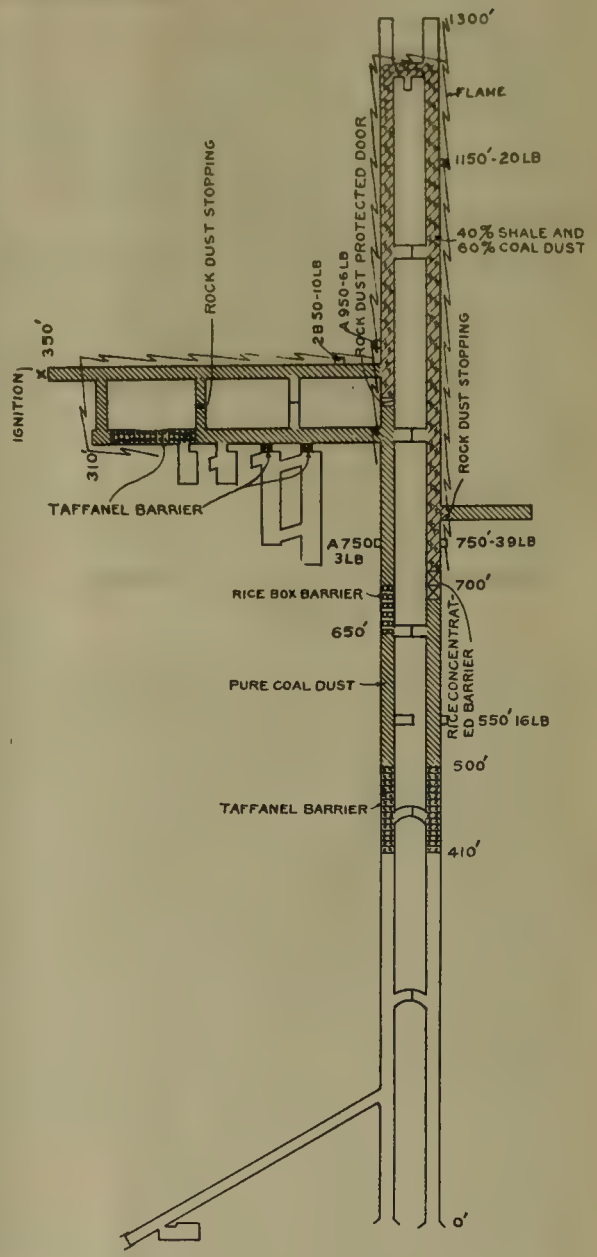
The Cement Gun in Mines

Afterward, there was an exhibit of the use of the 'cement gun' in covering with a layer of concrete some boards set up like a mine stoping. The concrete consisted of 2 parts of sand and 1 part cement, and wire mesh which was tacked on the boards served as reinforcement. This gun had recently been used in the mine to repair countless breaks in the concrete lining of the mine, caused during previous explosion tests; it had also been used to coat the inner part of the entries with a thin layer of 2 parts sand and 1 of cement without any reinforcement. The object of the coating was two-fold: to enable the entry to be more easily cleaned after each test, and to see whether the coating would protect the shale and bone coal roof from air-slacking. The conditions are somewhat severe at this mine on account of the explosion experiments, so it is hardly a fair test of the durability of the coating. It is hoped that this method of protecting the roof and walls may be durable in commercial mines, and if so, it would be a great economy to employ it, and indirectly it would add to safety in the prevention of falls.

The Explosion Test

After these exhibits the visitors moved up on the hill over the main entries to witness the explosion test. After the word had been given that the electrical connections had been made into the mine, and the physicist had made his tests to determine that the electric circuits were complete, warning whistles were blown, and 30 seconds later the explosion was started by throwing an electric switch in the observatory.

The first evidence issuing from the mine was a puff of light dust, accompanied by a muffled sound coming from the mouth of the air course, followed by a stronger and more continued puff of dust and smoke from that entrance; while this was issuing there was a puff of light dust from the main entry, and after an interval of several seconds this was followed by a prolonged outburst of dust and smoke accompanied by a crashing or booming sound. The explanation of these separate puffs and sounds appears to be that the first small puff coming from the air course was the shock wave from the cannon; the second and larger one was when the pressure wave



EXPERIMENTAL MINE ARRANGED FOR TEST.

issued from the explosion in the butt entry; the first puff from the main entry appeared to be caused either by the shock wave from the cannon, or the shock wave from the explosion itself in the butt entries; the larger burst of dust and smoke was due to the explosion in the main entry, which as the manometer records later showed, attained its maximum immediately before striking the concentrated barrier.

Perhaps one of the most striking features of this experiment was the demonstration of the present knowledge of dust explosive phenomena which enabled those in charge to plan the conducting and limiting of an explosion along a predetermined path.

Owing to the explosion being well in the interior of the mine, and as the fan was set barely to turn around, no smoke or dust was observed from either entrance after the outbursts above mentioned. A demonstration was then given by two mine-rescue crews of five men each from the Bureau, of the oxygen breathing apparatus; the advance party entering the main entry carried a guide rope, also a canary to observe whether or not it would be affected by the fumes. Owing to the retraction of the gases after the explosion the party had to go in 600 or 700 ft. before encountering the afterdamp, which affected the canary. On the coming out of the squad, the fan was started, to blow out a large amount of smoke and gas from the main entrance. Then ventilation was reversed and many of the visitors, including inspectors, entered and observed the effects of the explosion, getting a good view.

In conclusion, it might be stated that all of the explosion-checking devices used in this explosion test have been tried many times in the experimental mine explosions, and all of them with the exception of the Taffanel barrier, which has failed in low-pressure slow moving explosions, have always proved effective in stopping explosions. Installation of any of these types for separating different splits, panels, or sections of a mine from each other, or the other parts of the mine would undoubtedly be a big step in advance toward reducing the number of lives lost in large explosions. The Bureau engineers are now preparing a publication describing these devices, and it is strongly recommended that they be installed in bituminous mines in connection with a definite program of making coal dust inert by watering or rock-dusting.

Hoisting Accidents in Western Australia

The annual report of the Department of Mines of this state contains a mass of interesting information, and among the hoisting accidents the following occurred:

At the Golden Horse-Shoe, Kalgoorlie, there were three mishaps as follows: (1) An engine-driver had just emptied a skip of ore, when his attention was diverted to reply to a question from the chief engineer, and on receiving a signal from below to hoist, he turned on steam without noticing that he had not reversed the engine. On seeing his omission he applied both brakes, but too late to prevent an accident. The skip struck the safety thimble and hung up on the safety hooks and side grippers, releasing the rope. The Whitmore overwinding device was out of action at the time. No damage was done. (2) A case of overwinding occurred, in which the hoisting engineer, who was hauling ore at the time of the overwind, had the cage at the top landing, and on applying steam to lift the cage off the chairs the reversing lever became fast, and before he could pull it back the cage was at the ring, which sheared the copper rivet in the safety hook and released the rope. No damage was done to the cage or rope. (3) The next accident was also a case of overwinding, through the driver, while in the act of applying the foot-brake, missing the step and lurching forward, with the result that his left hand carried the steam handle forward and applied more steam. This gave the engine an impetus which carried the cage into the safety thimble before it could be stopped. No damage was done to the cage or shaft.

At the Eclipse mine, the engine-driver fainted while lowering two men to No. 5 level, and allowed the cage to run down to the shaft bottom, causing slight injuries to one of the men. On coming to his senses the driver found one cage hung up in the safety hook, and the other at the bottom of the shaft with nearly all the spare rope off the drum. Later on in the year the same driver was killed by his engine running out of control under circumstances which point to his having most probably fainted again.

The two following took place at the Great Boulder mine: (1) An overwind occurred through the driver losing control of his engine, because of the starting valve opening more easily than he expected. He was new to this work and had no right to drive the engine, as his certificate was restricted to geared engines and locomotives. No damage was done. [All hoisting engineers must pass an examination of general competency before being allowed to take charge of an engine.—EDITOR.] (2) Another overwind was caused by the driver allowing his attention to wander while hauling an empty cage. The copper pin in the safety hook was sheared, and the cage hung up in the thimble. An inquiry was held by the board of examiners, resulting in the driver being restricted from driving first motion hoisting engines for twelve months.

While hauling water at the Great Fingall, at Day Dawn, the engineer states that the tank hung a little when near the kick-up while being raised, and on his applying a little more steam suddenly went up to the wheel. He immediately shut off steam and applied the brake, but not in time to prevent the overwind.

GOLD exported from Colombia, Central America, in August and September amounted to $546,000, compared with $471,000 in that period of 1913.

The Platinum Deposits of Germany's Paleozoic

By P. KRUSCH, Translated by F. SOMMER SCHMIDT

*If the known locations of platinum deposits are put on the geologic map of Dechens they appear scattered around Freudenberg, Siegen, Meschede in Siegerland, Sauerland, and Westerwald. Geologically the lower and middle Devonian as shown by Dechens are questionable. The platinum even in these formations is not confined to any one horizon, but varies considerably. On this map the geology of the districts under discussion appears very simple. Large areas have the same color. The science of that day did not give proper stress to the geologic structure. Neither folds nor faults seemed to be considered. During the past year the Royal Geologic Society of Berlin has begun a special geological survey of the district. This specialized map brings out the fact that the oldest platinum-bearing formation known to date, belongs to the 'Gedinnien' and may therefore have to be reckoned as Silurian. Following this we note a series of most varied horizons irregularly distributed up to the uppermost middle Devonian where the shales are still subject to mineralization. The distribution of platinum is closely dependent on the stratigraphy and structure of the district.

In such districts as I have examined, the slates and graywacke formations play the main part. Platinum has been found in diabase and basalt, but as I have not determined this, I will restrict myself to the former formations. In isolated instances the slates have carried more platinum than the graywacke. The Siegerland miner lays great stress on the cropping of graywacke.

Microscopic Studies

I have made a microscopic study of the platinum-bearing graywacke formations. The normal graywacke is an elastic rock which consists mainly of quartz and slate which is bound with a clay cement. It is therefore made up of the fragments of other rocks. The fragments were laid in water with imperfect separation by specific gravity. Frequently the graywacke contains feldspars which are partly kaolinized. Denckmann found such conglomerate with distinct granite pebbles. It is reasonable to assume that the feldspathic matter of these rocks came from this granite. There is at present no granite at the surface in this district, nor in the underground workings. It is safe to say that under these known formations there exists a granite which may be considered the basal formation. The old Paleozoic sea disturbed parts of this basal granite and transported pebbles of this granite to make the newer formations.

The microscopic study reveals that the cement of the rocks is not merely clayey or silicious, but is also carbonaceous. The younger formations, bearing platinum, gold, or zinc are distinguished by the cement regardless of geologic age. While the majority of the younger sediments are of loose texture, the graywacke are really cemented.

The platinum-bearing beds belong to the marine sediments. That the surf is capable of concentrating particles of gold has been shown at Cape Nome, Alaska, where the gold nuggets having been transported by the sea show etchings which cannot be seen on the fluviatile gold not far distant. As a result of microscopic investigation, it is safe to say that the ore minerals are partly concentrated in the cement and are more rarely found in the fragments which have been recemented to form the graywacke.

Accessory Gold

Of great interest are the occasional gold particles found in the slides. They are extremely small and are found in the cement. This appearance of gold was not surprising to me. With high magnification, 240 to 1, small black scales can be seen in the cement, very seldom in the quartz. It is impossible to tell anything about them under the strongest power. They are easily distinguished from the coarser graphite scales which are seen occasionally. They frequently show crystalline structure. By very fine grinding it is often possible to float these specks on water. Up to now I have not gathered enough of them to make a platinum determination. Among the material that floated was graphite, sericite, mica, and gold. As I did not find any other platinum-bearing ore in the graywacke, I am forced to assume that the precious metals are associated with these specks, particularly as they are found especially in the cement. What is more striking is that these specks are sometimes found in the quartz.

Due to the fine dissemination of the black specks, one naturally thinks of the transportation by ground-water, which circulates through the capillaries of the graywacke and should loosen the cement to some extent. The released platinum specks would then mechanically find their way to fissures. The mechanical transportation theory cannot be substantiated by the light of present knowledge. The theory contradicts our experience with the chemical and mechanical ineffectiveness of ground-water in underground circulation.

Of particular value to the investigation of the origin of the graywacke fragments is the segregation of certain constituents. Pufahl has treated 200 grams of finely ground pulp for weeks with hydrofluoric acid and concentrated sulphuric acid. After the first attempt, there was still quartz in the residue, while after a second trial the residue was free from quartz. The insoluble consisted of 0.044 gm. of heavy precious metal resi-

*Abstract of an address made before the German Metallurgical and Mining Society and printed in *Metall und Erz.*

due and disintegrated chrome iron ore. With this precious metal residue there was considerable zircon with its characteristic radioactive rays. In one residue a small amount of platinum was determined which figured on one ton of residue would amount to 1.15 gm. The extraction was made in a platinum crucible and it is not impossible that it may have been derived from that source.

Chemical Combination of the Platinum

Pufahl determined the presence of the following metals in the ore: Cr, Pt, Ir, Fe, Au. Hommel determined Cr, Ni, As, Sb, Fe, Cu, Pb, Zn, Ag, Au. In this aggregate it is well to separate the earlier ones from those that came later. The later ones would be Cu, Pb, Zn, As, Sb, Ag. The original ones are probably Cr, Ni, Fe, Pt, Ir, Ag, Au. The later minerals are probably derived from basic eruptives. Until now it has been impossible to get any idea as to the origin of the platinum or its chemical combinations.

Primarily we recognize the presence of the precious metals in the peridotites, namely, olivine-bearing rocks. This was determined in the Urals at different points. In fact there were locally some rich deposits in these rocks. In this case the precious metals resulted from magmatic segregation. The chemical combination in this case was determined as Cr, Ni, Fe, Pt. Comparing this with the work of Pufahl and Hommel shows a marked agreement.

In recent years a basic eruptive has been found in Canada which contained Cr 8.46% and 1.2 gm. of platinum per ton. It is of further interest that Johnson of Ottawa and Miller of Toronto could determine microscopically thousands of minute diamonds in a single slide, while others were free of diamonds. It is the presence of these diamonds that distinguishes the Canadian rocks from those of the Urals, but the combination of Cr and Pt will be noted as common to both. In Canada some platinum is obtained from nickeliferous pyrrhotite, which being a vein product in an eruptive formation gives us an eruptive origin for the platinum. The observation that precious metals seldom find their way to orebodies that have been built through the agency of water is important in a negative way for this discussion of the origin of natural platinum concentration. This observation is in line with laboratory experience which shows that platinum goes into solution with much difficulty as compared with gold.

The principal production of platinum is in the Urals and a little from British Columbia, in which regions the deposits result from the destruction or disturbance of primary deposits reformed through the agency of water. While the mineral is not in commercial quantity in the primary deposit, the distribution of the mineral in the secondary deposits has permitted commercial extraction. A comparison of these well known deposits with the newly discovered ones in the Rhine slates shows that the platinum in these latter show the same chemical association as the primary deposits in the Urals and British Columbia. One is practically forced to the conclusion that in the Rhine slates the origin is connected with a basic eruptive, probably peridotite. To differentiate the platinum-bearing graywacke from the Ural and Canada formations, it can be said that they have a great geologic age and were consolidated by a cement.

The granite pebbles in the conglomerate point to the existence of the granite in depth. They belong to the basal foundation which is overlain by the graywacke to an unknown extent. This basal complex could also contain the platinum-bearing basic eruptives and the primary gold. The sea during Silurian and Devonian times disturbed this basal complex and transported the precious metals into certain definite strata. Later these platinum-bearing beds were again partly disintegrated and the fragments cemented in younger, higher horizons. This explains the wide distribution of the precious metals through so many horizons. They are the product of continual destruction of older beds and the building of new sediments.

The search for the primary deposits, namely, the basic eruptives, is not promising, data as to the depth of the basal complex are lacking, and experience in the Urals and Canada with this type of deposit is not encouraging. The distribution of local rich bodies was too irregular to make it an attractive economic project.

The Platinum Content of the Graywacke

As this is a matter of precious metals, I will depend only on my own sampling and tests. I used the greatest care, taking 2-kg. samples which were lead-sealed in boxes on the spot. In addition to these I took larger samples weighing from 20 to 40 kg. and put in the usual sacks. As I could not give these sacks the attention I desired, I only lay stress on them in so far as they agree with the sealed samples. In testing this material, it is necessary to use a fine mesh, namely, 280 to the inch. From my experience it is desirable to use the largest possible quantity of pulp. In the dry work, never less than 200 gm. and preferably 300 gm. should be fused. In the wet methods, 1 kg. should be used. If platinum tests are made in different laboratories, or if the same test for platinum is made in the same laboratory several times, surprisingly divergent results will be obtained. For example:

First test:		
Laboratory	A	30 gm. per ton
"	B	trace
Second test:		
Laboratory	C	33.5 gm. per ton
"	D	3.8 gm. per ton
Third test:		
Laboratory	E	8.0 gm. per ton
"	F	0.8 gm. per ton

To determine the cause of these great discrepancies requires most painstaking investigation. It used to be believed that the platinum of the graywacke behaved abnormally while the precious metals were in the gel form in the rocks. The first one to advance this theory

was Schreiber, the discoverer of platinum in the Siegerland. He has doubtless some justification for this assumption, because, first, the gels have the property of appearing in finest division in the rocks, and second, colloidal platinum solutions are known. The question whether a precious metal occurs as a gel cannot be answered by a chemist, but rather by a petrographer, because the gel is easily distinguished optically from crystalline bodies, and this cannot be done chemically. Schreiber was really in error when he assumed that the difficulty in platinum chemistry had something to do with the gel form. If platinum is in the gel form, this can work no hardship on the chemist with the dry method, because gel is converted into the crystalline form by great heat. As it is possible to distinguish minute crystal fragments in the black specks, it is probable that in this case it is not a question of gels, but of crystalline structure.

There must therefore be some other reason for this discrepancy in results. It is either an error in analytical method or the original distribution of platinum in the rock. I am loath to admit any possibility of error in the chemical work. I am inclined to agree with Pufahl that the irregular distribution of the metal, in spite of the great fineness and the most careful mixing, is accountable for incorrect averages. We are already acquainted with similar cases.

If platinum is alloyed with iron in the graywacke, then it is not crushed equally with the quartz in the ball-mill. This difference would be also caused by the difference in brittleness of the two minerals. Under these circumstances a flour would result in which platinum specks are irregularly distributed. In taking the sample it would simply be a question of whether a few grains had been caught to give a high assay or whether none had been drawn to get a blank. If irregular distribution is responsible, then assay results cannot be figured on the ton, but apply only to the individual sample.

It is then impossible to establish the average in this way. The practical inference from all this is that we can only depend upon actual production which is capable of being demonstrated on a small scale for experimental purposes. Only the most exacting tests on samples of one ton and the extraction of the contained platinum can guard us against error.

METHODS of driving mining machinery are varied, and in Western Australia, out of a total of 3422 plants, electric motors led with 1333; steam, 1309; compressed air, 27; oil engines, 541; and suction gas engines, 163. In the last named class, the down-draft type of producer using wood was installed at five government mills, costing 10.32 and 10.86 cents per hour run at two plants, against 16.4 and 19.8 cents at two others using charcoal, the mills containing 5 stamps each and other apparatus. The 10-stamp mill gas-engines, using charcoal, cost from 32.8 to 23.2 cents per hour run. The consumption of fuel was 1.05 to 1.45 lb. per brake horsepower.

Labor Union Proposals in Western Australia

*The annual conference of the Westralian Goldfields Federated Miners' Association was opened at Boulder City on November 23. Delegates from all parts of the eastern goldfields attended, and many important matters were discussed. The following were among matters proposed:

General Executive Committee—1. Consideration of affiliating with the Miners' Federation of Australia. 2. That rule 21 be amended.

Kalgoorlie and Boulder Federated Miners' Union—1. That contract and bonus system be abolished. 2. That night shift in mines be abolished. 3. That 44 hours constitute a week's work underground, inclusive of crib (lunch) time. 4. That the maximum height of stopes be not more than 12 ft. 5. That the practice of men shoveling under stopes be abolished. 6. That the practice of lowering and hauling men in cages hung under skips be abolished. 7. That the practice of rigging Holman hoists directly over winzes be abolished. 8. That the 1913 Mines' Regulation Act Amending Bill, with amendments, be again submitted to parliament. 9. That boards be constituted to examine foreigners as to their ability to speak the English language, with power to grant certificates to those considered proficient; the employment of any non-certificated foreigner to be an indictable offence on the part of the manager responsible. 10. That the state appoint public *accoucheurs*. 11. The question of continuing to pay *Westralian Worker* (the union weekly paper) dues from the funds of the association be considered. 12. That capitation dues be reduced. 13. That general rule 18 be struck out. 14. That fatal accident allowance be discontinued in cases where the dependents benefit under the Workers' Compensation Act. 15. That uniform rate of accident pay be recommended. 16. That subclause (e) of general rule 36 be deleted and insert the following: "All ballots taken shall be on the compulsory preferential system." 17. Amendment of the Workers' Compensation Act. 18. That overtime be paid for at the rate of time and a quarter, and double time for Sunday work. 19. That pay-day be fortnightly (every two weeks). 20. That the workers' representative on Court of Arbitration be elected by congress. 21. That the Trade Union Act be amended on the lines as laid down by congress. 22. That the office of general secretary be reconstructed. 23. Uniform rules and badges. 24. That the matter of granting clearances to unaffiliated unions be considered. 25. That the placing of candidates' names on ballot papers be considered. 26. That the Arbitration Act be amended. 27. That conference consider the size of trucks used in the mines. 28. That conference define a winze, shaft, and general mining terms. 29. Every mine shall be under a manager, who shall be responsi-

*Abstract from *The Kalgoorlie Miner*.

ble for the control, management, and direction of the mine. The manager shall be registered as the holder of a certificate of competency; he shall have had at least five years' practical experience. Second-class certificates shall be given to under-managers on the same conditions. Examination for certificates to be obtained from a board to be appointed for the purpose. 30. The Mines' Regulation Act be amended to provide for the appointment of check inspectors, and that the miners' union shall have the right to appoint an expert for the purpose of investigating any case in dispute regarding matters covered by the Mines' Regulation Act. 31. Each inspector of mines shall make a quarterly report on the condition of the mines in his district. A copy of such report shall be forwarded to the secretary of the miners' union. 32. That all inquiries into mining accidents shall be by a board, the members of such board to have practical experience in mining, and to represent workers and employers; it to be presided over by a district court judge, or a person accustomed to the technicalities of taking evidence. 33. That the inquiry into any mining accident where life is lost commence within one calendar month of the date of such accident. 34. That the workers' representative on the proposed board of inquiry be elected annually by members of the union. 35. That the Mines' Regulation Act be amended and provide protection to workers called on to give evidence on any matter relative to dangerous and defective mining conditions, against victimization by employers. 36. That all employees working in or about a mine be supplied with a copy of the general rules (free of cost) of the Mines' Regulation Act.

Gwalia Union.—1. That the capitation dues of 25% of contributions to the executive be reduced. 2. That the 30% of the capitation dues paid to the *Westralian Worker* by the executive be discontinued. 3. That the conference is in favor of procuring badges for all members of the federation, and that conference decide on style of same, and the executive be given power to provide the necessary cost. 4. That this federation refuse to grant any financial assistance to any labor body in the state that may be engaged in any industrial dispute, if action has been taken without first getting the consent from the district council with whom it is affiliated. 5. That a committee be appointed by conference to suggest amendments to the present Workers' Compensation Act, the same to be dealt with by conference and sent on to the parliamentary labor party, with a request that a new bill be introduced at the earliest opportunity.

Norseman Union—1. That parliament be asked to define a shaft or winze, as used in connection with mining operations. 2. The definition of the term 'rise' as used in mining operations.

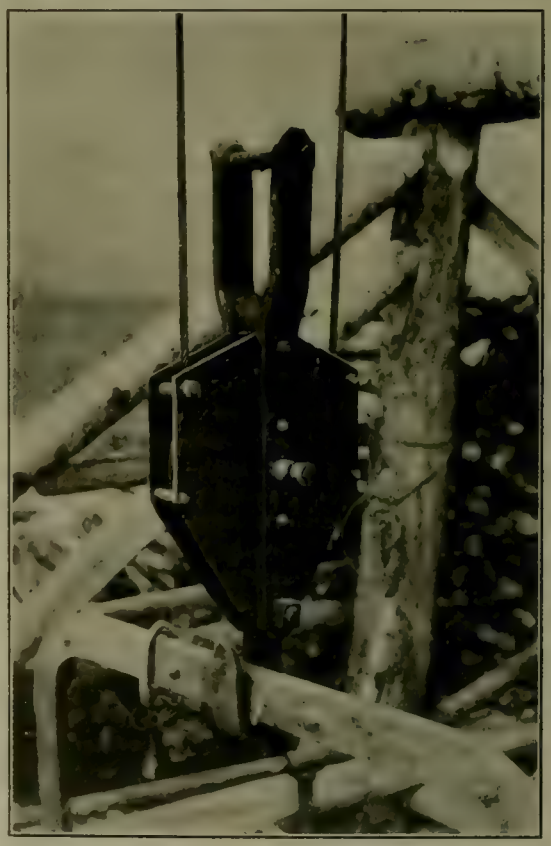
Coolgardie Union—1. The nationalization of the medical profession. 2. That the government be urged to provide legal advice free when plaintiff or defendant makes application for same. 3. That our laws be printed in English. 4. The abolition of state governors. 5. The reduction of representatives in both state houses of parliament by 50 per cent.

Marvel Loch Union—1. That a ballot be taken of the whole of the members of the W. G. F. M. U. with a view to the abolition of the contract system. 2. The government be requested to insert a clause in the mines' bill providing for the abolition of rising ground, excepting when absolutely necessary, and that the hours of labor in it should not be more than four-hour shifts. 3. We recommend to the government that more consideration should be extended to prospectors by way of reduction of rents, etc. 4. The total abolition of the use of telescope machines.

Menzies Union—1. That conference adopt a uniform design for the presentation medal to stewards and other union officers.

A Well Guarded Sheave

Where ropes and tackle are in use there is considerable danger to men of pinching fingers between the rope and sheave wheel. In the accompanying figure is shown a sheave wheel in common use at Fairbanks, Alaska, in hoisting gravel from placer mines, which is simple, strong, and safe.



A WELL GUARDED SHEAVE.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Potash and the Geological Survey

The Editor:

Sir—There appears in *Bulletin* 599, of the U. S. Geological Survey, entitled 'Our Mineral Resources—How to Make American Industry Independent,' a discussion of some of the mineral resources of the United States which require development in order to supply American demand, now that European hostilities have deprived American manufacturers of that source of chemical and mineral materials.

The author of this pamphlet is George Otis Smith, Director of the Survey. Under the title, 'Potash Salts,' I find the following opening sentence: "Outside of Germany, there is no known commercial source of potash salts." This statement appears to be in direct conflict with previous statements made by the Geological Survey, and the readers of your publication will remember that a special bulletin issued, I believe, jointly by the Bureau of Soils and the Geological Survey about two years ago, claimed the discovery by those Bureaus of a commercial source of potash at Searles lake in San Bernardino county, California.

I am willing to concede that Mr. Smith may raise a point as to the specific definition of the term, "commercial source," but regardless of the possible constructions of this term, Mr. Smith does not seem to show a spirit of fairness in this statement. We may lay aside the suspicion that the statement is wilful misrepresentation and assume that it is merely ambiguous. However, I cannot help but feel that the statement is particularly unfortunate in view of the circumstances surrounding the announcement of the Searles Lake discovery, with which, I believe, your readers may not be entirely familiar.

At the time of the announcement of the discovery of potash at Searles lake some two years ago, the owners of the property objected to the claim of the Geological Survey and Bureau of Soils that the discovery was due entirely to the initiative efforts of those departments. The facts of the case are that the presence of potash in large quantities was known by C. E. Dolbear and others some eight months prior to the announcement by these bureaus. The intimation of its presence came to the Geological Survey, I believe, through the misplacement of a copy of a report belonging to the California Trona Co., and shortly thereafter I received a telegram from Frank L. Hess of the Geological Survey, asking that I wire him at government expense full details regarding same. This telegram was referred to C. E. Dolbear, and subsequently Mr. Gale of the Geological Survey and Mr. Free of the Bureau of Soils were taken to Searles lake as guests of the California Trona Co. in the Company's automobile and were given logs, analyses, and other particulars which they confirmed.

Subsequently the special bulletin to which I refer was issued, announcing the discovery of millions of tons of potash at this point and the statement by Mr. Smith at this time would seem to contradict the conclusions reached by Messrs. Gale and Free. It is worth while observing that since this discussion of the authorship of the discovery, the U. S. Geological Survey has either been singularly silent in discussing potash at this point or has passed the subject by with only brief remarks. An instance of this character is the bulletin just published, which makes no mention whatever of the Searles Lake deposits. If the public is to continue to believe in the value and accuracy of the service rendered by the Geological Survey, it would seem that Mr. Smith should issue some statement in this regard.

As I am not materially interested in any way in these deposits, I feel at liberty to call your attention to this matter.

Samuel H. Dolbear.

San Francisco, November 5, 1914.

[The history of the discovery of potash at Searles lake lies in a field of controversy. Whitman Symmes is credited with being the first, in 1898, to recognize the value of the potassium content of the brine. Desiring to get the history straight, we asked him for details, and he has courteously furnished us the statement printed below.—Editor.]

The Discovery of California Potash

I was superintendent for the California Borax Co., which was attempting to extract borax from the sands on the southeastern side of the lake, about two miles from Dean's mill, after the manner of the operations at the Searles works on the northwestern edge of the lake. The California Borax Co. was in operation before I went down there. Its board of directors offered me a lease upon the plant, and while I was superintendent, I made a considerable number of investigations. I rejected the lease, and after making analyses of the water of the lake, I staked out everything that was not owned by the San Bernardino Borax Co. In fact, by mistake, I staked out some of the sodium bicarbonate on the shores of the lake, and Dennis Searles, then manager, became very wrathy. He thought I was jumping some of his claims. I promptly informed him, however, that it was merely an error,

for the reason that I had not seen some of the location monuments, and the incident was closed.

Alfred Von der Ropp has since told me that his people said that the lake had never been staked, and from their standpoint his statement is correct. The only law in force there at that time required that a claim should be plainly marked, so that its boundaries could be determined on the ground. I staked out the entire lake with 1½-in. stakes, with pieces of tin nailed on them. I regarded that as preliminary work and sufficient to hold the ground until I could raise some money. I came to San Francisco and interested a man now living there in the project. In order to satisfy him that I was not mistaken in the value of the brine, I had two complete analyses made by Edmund O'Neil, professor of chemistry in the University of California. I then went to work upon a process for extracting the various salts, and built special filter-presses and centrifugal machines for that purpose.

At that time Borax lake was a long way from transportation, and I was not able to raise sufficient money to proceed with the project. The amount of work required for assessment work alone to hold the property for one year was enormous. I believed that if I did not take all of the property except that held by the San Bernardino Borax Co. there would probably be competition, and that I would not be able to make any money. I believed that with only one other concern having access to the brine, there was a chance to make something. Finally, after I came to the conclusion that I was wasting my time on the project, as well as the little money I was at that time able to command, I let the whole scheme go by the board. I might add that my friend and I incorporated a company at Sacramento for the purpose of developing the property. Its name was the Crymere Chemical Co., Crymere being a combination for the words standing for clear and crystal.

WHITMAN SYMMES.

Steam Stamps From a Gold Miner's Point of View

The Editor:

Sir—Referring to the most interesting article in your issue of October 3, by Algernon Del Mar, relative to stamp and Hardinge mill installations in the Lake Superior copper district, Mr. Del Mar makes pertinent inquiries which are of interest to metallurgists. In referring to the large installations in the copper districts, he asks "How Mr. Hardinge did it?"

I undertake to answer that question by stating that my preliminary investigations tended to prove that the Hardinge mill was more efficient that the Chile mill, based upon results obtained in crushing the metallic silver ores of Cobalt. Tests were made of $\frac{3}{16}$-in. jig tailing from the Lake copper district sent to New York for testing in Hardinge mills, with the result that we knew our position, and later sent one of our mills to the Calumet & Hecla plant on trial. A contract was made with the Calumet & Hecla Co., based upon the results obtained. The long tube-mill, cited by Mr. Del Mar as being 4 by 26 ft., is in reality 5 by 18 ft. and was installed alongside of the Hardinge mill; Chile mills were already in operation. These three classes of machines were run in strict competition and on identical feeds for over a year. The Hardinge mill was only 22 in. long, in the cylinder, and produced less oversize than did and does the 5 by 18 ft. cylindrical tube-mill.

The result of these combined tests was the selection of the Hardinge mill. Further competitive tests were made by still other companies in this district, resulting in the construction of one plant of 64 8-ft. mills, another plant of 42, and others of less numbers. Plans are now completed which call for two more plants, one of which will contain 32 8-ft. and the other 12 8-ft. Hardinge mills.

Mr. Del Mar says that only one of the users of the Lake district thought conical mills had any appreciable sizing action. If the cones are of no value and have no classifying effect, then the Hardinge mill of only 18 to 22-in. cylindrical length has some unknown good reason for its being. After exhaustive trials in competition with a tube-mill as well as Chile mills, the Calumet & Hecla Co. selected the 18-in. cylindrical length of mill for the grinding of over 40,000,000 tons of tailing. One can hardly question the action of a company whose experience has enabled them to pay over $120,000,000 in dividends.

Mr. Del Mar states that the flattening of the particles of copper in pebble mills causes them to float off on the table, which would not be the case with a machine giving a cylindrical or spherical shape to the copper particles. In this assertion he is mistaken. Originally and theoretically, I also supposed such would be the case, but the actual practical working gives data showing the contrary. The results proved that the Hardinge mill effected 25 to 33% higher saving than did the Chile mills, the product of which was more or less granular and by no means flattened, when compared with that of the Hardinge mills. An explanation of this unexpected result, given by one superintendent in the copper district, was to the effect that the copper scales, through natural attractive cohesion or possibly skin friction, lay one upon another like scales on a fish, forming a flat mass on the Wilfley table. The Chile mill product, however, consisted of small spongy and rounded particles which were more readily carried away by the wash water flowing over the table. This same flattening effect also occurred in crushing metallic silver ores in the Cobalt district in Hardinge mills, and to this I attribute the unusually high saving obtained in many plants of that district.

The exhaustive critical investigations in the Lake copper district are the result of necessities developed by over 60 years' experience and experiments with all kinds of grinding devices, and we certainly must give them credit for intelligent impartiality in their conclusions. It is well enough for the layman to question the reason for certain physical actions, but the result—economic

efficiency certainly must be considered as being superior to a mere supposition based on theory.

I am enclosing two samples of copper concentrates both sized through 40 on 60 mesh, from which it will be seen that the physical conditions are as above stated. You will note that the Chile mill product is partly rounded while that of the Hardinge mill is a mass of scales. The one on the left is the concentrate from Chile mill crushing, while that on the right is the concentrate from Hardinge mill crushing.

H. W. HARDINGE.

New York, October 26.

[This interesting letter has been delayed in an effort to get satisfactory photographs of the two samples of concentrate forwarded with it. Nothing suitable for publication has proved possible, but we can state that the difference in shape referred to is very marked. While the two samples have been sized on the same screen, because of the difference in shape of particles the Chile mill product *looks* decidedly finer.—EDITOR.]

Trade Possibilities in Latin America

The Editor:

Sir—In further elucidation of your editorial in the *Mining and Scientific Press* of November 21, as far as Bolivia is concerned, I beg to mention that the petroleum, crude and refined, found at the ports of Chile comes from two different sources—from the north of Peru and from California. Gasoline and the residue from oil refineries also find there a ready market. The Standard Oil Co. of California has established at all the principal ports, large storage tanks, replenished by its tank steamers. Either by a submerged pipe or a flexible pipe-line supported by floating skids, as we have them in connection with suction dredges in San Francisco bay, the oil is pumped from the ships to the shore tanks and from these is drawn off to railroad cars to be conveyed to the various points on the railroad systems of Bolivia. The ports of Arica and Antofagasta are thus equipped.

The Standard Oil Company's work is finished when the oil is delivered to the large shore tanks, while the distribution of the oil to all inland rail points rests with W. R. Grace & Co. This Company has its principal Bolivian office at La Paz, and a great number of agencies in all parts of the country. There are oil prospects in various parts of Bolivia, but no development work has been performed in connection with any of them; besides that, these prospects are at remote points, with no good connections. No doubt they will come in with advantage in the future.

Steam boilers in Bolivia are always a serious consideration, on account of first cost, transportation, operation (especially at high altitudes), repairs, the water supply (which may have to be procured from considerable distance), and other local difficulties. Where no boiler is required, as where petroleum is directly converted by a Diesel engine into power for mechanical purposes, or into electric power for transmission and subdivision, these problems are greatly simplified.

In ordinary times the cost of one ton of 2240 lb. of coal at the Pacific Coast ports on board steamer is $7, and of petroleum $10, in round figures. Bolivia offers a field for investment of capital in many lucrative enterprises. Experienced engineers, able and reliable, can be found, ready to take a hand in the installation of mines, mills, and other metallurgical enterprises.

G. W. WEPFER.

Berkeley, California, November 24.

Precision of Thought

The Editor:

Sir—In a late issue you laid down the rule that "• • • 600,000 tons *was* crushed" was the proper form. I decidedly object, and state my reasons in a few brief words.

1. A fundamental rule of grammar, "plural noun—plural verb." If this rule is not strictly binding, then there is no rule whatever in grammar, from cover to cover, that is worth anything at all. If you can override this, then you should hereafter sign yourself as *"Dei gratia Rex Gram."*

2. In order to reach your conclusion, you assumed that the words of the sentence did not mean what they said, "tons," but meant something else. You are out of place. There is only one human that is allowed to talk such nonsense, and that is the judge on his bench.

3. You claim that the study of such nice hair-splitting technicalities must increase "preciseness of thought." I lift a warning finger, for the prolonged study of the vacuities of the fourth dimension produces minds that are unfit for ordinary life, and we have to build asylums for them.

On the contrary, I implore you to urge your readers to persevere in the effort to think real thoughts—valuable ideas—and prayerfully to avoid the temptations of metaphysics and Lindley Murray.

4. The chief curses of our schools for children are the various kinds of trash, of which the alleged 'grammar' is the worst. The permanent effects of the printed grammar are little deeper than the shadow of a passing cloud. The makers of a language are the common people, and the dominant force is the *ear;* it is the *ear* that makes all meters and rhymes, and all poetry and prose that will live.

W. S. PROSSER.

San Jose, California, November 16.

[This letter illustrates what we stated editorially—that many confuse form and fact when using collective nouns. Whether plural or singular verb should be chosen depends upon what the writer wants to say, as we illustrated. English has many pitfalls. There are numerous instances where the verb, even when singular in fact, follows a plural form of noun and conforms to it in form, but collective nouns allow discrimination to be exercised.—EDITOR.]

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

HYDRAULICKING in Alaska shows a duty of 5 cu. yd. of gravel per miner's inch per 24 hours.

LEAD ORES from the Coeur d'Alene mines, and sent to the East Helena smelter, contain from 10 to 13% sulphur.

EMPTY DYNAMITE CASES which show stains of exuded nitroglycerin generally explode when burned, and should never be used as fuel. In lighting them it is safer to lay a train of fuse or waste two or three feet long.

FERBERITE is a mineral of the wolframite series which is composed wholly or in great part of iron tungstate. It is comparatively rare, generally occurring in small deposits, but in Boulder county, Colorado, it occurs in commercial quantities.

A SHAFT-SINKING RECORD was recently made at the Coker mine of the Mineral Point Zinc Co., near Livingston, Wisconsin, when one man working one shift sunk a 5 by 8-ft. hole 60½ ft. in 42½ days in limestone. The consumption of powder was 250 lb. of 35 Du Pont Red Cross Extra brand.

AN AERIAL TRAMWAY is used to convey copper ore from the Britannia mine, in British Columbia, to the concentrating plant. The former is at an elevation of 3275 to 3775 ft., and the latter at tidewater, a distance of 3¾ miles. A Leschen patent special automatic ropeway, in two sections, carries the ore. It operates by gravity at a speed of 300 ft. per minute, and has a capacity of 40 tons per hour, using 10.5-cu. ft. buckets. A flattened strand cable is employed for both the track and traction ropes. One rope handled 400,885 tons of ore in 682 days.

WASH-HOUSES are to be erected at Illinois coal mines by the operators, in compliance with the state law. The estimated expense of construction is as follows:

Man capacity.	Building.	Equipment.	First aid, etc.	Cost per man.
300	$3971	$1933	$1431	$24.45
600	5904	3047	1431	14.90
1000	8308	3727	1431	12.45

The fixed charges on a wash-house of $10,000 cost would be about $200 per month, not including water, steam for heating water and radiation, and insurance.

IN TREATING GOLD with nitric acid, none of the gold should go into solution, unless the acid contains chlorine as an impurity, or some salt is used which would generate chlorine with the acid. It is improbable that any gold could go into solution, since gold is not soluble in nitric acid. Solutions of this acid containing gold must first be boiled to dryness to get rid of the acid. If litharge or some other form of lead is added, the dry residue can at once be melted, and the gold precipitated with the lead. If it is desirable to dissolve the gold chemically, digest the dry residue with hot water, and precipitate the gold with oxalic acid or ferrous sulphate.

EXPLOSIVES are not manufactured in Australia to any extent, and during 1913 imports were as follows, including gelignite, dynamite, and other nitroglycerin compounds, and sporting and blasting powders: Western Australia, 3,309,005 lb.; New South Wales, 3,154,145 lb.; Victoria, 1,487,556 lb.; Queensland, 1,227,239 lb.; South Australia, 1,728,860 lb.; and Tasmania, 452,400 lb.; valued at £609,375. In the first-named state 2,006,970 detonators, and 247,500 coils of fuse were imported. In 73 private and 5 government magazines of this state there is a capacity for 1092 tons of explosives. There were 1655 tests made during the year.

PEARL is a lustrous calcareous concretion, chiefly calcium carbonate, deposited around a central nucleus in successive filmy layers of a nacreous or mother-of-pearl substance. Pearls found in the oyster are believed to be the result of an abnormal secretory process caused by an irritation of the mantle of the mollusk or oyster. Early in October, at Broome, Western Australia, a gem was found in a blister in the adductor muscle of a 5-lb. mother-of-pearl shell, at a depth of 48 ft. in the sea. The blister was 1¼ in. long, 1 in. wide, and ⅞ in. high. On being opened, it was found to contain a perfectly round pearl of 100 grains, which was cleaned down to 96 grains. If it can be properly cleaned and retain its shape, it will be worth £8000 or $38,400.

LOCATION of claims by an employee raises questions, but we know of no objection to the employees of a mining company making locations in their own name and for their own interests, provided they are not made in the regular course of their employment or because of peculiar knowledge as to the character of the ground located, gained through such employment. In other words, if the location is made out of working hours and under knowledge of conditions not gained through any fiduciary relation to the company, such location would enure to the benefit of the employee and he could not be held as trustee for the company. The idea is that the location should be made distinctly outside of the scope of the employment or knowledge gained by reason thereof.

MINING IN THE FAR NORTH*

The Upper Yukon: Circle City, Eagle, and Woodchopper

By EMIL EDWARD HURJA

The Circle Mining District

The discovery of gold on Fortymile creek was made in 1886. Later discoveries in the Birch Creek and Rampart districts, in 1893, encouraged and stimulated the development of placer mining on all streams entering the upper Yukon. Circle was founded by miners from the Fortymile coming down the Yukon to the so-called Birch Creek diggings. Circle is 140 miles below Eagle.

There are several stores there, one of the biggest being that conducted by the Northern Commercial Co. There is a wireless station, which connects with the Fairbanks station, as well as with Eagle. A post-office, several residences, and a roadhouse make up the rest of the camp.

A good road connects Circle, as the local supply point of the mining area surrounding it, with the different creeks. Three roadhouses, Twelvemile, Central House, and Miller House, are maintained at convenient intervals along the trail.

CIRCLE CITY, ALASKA, FROM THE YUKON.

The headwaters of Crooked creek occupy a fan-shaped area within the edge of the hills to the south of its broad, flat valley. On its meandering way eastward to Birch creek, it receives also two tributaries, the Boulder and the Deadwood, which head a dozen or more miles to the south and flow northeast to the main stream in parallel courses about three miles apart. The creeks that are of economic importance on the north side of the divide are Deadwood, Mammoth, Mastodon, Independence, and Miller; on the south side, Eagle creek, and its tributary, Mastodon fork. Deadwood creek is about 20 miles long.

Season of 1914

The summer of 1914 was a good one for the Circle district. The output for the season is expected to be over $250,000, which exceeds any year since 1907. Water conditions were excellent; the heavy rains that kept up during the entire summer maintained the ditches at their high mark for the whole sluicing season.

The Risdon dredge which was erected early in 1912 on 10 Above, Mastodon creek, by the Mastodon Creek Dredging & Hydraulic Co., has been dismantled. Its operation was not satisfactory, because of the age of the machinery. The dredge was the first brought to the Klondike and was moved from Dawson to Circle in 1911. The ground held by the dredging company has reverted to the original owners, and the claims from 10 to 17 Above, inclusive, are being operated by hydraulic methods. Theron Fell and J. P. Anderson are conducting hydraulic operations on the ground, one plant on 10 and the other on 20 Above. Anderson owns from 18 to 24 Above, inclusive. A. P. Clark owns considerable ground on upper Mastodon, including claims 29, 40, and 41 and 52 Above. He erected a hydraulic plant last year, but was unable to do any work until the present season.

Berry & Lamb Dredge

Barnette & Harington own from 8 Above to 5 Below, Mastodon. They operated the past summer on Discovery. Berry & Lamb, on Mammoth creek, from the mouth of Mastodon to one and one-half miles below the mouth of Porcupine creek, are hydraulicking. A dredge will be built on the ground during the winter, to replace the hydraulic plant. The material was landed at Circle during the summer by boats of the American-Yukon Navigation Co., and will be freighted 40 miles over the government road to Mammoth creek. The dredge was built by the Union Construction Co. of San Francisco, California. The buckets have a capacity of 3½ cu. ft. Power will be furnished by two 85-hp. Wolf locomobiles. Wood will be used for fuel. It costs $10 per cord and is hauled from Porcupine creek. The ground on Mammoth has a depth of from 12 to 14 ft. The construction of the dredge will proceed during the winter.

On Miller creek, a tributary of Mammoth, J. P. Anderson, Jay Kelly, and Charles Lamb are operating.

Kalenborn & Moss spent the summer preparing to experiment on Independence creek with a new type of gold-saving apparatus. They have purchased a Bucyrus one-yard steam-shovel which had been used in stripping work on the Mammoth Creek holdings of C. J. Berry and Charles Lamb, and with a movable grizzly over portable sluice-boxes expect to mine economically. The Kalenborn-Moss ground is one mile from the mouth of Independence.

Clarence J. Berry has a hydraulic plant at work on Eagle creek, a tributary of Birch creek. The ground is from 14 to 24 ft. deep. Water is obtained from Independence creek. From two to four nozzles are used, depending on the water supply.

Deadwood Creek

From eight to ten small outfits are 'shoveling in' on Deadwood creek, a tributary of Crooked creek. The ground is shallow and of comparatively low grade, so that it pays to work in primitive fashion. Ground on the lower end of the creek is 'drifted' in the winter.

Riley Erickson and William Arthur are drifting on Switch creek, a tributary of Deadwood creek.

*[Previous articles in this series by Mr. Hurja on mining in Alaska and the Yukon have been 'Mining Revival in the Ketchikan District, Alaska,' July 4; 'Wrangell, Alaska,' special correspondence, July 11; 'Developments of the Alaska Gold Mines Co.,' July 18; 'Juneau, Alaska,' special correspondence, July 25; 'Cordova, Alaska,' special correspondence, August 8; 'Valdez and Prince William Sound,' August 15; 'Seward and the Kenai Peninsula,' August 29; 'The Koyukuk Mining District,' September 12; 'Operations of the Yukon Gold Co.,' October 10; 'Skagway-White Horse Mining District,' October 17; 'Operations of the Canadian-Klondyke G. M. Co.,' November 14; 'The Klondike, the Treadgold Placers, and Outlying Districts,' November 28.—Editor.]

[illegible] sawmill and electric light plant at Circle [illegible] have it hauled over the trail to No. 3 Switch [illegible] and erected. He owns No. 3, 4, 5 and 6 on Switch. The ground is from five to seven feet deep. The outfit consists of 1500 ft. of pipe and one No. 1 Hendy nozzle. J. Stacy, owner of several claims on upper Deadwood creek, plans to erect a sawmill soon. Jack Cotter, who worked on upper Switch last year, may continue work next season. On Hall Dollar creek, a tributary of Harrison creek, Lang & Co. worked during the summer. Recent finds of pay-dirt have attracted considerable attention to the district. E. H. McGriff, said to represent capital, recently completed an examination of ground on lower Deadwood that appeared feasible to dredge.

Eagle District

The Eagle district embraces a few streams flowing into the Yukon near the town of Eagle. Eagle is the first port on the Yukon from the Yukon boundary. It formerly was a military post—Fort Egbert—but that has been abandoned. There is a store, a post-office, several trading posts, and a roadhouse there. U. G. Myers is United States commissioner and recorder.

There are five outfits at work on American creek, which enters the Yukon 10 miles from Eagle. Curtis & Danielson have a crew of from eight to ten men employed, as have A. H. Meinzer and August Fritsch. Meinzer is on the main stream. Fritsch is immediately above him on the same creek. There are a few smaller outfits farther down the creek. Most of the work is open cut. The creek was discovered in 1894 and has been worked intermittently ever since. Several years ago a $135 nugget was picked up on No. 8 Below American creek.

The Seventymile District

The work in the Seventymile district in the upper Yukon district of Alaska during the summer has been encouraging, despite the fact that the production is small compared with other Alaskan camps. Water conditions were favorable and indications were that the output would be greater than last year. Seventymile river is a tributary to the Yukon, entering on the left limit 20 miles below the town of Eagle.

Froelich & Kummer, operating on Crooked creek, a tributary of Seventymile, expected their season's work to net between $5000 and $6000. William Russell is working on the main river at the bar near the falls of the Seventymile. His operations have been entirely satisfactory. Olson & Johnson and Jones & Hanson are two open-cut outfits on Barney creek, which operated satisfactorily because of the abundance of water. Each expected to clean up $5000 to $7000. Turnbull & Williams erected a small hydraulic plant on Barney creek and expected to do considerable dead work preparatory to a better season next year. They estimated this season's output at $6000.

C. F. Yost is operating on Nugget creek, in the Seventymile precinct. Ross & Madison and James Murphy operated on Alder creek. The ground they worked by open-cutting had a depth from 6 to 14 ft. E. A. Robertson's work on Flume creek probably is the most pretentious placer mining in the district. He has a small sawmill operated by water power. His mining is conducted on a high bar having a depth of from seven to eight feet. He has built automatic dams to control the water, and although this season's work was satisfactory, he hopes for better returns next season.

Minor prospecting work has been done on Washington, Sonderson, Lee, Curtis, and Pleasant creeks. Some surface has yielded short returns. There is much low-grade ground on several creeks that has been subject to investigation by different mining companies.

There is but one quartz prospect in the Seventymile district. It is known as the Caribou and is on Flume creek, a tributary of the north Seventymile. An adit 140 ft. long has been driven on it and an arrastre erected to handle the ore. The vein is said to have a maximum width of 8 ft. Hudson brothers have found coal prospects at the head of Charley river, 100 miles from the Yukon.

TAKING WOOD ON A YUKON STEAMER.

Woodchopper Creek District

Placer mining continues in the Woodchopper Creek district of Alaska. Most of the operations are on a small scale and of the pick-and-shovel order, although plans are under way for a hydraulic plant. There are about 20 men at work in the district, most of them on Coal creek, a left limit tributary of the Yukon entering it 60 miles above Circle.

Nelson & Beaton are working a crew of five men on Coal creek. George Powers and Frank Slavin have a hoisting plant and expect their season's output to be doubled over that of last year. On Woodchopper, John Holstrom, Frank Bennett, Valentine Smith, and Fred Myers are working on a small scale. Chris Gabelman is operating a small plant. Jack Boyle and Charles Boyle are taking out a small block of ground this year. Water conditions on Woodchopper have been fairly good during the past summer.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents

NEW YORK

[illegible] Mexico Mines of El Oro [illegible] Production and Cost [illegible] Lead Co. [illegible]

[illegible] Co. reports that its estimated profit [illegible] Messina mine [illegible] to total $[illegible] from [illegible] [illegible] [illegible]

John Broan, the mining 'captain,' leased the mine from the Company and began working on tribute. It is reported that by careful sorting underground, the 'rock' now being mined will average 22 lb. of refined copper per ton. With 30 men underground and 10 on surface, five cars of 'rock' per day are shipped to the Centennial-Allouez stamp-mill. In order to employ as many men as possible, Mr. Seeber, the superintendent, has a number of men cutting timber on Company land. The hardwood is sent to the Stratton handle factory at Atlantic.

'The Copper Handbook' will no longer be published in the Michigan copper district. This well known publication on copper was founded in 1900 by the late Horace J. Stevens, of Houghton, and was published annually by him until his death in April 1912. About a year later, rights of the book were sold to Walter Harvey Weed. Mr. Weed, as owner and editor, opened an office in Houghton, and published the 1914 edition. It was feared at the time of the sale that Mr. Weed would not maintain an office in Houghton for any length of time. However, the news of the removal of the publication office to New York is received with much regret by the people of the copper country. Mr. Weed desires to handle all his business interests from one New York office, and the Houghton office of 'The Copper Handbook' will be closed about December 1.

LUNING, NEVADA

CONDITION OF THE DISTRICT.—LUNING-IDAHO, COMMERCIAL, RED BUTTE, SHIPPER, AND WAGNER.—AZURITE COMPANIES.—GOLDYKE DISTRICT.

Generally speaking, the future of this copper-silver district appears bright. Although the copper properties are slow in getting under way again, yet the district is working at about 75% of its average mining capacity. Success of the improved leaching processes on the ore found here has caused a continued activity in mining this metal. This, with the fact that the gold and silver contents are high, makes the district a good one at this time.

The large holdings of H. H. Hill and C. Barr of the Nevada Silver Peak have been financed by Frank Everett and associates, who will erect a mill on the ground at once. This property, which is about eight miles northwest of Luning, consists of four claims having a series of well defined veins varying from 2 to 46 in. wide, and averaging $16 to $22 gold per ton. The mine has been worked in such a manner as to prove a large body of ore which will insure the erection of a small mill, and the further development of the property.

The Luning Idaho Mining Co. is going right ahead with a small force, and extending development on the eastern portion of the ground and has cut large bodies of good grade copper ores, some of it containing over 80 oz. silver and some gold.

The Commercial Ores & Mines Co., which has taken over the Luning Gold Mines Co.'s holdings, will soon be ready to increase its output and develop this ground. From reports received, the outlook there is for another large shoot of high-grade ore, such as the Luning people had two years ago.

The Red Butte Mining Co., which is operating west of town, has opened good ore in the adit which is being driven by C. S. Smith, and this will insure steady operation during the coming winter. This Company, which is composed of Spokane people, has made arrangements to start sinking on the new ore at once.

The Shipper Copper Co. and Alameda Mines Co., which are working on a custom leaching plant to treat a large tonnage of ore, have plans nearly arranged for the beginning of preliminary work to start December 1.

The Wagner-Azurite Co., which closed down to permit installation of the flotation process in connection with its mill, will make arrangements to be running full time again by January 1.

The continued activity in gold mining has again brought the Goldyke district north of Luning to the front, and in the past week several leases were given on good property, and long delayed work was started on others. Also there has been a quiet movement of mining men out there, which should lead to the general opening of a rich mineral belt. This district will be much heard of during the coming winter.

Summing up the general conditions in southwestern Nevada, the opinion is that it is entering a new era of mining, of which the Luning area will draw a large share of attention.

SILVER CITY, NEW MEXICO

ZINC MINING DEVELOPMENTS.—CHINO COPPER IMPROVEMENTS.—MOGOLLON MINES.—MINING PATENTS.—SIERRA COUNTY PROSPECTS.

Work was commenced, on October 16, on Thunderbolt mountain, near Hanover, by the Empire Zinc Co., in developing another zinc sulphide orebody. A two-compartment shaft will be sunk. The Company has already opened large carbonate of zinc ore reserves west of Hanover, and is making periodical shipments to Kansas and Wisconsin. If the blende claims are operated, the erection of a concentrating plant will be necessary. All Hanover ore being mined by the Company occurs as a replacement in crystalline limestone. C. T. Brown, manager for the Company in New Mexico, would make no definite statement as to the actual plans of the operators, but it is generally understood that extensive construction work will be done at both Hanover and Pinos Altos, where zinc property is owned.——At Fierro, several promising zinc claims are being developed under lease and bond.——J. W. Bible is taking out a good grade of zinc-lead ore and opening some carbonates.——T. B. Fisher and associates have established a camp near the McGee mines, and intend opening up the zinc sulphide orebodies. It is claimed that their intention is to erect a small treatment plant in Shingle cañon, after doing experimental work.

The Chino Copper Co. is experimenting with a flotation process in its mill at Hurley, and has a unit at work treating slime. Several additions have been made to the mining forces at Santa Rita, and a shovel is now digging in the northwest cut. The new crushing plant and loading station at Santa Rita is being operated with a great saving of time at the concentrator, all ore now being under 2 in. when it reaches the rolls. The plant is situated at the west end of Santa Rita and on the side of a dump. The ore is dumped from ore-cars down a concrete chute about 50 ft. wide and 100 ft. long, in which grizzlies are arranged. Jaw crushers reduce the coarse, and all the ore is elevated across a small *arroya* to the steel loading bins, where it is deposited in three piles from both sides of the bins in Santa Fe cars *en route* to Hurley. The Company is making needed road improvements on Santa Rita hill. Drilling for air is in progress at the old Santa Rita mine.

In Mogollon, work is progressing at the usual rate in all mines and mills, although it is reported that the Deadwood mill was closed down last week for repairs and renewals.—— The Socorro Mining & Milling Co. has the towers up for its 2000-ft. tramway across an *arroya*, and it will soon be in use. The Company shipped 16 bars of bullion to New York on November 8.——The Ernestine Mining Co. shipped 15 bars on November 9. Frank Hitchcock, ex-postmaster general, president of the Company, is spending some time in the vicinity.

Mining patents are being secured this year by the Fauquier company (C. Amory Stevens), of New York, on property in the Pinos Altos, Chloride Flat, and Burro Mountain districts; Woodward Mining Co., of Tyrone, New Mexico, on its property in the Little Burros consisting of 11 claims; the Azure Mining Co., on Burro Mountain property, and other small property holders. Quite a lot of patent applications are

listed from Mogollon. Throughout the district assessment work has been postponed owing to the exemption bill being before Congress.

In the Organ district of Dona Ana county, lessees of various properties are shipping a good grade of copper-silver ore to the El Paso smelter.——Lois A. Wright, of New York City, will examine some property in the district soon.——Norvel Welsh, lessee of the Memphis mine, has just returned from New York.——J. C. Miller and S. Brown are reported to have closed a lease on the Leona mine, and have begun sampling.——J. A. Yawger is in charge of two assessment crews in the district.

Sierra county is in the limelight at present, its most promising districts having been examined recently by prominent engineers, and reports are being compiled.——It is claimed that a leaching plant at Kingston is one of the proposed projects.——The Carpenter zinc-copper-lead district is receiving its share of newspaper publicity, but active work has not started. Owen Bros., of Santa Rita, have become heavily interested in the area, and are preparing to operate some good property.——The Calumet Commercial Mining Co., at Phillipsburg, is working the Republic group and treating good grade ore.——There is much property in Sierra county worthy of examination.

TORONTO, ONTARIO

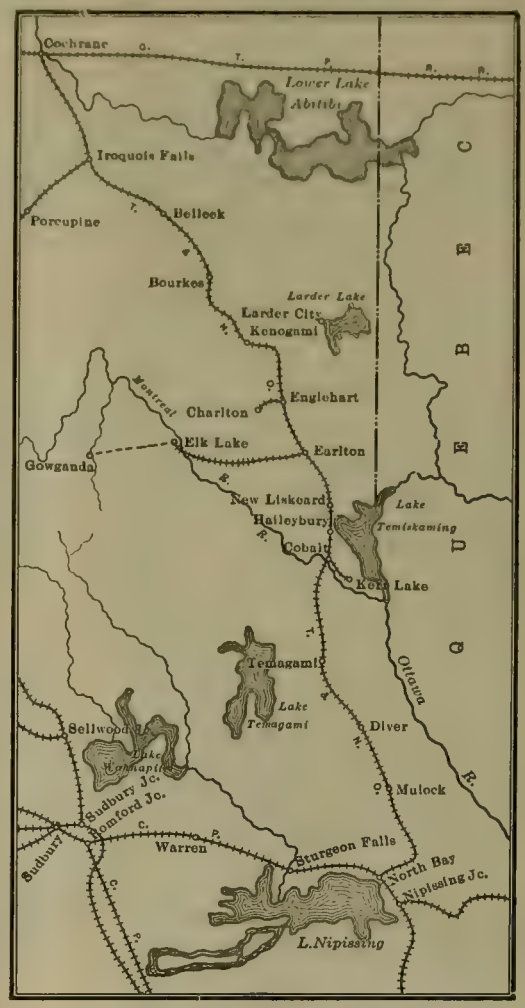
SHARE DEALINGS ON 'CHANGE.—CROWN RESERVE AFFAIRS.—SILVER OUTPUT FOR NINE MONTHS.—NICKEL.—NOTES ON THE DOME, HOLLINGER, JUPITER, TOUGH-OAKES, AND SESIKANIKI DISTRICT.

Business at the Mining Exchange, which has been very quiet since August, is beginning to improve. Two sessions daily are now held in place of one, and the minimum price limitation has been removed with but little effect on quotes, the only restriction now in force being that all transactions must be for cash. The most noteworthy price change was in Crown Reserve, which sold down to 68c. as the result of an official announcement that the present dividend rate of 24% would be reduced. No intimation as to the extent of the reduction is given, but the general expectation is that the dividend will be fixed at 12%, payable quarterly, instead of monthly as at present. The Company is in an excellent position, having ore reserves of about 2,000,000 oz. and a surplus on hand in the neighborhood of about $900,000; but the directors are disposed to pursue a conservative policy in connection with the acquirement and development of new properties. The Porcupine Crown is turning out a valuable asset, and also the Silver Leaf, in which a vein 1 in. wide of high-grade ore has been cut at the 75-ft. level.

The returns to the Bureau of Mines for the first nine months of the year show a heavy reduction in the output of silver, compared with last year. The production was 19,448,018 oz., valued at $10,082,229, a decrease in value of $2,885,710. The output of nickel was 18,085 tons, valued at $4,023,556—an increase of $197,923.

Notwithstanding the recent issue of an Order-in-Council prohibiting the export of nickel to most of the European countries, a feeling prevails that Germany may still be drawing supplies of this metal from Canada *via* the United States, and more drastic measures are being strongly advocated. It is pointed out that no nickel is exported anywhere from Canada except in the form of matte, which is refined in the United States, so that the action of the government entirely fails to meet the case. The question is likely to come up at the next session of Parliament.

The Dome mine has now six years' ore reserves blocked out at the present capacity of the mill.——The main vein of the Hollinger has been cut in the winze at the 800-ft. level, where it shows about the same width and value as on the upper levels. A third compressor with a capacity of 50 drills is being installed, and is expected to be in operation by the end of the year. The cross-cut to connect the new main shaft with the Miller-Middleton has been commenced, and will be carried 800 ft. from the present workings to the old Miller-Middleton shaft.——At the Jupiter, 500 ft. of the main vein has been opened at the 400-ft. level, and 225 ft. at the



MAP OF PRINCIPAL MINING DISTRICTS OF ONTARIO.

475-ft. level. The option of the McKinley-Darragh mine expires December 17, and the final examination and sampling will be made shortly.——Development at the Tough-Oakes has reached the 300-ft. level and the veins are reported better than at the surface. It is stated that the ore assays about $500 per ton.

Eight locations in the Sesikaniki camp, situated on the east side of Wolf lake, Maisonville township, known as the Murray, Mogridge & Powell group, have been bought by J. M. Bell of the Huronian Belt Mining Co. The price is stated as $150,000.

The Caribou-Cobalt company shipped 52,833 oz. silver to England last week.——A rise has been started from the 330-ft. level of the Hudson Bay south workings, to reach the conglomerate.

The main vein of the Hollinger is being opened at 800 ft. Early next year the electric haulage system at 425 ft. will be ready.——Cross-cutting at 675 ft. has been started in the Acme. Three veins have been cut at 550 feet.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

Circle

W. L. Julian, D. Creighton, and John A. Clark are installing a hydraulic plant on Woodchopper creek. A ditch which will have a length of 5½ miles is under construction. It will be supplemented by two pipelines, one 800 ft. and the other three-quarters of a mile long. Water will be conducted from Iron creek to the mouth of Mineral creek. The ground on Woodchopper creek is from 9 to 18 ft. in depth, all of which is gravel.

Juneau

During October the Alaska United company results were as below:

Details of operation.	Ready Bullion Claim.	700-Ft Claim
Stamps working	120	120
Ore crushed, tons	20,132	21,315
Concentrate saved, tons	196	148
Total gold recovered, realizable value	$11,951	$15,186
Average yield, per ton	$2.25	$2.28
Operating expenses	$7,950	$35,85[illegible]
Construction	$4,878	$[illegible]
Net profit	$12,123	$3,341
Development, feet	452	884
Stock of broken ore, tons	[illegible]1,0	13,380

The report that the Jualin mine was closed for the winter was incorrect, according to the manager, V. N. Nadeau. Some machinery was due to arrive at Juneau last week for the property, including a Diesel engine. The sum of $250,000 is to be spent in developing the Kensington mine, controlled by D. C. Jackling and B. L. Thane. Two parallel adits show a good body of ore. B. B. Nieding is mine superintendent. A 500-ton mill is proposed for the future.

Nome

A violent storm is raging at Nome, and ice from the Bering sea is being forced against the town, while several mining areas nearby are surrounded with water. Solomon, 32 miles east, is also flooded.

ARIZONA

Cochise County

The Calumet & Arizona property at Bisbee was inspected last week by T. F. Cole, of Duluth, and Charles Briggs and C. E. Briggs, of Calumet. They will also inspect the New Cornelia mine in the Ajo mountains.——Good results are being made in developing the Shattuck-Arizona mine. Between the 100 and 300-ft. levels a large tonnage of $15 gold-silver ore has been blocked out. Good copper ore is showing at 400, 600, and 800 ft.——Work on the gold-bearing area of Juniper Flats continues with encouraging prospects.

Gila County

On July 17, 1913, the Inspiration Consolidated Copper Co. of Miami, commenced a suit against the New Keystone Copper Co. to condemn a right-of-way for an underground tunnel through the latter Company's Copper Hill mining claim. The object of this was for the transport of ore mined by the former Company from its Live Oak claims, to the working shafts of the Inspiration claims, and through these to the surface. The Inspiration started driving the tunnel, but the Keystone obtained an injunction from the Superior Court of Gila county stopping further work. Then the Inspiration started the suit of condemnation under the right of eminent domain for such [illegible]. The Inspiration and Live Oak mines contain 30,[illegible] and 15,000,000 tons of 2% copper ore, respectively, and are operated by the Keystone group. A 7500-ton mill was built erected to treat this ore, but for the successful working of the whole Inspiration Consolidation this tunnel was necessary. It would be 9 by 11 ft. in cross-section and would be available for public use. The lower court upheld the demurrer of the New Keystone on the ground that the tunnel was for the Inspiration's private use. The Supreme Court at Phoenix on November 27 has confirmed the lower court's decision, arguing that the tunnel as desired as a private way is not one of necessity, therefore the power of condemnation in this instance lies dormant. Curtis H. Lindley of San Francisco and E. W. Rice of Globe appeared for the Inspiration company, and Alderman & Elliott of Globe for the New Keystone company.

Yuma County

The American Girl mine, two miles from Tumco and near Ogilby, has been shut down and 175 men are out of employment. Recent heavy rain flooded the reservoir and then the mine. Unwatering will take two or three months. A good tonnage of low-grade ore exists in the property.

CALIFORNIA

In a *Press Bulletin* of November 28 the California State Mining Bureau states that assessment work on mining claims must be done before the end of the year in the usual manner. The Secretary of the Interior, Franklin K. Lane, in a telegram to the State Mineralogist, F. McN. Hamilton, states that no legislation was enacted which exempts holders of unpatented mining locations from the statutory annual labor. The State Mineralogist is anxious that wide publicity be given the matter, as only a month remains in which to begin work. Many inquiries on this subject have been addressed to the State Mining Bureau, probably because legislation was expected.

Conditions of the oil industry should improve, and it is the aim of the Bureau to aid in bringing about such improvement. The past year has been one of depression, and has seen some valuable oil holdings almost slip from the grasp of American investors. The public must be made to realize the important factors, supply and demand, which underlie the oil business. The state contains immense deposits of oil, and a large demand, but money or credit is needed to join the two. The remaining necessity is the use of brains and co-operation of all interests. For several years ill-informed operators have caused overproduction, and thereby rushed toward financial suicide as well as maiming their more conservative neighbors. It has become a habit to blame the large concerns for all misfortunes and to clamor for more laws or regulations. The prosperity of California rests to no small degree upon the oil industry, which furnishes its only cheap fuel. There are 300 oil-producing companies, 6 marketers, and innumerable consumers. Notwithstanding the importance of oil, there is no adequate means of closely estimating probable fluctuations in supply and price. It is true that there are several monthly summaries voluntarily published by marketers, and if it were not for these the public would have practically no data. However, a business annually involving about $50,000,-

[illegible]

[illegible]

[illegible]

COLORADO

Lake County (Leadville)

The Leadville district is more active than for some time past, owing to new developments, the scheme for unwatering the downtown mines, and the improvement in metal prices. Some doubt has been held regarding the value of orebodies in the area to be drained, but samples of silver and copper ore from a wide shoot in the Coronado, now under water, show what may be found later. The surface equipment at the Penrose shaft, which will be the pump shaft, is rapidly being put into shape.——Lessees in the Little Jonny sent about 1000 lb. of ore to the smelter last week. Metallics weighing 41 oz. was screened out, the remainder assaying 190 oz. gold per ton.——The New March company is sinking its shaft another 100 ft. ——Various work is under way in the Big Four, Prospect mountain adit, Davis shaft, Gordon, London, Ibex, Tenderfoot, Venture, and Adelaide properties.

Gilpin County

Denver men have secured a lease of the Concrete claims, west of the Gunnell mine on the same vein, and intend to work it extensively.——A vein 17 in. wide and containing high content in gold, silver, and copper has been opened for 14 ft. at 225 ft., in the Bezant mine in Leavenworth gulch. There is 30 in. of low-grade milling ore at the side of the smelting ore.——A cross-cut in the Buckeye, worked by the Gold Cup company, has cut rich gold-silver-lead ore.——About 80 tons of high-grade gold-silver-copper ore has been shipped from the Pittsburg mine in lower Russell gulch. W. Augur is manager.

Ouray County

A 6 by 16-ft. Allis-Chalmers tube-mill has been installed in the Wanakah mill. The 200-ton blast-furnace is to be blown in this week.——Development has been resumed at the Mountain Top mine after two months' suspension.

San Miguel County

Profit of the Tomboy mine in October was $33,000.

Teller County (Cripple Creek)

The new 150-ton mill of the Vindicator is being operated at capacity, and making a good recovery. Five sets of sub-lessees are breaking three grades of ore from ground around No. 2 shaft.——Three to four feet of $60 ore has been opened by a lessee in the Isabella. There are 30 sets of lessees in this property.——The Gold King Mining Co., the closest corporation in the district, paid a dividend of 1c. per share, equal to $10,000, on November 21. This was from accrued royalties on ore shipments.——Two to three inches of sylvanite ore has been opened by M. D. Rapp on the third level of the C. O. D. mine.——Nutter Bros., lessees on No. 2 level of the El Paso, are mining $35 ore from a shoot 2 ft. wide.——Four feet of $25 to $40 ore has been cut on No. 7 level of the Ajax.——Foundations are being laid at the El Paso for the machinery to take the place of that recently destroyed by fire.

IDAHO

Shoshone County

The Interstate-Callahan mine and mill are being operated three shifts, producing 50% zinc ore.——Eight feet of about 40% zinc ore is now showing in the Silver Cable cross-cut.——In the Reindeer-Queen there is 12 to 18 in. of 34.2% copper ore, and 5 ft. of high-grade milling ore at 700 ft. depth. The mine is at Stevens peak, and E. B. Crawford is in charge.——Two fatal accidents occurred in the Bunker Hill & Sullivan mine last week. In one case J. R. Williams was crawling into an ore chute to place some dynamite to release a jamb, when the ore suddenly moved and caught him. In the other instance E. Labus, a motorman on an electric locomotive with a train of ore cars on No. 12 level, was killed by accidentally striking his head against an ore chute.

MICHIGAN

Houghton County

Sand-filling of worked-out stopes in the Copper Range Consolidated mines has been a success. The Quincy company is now trying the system, while others contemplate doing so.——During October, the Isle Royale mill crushed 44,205 tons of 'rock' in 25 days, yielding 586,120 lb. of copper, not including mass copper.

MONTANA

Lewis and Clark County

Twenty stamps, the first unit of the 60-stamp mill for the Porphyry Dike mine, in the Ten Mile district, near Helena, have started work. This property consists of 330 acres, and contains a large deposit of free-milling gold ore. The plant is operated by electric power. George Gordon is manager for the James Breen interests.

The old Drumlummon mine at Marysville, which has produced a great quantity of gold and silver, was sold on November 27 for $11,486, the result of a suit against the owners for $10,000 and court costs. The new owners are B. Betor, F. Trudell, and C. S. Caird.

Lincoln County

Superintendent John Johnson of the Lukens-Hazel mine was in Libby last week, and stated that the day and night shifts are opening two veins of rich ore in two adits. Twelve inches of smelting ore has been cut in No. 1 adit. Arrangements are under way to erect a concentrating plant next spring.

Silverbow County

On November 21, 'Muckie' McDonald and Joseph Bradley of the Butte Mine Workers' Union, were sentenced to three and five years' hard labor, respectively, for complicity in kidnapping Patrick Towey. McDonald became leader of this union after the split with the Western Federation of Miners, but Bradley was considered the 'brains' of the new concern. Joseph Shannon of the executive committee, was declared not guilty by the court at Butte.

NEVADA

Churchill County

The Nevada Hills company reports as follows for October: ore treated, 6213 tons; average per ton, $7.136; net profit, $6590; and resources, $253,352. The last named item includes silver worth $14,077 (28,000 oz.); concentrate and bullion in transit, $17,818; and value of mill solutions, $20,000.

Esmeralda County

Eighteen feet of ore has been cut in rise 503-C above the 1017-ft. level of the Velvet claim of the Jumbo Extension. This is the downward extension of the shoot which has given rich rock at 9.52 ft. The ore contains gold, silver, and copper.

Humboldt County

Rochester is showing considerable activity at present in its mine development, new mill, and railroad. The 1300-ft. level of the Seven Troughs Coalition is opening well, and a winze below this point is down 25 ft. in good ore.

Lander County

It is proposed to ship from 20 to 40 tons of ore per day from McCoy, the gold-silver area found on May 23, 1914. This place is 29 miles south of Battle Mountain. The principal rocks are rhyolite, porphyry, and dolomite, according to Guy E. Pierson of Salt Lake City.

Nye County

(Special Correspondence.)—The shaft of the Jim Butler company has just been retimbered to the depth of 700 ft., and during this work a new double-drum Nordberg hoist was installed, which is operated by a 125-hp. variable speed motor.

This hoist is capable of handling a gross load of 3900 lb. and is geared to give a speed of 700 ft. per minute. Of this load, 2600 lb. is counterbalanced by the use of the Balliet system, which makes a variable weight at all points of the cage's trip through the shaft, compensating for the weight of the cable, cage, and car, and making a large saving in power that would have been required otherwise.

A vein of rich ore, 8 or 10 in. wide, has been cut in the Mizpah Extension, and has caused considerable comment in the stock markets. The vein is running eastward through the trachyte formation. At this time the quantity of ore has not been determined, but thus far it is not great. Ore is now being sacked for shipment.

Tonopah, November 27.

A good tonnage of $5 to $15 gold ore has been developed by John Mullen and Salt Lake City people in the Altmore mine, near Springdale. It is only 1500 ft. from the Pioneer mine, which is milling ore. An electric hoist is to be added to the equipment.

A 5 by 20-ft. Allis-Chalmers tube-mill weighing 14 tons is being hauled from Tonopah to the Mushett and Wittenberg plants at Manhattan by a team of 18 horses. Ten other horses will be added to the 18 when climbing hills. Pebbles for the tube-mill will be supplied by Maris' chalcedony quarry, eight miles northeast of Manhattan. These are doing good work in Tonopah mills.——Satisfactory results are being made in crushing oxide ore from the White Caps mine.——Construction of the transmission line from Manhattan to the old Belmont district is almost finished. The deepest shaft, 500 ft., in the area is to be unwatered at once.

Six mines at Tonopah last week produced 9687 tons of ore valued at $190,326.——The Extension company's profit was $49,442 in October.——At the annual meeting of the Midway at Phoenix, Arizona, on January 4, it is proposed to reorganize the Company.——The Belmont will pay 12½c. per share on January 1.——The limit of windlass work having been reached at Tonopah, there is a lull in prospecting, although considerable work is under way. Power hoists will soon be installed.

Storey County

During the past week 200 tons of $14.02 ore was extracted from a two-compartment rise at 2500 ft. in the Con. Virginia. There were 350 tons sent to the Kinkead mill.——At 2300 ft. in the Mexican, 22 tons of $16.40 ore was mined.——The Yellow Jacket mill received 579 tons from the Belcher mine, and 471 tons from other mines.——Gypsum insulation is being put on pipes and pumps at the Reidler station of the C. & C. pumping station.

TENNESSEE

Polk County

On December 1 the Tennessee Copper Co. paid off $200,000 of the 6% gold bonds issued for construction of the sulphuric acid plant, leaving $800,000 outstanding. Acid production is the largest in the Company's history.

UTAH

Beaver County

Electric power from the Beaver River Power Co. is to be used for the plant at the Moscow mine. This power concern has 2000 hp. available, and is extending its field of operations, having 150 miles of line to mining districts.——The Beaver Gold Mining Co.'s shaft has cut ore at 60 ft., which is supposed to be a continuation of the Sheep Rock vein, opened one mile distant.

Juab County

Shaft repair work is finished at the Chief Consolidated at Tintic, and 50 men have started on development.——Twenty-six men are working on leases down to 700 ft. in the Eureka Hill.——Some 6 to 8% copper ore is being mined in the Dragon.——Promising developments are taking place in the Scranton and Tintic Zinc properties.——Ore shipments from the Tintic district last week totaled 69 cars, about 2200 tons, from 9 mines.

Salt Lake County

Lessees have opened two shoots of copper-lead-gold-iron ore in the Montana-Bingham adit, being driven through Bingham Amalgamated ground. The adit is in 3500 ft., and the Congar vein is in 750 ft. farther.——The Miller Investment & Leasing Co. of Salt Lake City, has secured control of the Peruvian Consolidated Mining Co.'s claims in the Alta district for $125,000. Several adits were driven by J. P. Clays, former owner, and the new concern will extend one adit to open an orebody. Plans are under way to construct an aerial tramway 3700 ft. long. A compressor, drills, and a mill will probably be installed next spring. Albert Burndles is manager.——In white limestone formation, in a distance of 863 ft. the Alta Tunnel & Transportation Co. has cut stringers of ore assaying 17% copper, 21 oz. silver, and $1.60 per ton gold.

Summit County

Vigorous development work is proposed for the Thompson-Quincy mine at Park City, which was recently examined by F. Sommer Schmidt. Revenue of the Company during the past

MAP OF UTAH.

financial year was $9937 from ore sales and $4616 from sales of shares. The balance on hand is $244, and the indebtedness on October 31 was $44,382.——Ore from the Revelator mine in the Snake Creek district has been settled for at 81.8 oz. silver, 41.4% lead, and 1% copper. Samuel Hair is superintendent.

WASHINGTON

A new map of this state, containing the latest information, on a scale of 8 miles to 1 in., and 32 by 48 in., has been issued by the U. S. Geological Survey, and is sold at Washington, D. C., for 25 cents. The state geologist, Henry Landes, co-operated with the chief geographer, R. B. Marshall.

Chelan County

One ton of high-grade molybdenite, worth $2000, was shipped through Wenatchee last week from the Aurelia Crown mine, at the head of Chelan lake. Robert Dahl is in charge of the property.

FERRY COUNTY

(Special Correspondence.)—The Western Union Mines Co., at Republic, is employing 105 men. At the Surprise mine this Company has installed a 90-hp. Diesel engine, and is also erecting a small compressed to help the other one and supply air for eight drills. The mine is being unwatered to the 500-ft. level, where an crosscut 400 ft. long has been opened, with high-grade ore below this point. The Insurgent claim has been leased to the Company, and it will be worked with the Lone Pine and Last Chance claims. The latter is being reopened at 500 ft., and when unwatered the 540-ft. level will be worked where rich ore is said to be showing. From the 500-ft. level 150 tons of $50 ore has been shipped to the smelter, and there is estimated to be 2500 to 3000 tons opened. The Company is sending 80 tons of $40 ore per day to the San Poil mill, in which a new set of steel rolls is being installed. The Company will take over the plant built by the New Republic company and add another tube-mill and Oliver filter, to bring the capacity up to 200 tons per day. It is planned to have two 500-hp. Diesel engines in a central power plant, increase the mill's capacity to 1000 tons per day, and supply the town of Republic and all the mines and mills with light and power. F. M. Croft, of West Virginia, is president of the Western Union Mines.

Republic, November 20.

The Western Union Mines Co., of Republic, is calling for bids for plant to generate 1000 hp., the machinery to consist of two 500-hp. Diesel engines, generators, and other electrical appliances. The Alliance Mining Co., of Republic, has acquired the mines and plant of the Anaconda Gold Mining & Reduction Co. for $171,000. Of this, $120,000 was paid in Alliance shares, and the remainder is an indebtedness by the purchasers. C. M. Hanson, of Spokane, is president.

PEND OREILLE COUNTY

Since the railway has been opened in the Okanogan valley, the old Ruby district is regaining activity. In the early nineties there were 1500 people there. Two cars of $75 silver ore have been sent from the Arlington mine to the Tacoma smelter. It is estimated that there is 10,500 tons of ore ready for stoping. A caterpillar tractor will probably be used to haul ore to Okanogan.

SPOKANE COUNTY

It was proposed to reopen the Spokane Stock Exchange on November 30, according to the secretary, C. E. Mallette.

STEVENS COUNTY

The United Copper Co., of Chewelah, according to Conrad Wolfe, of Spokane, is to add a tube-mill to its plant, and is testing several flotation processes.——New mining machinery has been delivered to the Hecla mine for its further development.

WYOMING

A new map of this state, a single sheet 40 by 50 in., printed in black, has been issued by the U. S. Geological Survey. It contains the latest county boundaries, railroads, streams, etc., on a scale of about 1 in. to 16 miles, and is sold at Washington, D. C., for 30 cents. The state's area is 97,914 square miles.

CANADA

ALBERTA

(Special Correspondence.)—The Edmonton Industrial Association Drilling Co. has been drilling a well at Viking (about 75 miles east on the Grand Trunk Pacific) under an arrangement with the city that, if it found gas in certain quantities and pressure, the city would take it over and reimburse the Association. At 2340 ft., at 3 a.m. on November 4, the well came in strong and blew wide open until about 4 p.m. November 7. I got there about 5 p.m. that day (on a special train run for the purpose of taking a crowd down) and the gage stood at 450 lb. The Company had run a pipe out about 100 ft. and let the gas burn there. After it had been burning some time, I watched the gage and it stood at 300 lb. The International Drilling Co. had the contract for the drilling, and officials measured the volume as 9,350,000 cu. ft. and gave out the statement that it is next to the big well at Bow Island field from which Calgary gets its supply. This gas has a distinct odor, and I would not be surprised to see that territory bring in oil at a little greater depth. It is the most important find in the province this year, in my opinion. They had gas at 2193 ft. and it kept getting stronger until they ran into the strata at 2340 ft., when the big volume came in. From an examination of the samples kept from the log, I judge it is in either the lower Benton or the upper Dakota that the discovery was made, more likely the Dakota. It is possible, owing to unconformity, that the gas comes from the Devonian, and this opens distinct possibilities of profitable oil as well as gas.

Edmonton, November 20.

BRITISH COLUMBIA

It has been officially stated that two of the eight blast-furnaces of the Granby plant at Grand Forks are to be blown in as soon as possible. A reduction of 25% of the wages at the time of the shut-down, early in August, will become effective. The Josie mine of the Le Roi No. 2 company was reopened on November 23 with 40 men.——Good reports come from development work of the British Columbia Copper Co. since August. From March 1 to November 1 drilling totaled 20,500 ft., and 15,000 ft. of trenching done. One orebody is 600 ft. long and 100 ft. wide, and another 500 ft. long with a width varying from 50 to 150 ft. About 145,000 of the 591,709 outstanding shares of the Company have not been exchanged for the stock of the Canada Copper Corporation. This exchange involved a $1 subscription to the debenture bonds of the Canada Corporation for each share of British Columbia stock held.

ONTARIO

The emptying of Kerr lake has been suspended for the winter. Owing to the depth of mud in the bottom, work was interfered with considerably.——After being hung up for 105 days, 20 out of 40 stamps of the Temiskaming mill started again on November 16. During the past six weeks, about 5000 tons of ore was broken in the mine stopes. The new vein at 750 ft. is being underhand stoped.——Recent prospecting at La Rose Extension has uncovered for 50 ft. a narrow vein assaying 2500 to 3000 oz. per ton. It will also be developed underground.——At Porcupine the Pet shaft is to be sunk to 200 ft. The mill is treating 15 tons per day.——Stopes at 100 and 200 ft. are supplying the Vipond mill. The new refinery is ready for operation.

YUKON

What the *Dawson Weekly News* calls a 'smashing run' was made during the week ended October 27 by No. 3 dredge of the Canadian Klondyke company, operating close to Dawson. The gravel was 30 to 35 ft. deep, with 7 ft. exposed, the ground and gravel thawed, with a soft bedrock. According to the general manager, J. W. Boyle, the record is as follows:

Operating time, hours (possible 168)	163.83
Gravel handled, cubic yards	110,045
Average per hour, cubic yards	674
Average depth cut, feet	30.6
Average width cut, feet	280
Power used, kilowatt-hours	106,000
Power used per yard, kilowatt-hours	0.96

A new bucket-line was recently put on this boat, the buckets having an extra 2 in. on the lips, making 17 cu. ft. capacity instead of 16 cu. ft. The dredge crew comprises Arthur Gibson, dredgemaster; Stanley Gibson, Joe McKinnon, and George Munroe, winchmen; J. C. Campbell, Sam McLellan, and James Forbes, oilers.

PERSONAL

R. E. Lawrence is [illegible] Colorado.

G. W. W. Macomber, [illegible] Australia as a prisoner of war.

Irving F. Wilcox has returned to New York from South America.

Cecil Cropper has returned to London from the Federated Malay States.

Louis G. Kirchof of the Tonopah Extension, Nevada, is at San Francisco.

Karl E. Lloyd recently of the Central Chile Copper Co. has returned to the United States.

Kenjiro Nishio mining engineer from Tokyo, Japan, is visiting the mines and mills of the copper country, Michigan.

G. L. Sheldon expects to go to Eureka county, Nevada, on professional examination during the last part of December.

Denis M. Riordan is on his way to California to inspect the mining properties owned by the General Electric Company.

A. C. Lawson has been made acting dean of the College of Mines of the University of California, succeeding S. B. Christy.

Frederick Bradshaw and W. H. Blackburn of Tonopah have been at Reno attending a meeting of the Nevada Mine Owners' Association.

D. C. Jackling has returned to Salt Lake City from a visit to the Ray Consolidated property in Arizona, and the Chino property in New Mexico.

T. M. T. Ranson has retired from the board of the First National Copper Co., following the death of his brother, and their places have been filled by E. M. Buchanan and J. A. Young.

J. K. Turner, general superintendent for the Jumbo Extension Mining Co., has been appointed by Governor Taskie L. Odom as a Nevada delegate to the American Mining Congress at Phoenix, Arizona, December 7 to 11.

A. L. Queneau writes to a friend in New York that since August 5 he has been at the front with his artillery regiment. Those of his friends who wish to write him can address him in care of Miss Blaisdell, 5 Rue Napoleon, Paris.

George Kingdon has been appointed general superintendent for the Cananea Consolidated Copper Co. He hopes to start development work before the end of the present year. He recently visited the United Verde Extension property with S. P. Applewhite.

Robert Hallowell Richards will be given a complimentary dinner, on December 7, in recognition of his fifty years as a devoted 'Tech' man by the corporation, faculty, and alumni of the Massachusetts Institute of Technology, at the Copley Plaza Hotel, Boston.

William Hague, director of the North Star Mines Co.; George W. Starr, managing director of the Empire Mines, and C. A. Brockington, superintendent of the Golden Center, have been named by W. G. Thomas, president of the Chamber of Commerce, to represent Grass Valley at the American Mining Congress at Phoenix.

Nominations for officers of the Geological Society of America are: Arthur P. Coleman, Toronto, Canada, president; L. V. Pirsson, New Haven, Connecticut, first vice-president; H. P. Cushing, Cleveland, Ohio, second vice-president; Edward O. Ulrich, Washington, D. C., third vice-president; Edmund Otis Hovey, New York City, secretary; William Bullock Clark, Baltimore, Maryland, treasurer; Joseph Stanley-Brown, New York City, editor; Frank R. Van Horn, Cleveland, Ohio, librarian; and Charles K. Leith, Madison, Wisconsin, and Thomas L. Watson, Charlottesville, Virginia, councilors.

SCHOOLS AND SOCIETIES

The Cobalt branch of the Canadian Mining Institute met on November 25. The principal discussion was on C. C. Gow's paper. The Sampling and Assaying of Cobalt Ores presented at the Institutes meeting at Montreal last March.

The Cleveland Engineering Society, Ohio, met on December 1, when Thomas D. West read a paper entitled 'The Foundry as an Adjunct to Engineering.' On December 8 J. V. Emmons will discuss 'The Structure of Tool Steel.' Both of these papers are illustrated.

Night schools for mining instruction were started at Miami, Oklahoma, some time ago, in charge of Mead S. Johnson, and have been a success. Assaying and chemical apparatus is available for students, also for mechanical drawing. The new schoolrooms were opened on November 23.

The American Mining Congress has issued a 58-page illustrated pamphlet covering its past work, the meeting at Phoenix, Arizona, on December 7-11, the U. S. Bureau of Mines and Geological Survey, and articles on Arizona and districts. A provisional program of the meeting is given on p. 869.

The Michigan College of Mines' *Alumnus* for October contains, among other matter, a paper on 'Drying Iron Ore on the Mesabi Range,' by Edwin J. Collins; 'The Rainbow Lode Shaft,' by E. C. Reeder (a reprint from the *Mining and Scientific Press*); and 'Data on Iron Mining,' by E. S. Dickinson.

The School of Mines at Socorro, New Mexico, has 52 students, and according to Fayette A. Jones, president of the department of education, the income last year was $27,510, of which $24,392 was from the state. The total value of the buildings, equipment, and 20 acres of ground is $102,633. It costs about $500 per year to teach each student.

The University of California expects several hundred new students at the start of the second half-year on January 11, 1915. The attendance at present is 8481 students. According to Henry T. Claus in the *Boston Transcript*, the numbers at various universities of the United States are as follows:

1. Columbia	10,961	12. Syracuse	4,000
2. California	8,481	13. Nebraska	3,793
3. Pennsylvania	7,368	14. Yale	3,289
4. Michigan	6,302	15. Washington	2,738
5. New York	5,875	16. Iowa	2,725
6. Illinois	5,620	17. Pennsylvania	2,246
7. Ohio	5,395	18. Purdue	1,961
8. Wisconsin	4,901	19. Stanford	1,884
9. Cornell	4,848	20. Massachusetts Institute of Technology	1,818
10. Northwestern	4,632		
11. Harvard	4,516	21. Princeton	1,665

Forty members of the Columbia branch of the American Institute of Mining Engineers were present at the fourth annual meeting at Spokane on November 20. The secretary-treasurer, L. K. Armstrong, reported that membership had increased from 120 to 150, and that the financial condition was good. F. A. Ross, of Spokane, was elected president, and Rush J. White, of Wallace, Idaho, vice-president. The principal address was made by F. M. Handy, of Pullman, associate professor of geology at the university, on the 'Economic Geology of Eastern Washington.' Other speakers were Loren A. Campbell, of Rossland, B. C., of the West Kootenay Power & Light Co.; Oscar Lachmund and Frederic Keffer, Greenwood, B. C., of the British Columbia Copper Co.; G. H. Wyman, Jr., Wallace, Idaho, flotation and concentration engineer for the Federal and Hercules mining companies; Sam H. Richardson, of Republic, and D. C. Livingston, Moscow, of the mining department at the University of Idaho.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

San Francisco, December 3.

Antimony	15 —15¾
Electrolytic copper	13 —13¼
Pig lead	4.05— 5.00
Quicksilver (flask)	$55
Spelter	6½— 6¾
Tin	34½—36
Zinc dust, 100-kg. zinc-lined cases	10

EASTERN METAL MARKET.

(By wire from New York.)

NEW YORK, December 3.—Generally the market is better. Copper is strong and advancing, lead quiet, and spelter firm. The following dividends have been declared: Calumet & Arizona, 50c.; Goldfield Consolidated, 15c., or $533,872, on February 27; Quincy, 50c.; and Yukon Gold, regular quarterly of 7½c. per share on December 31.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59 32	54.35
Mch.	57.87	58.01	Sept.	60.53	....
Apr.	59.26	58 52	Oct.	60.88	....
May	60.21	58.21	Nov.	58.76	....
June	59.03	56.43	Dec.	57.73	....

The trend of prices has been upward this week, as follows: New York, 48.50, 49.25, 49.12, 49.50, 49.75, and 49.87c.; and London, 23.00, 22.81, 22.75, 22.78, 23.00, and 23.06d. per ounce. In November the highest was 49.87c., and lowest 47.62c. in New York. Producing companies are still storing metal, selling as they find necessary. It is said that the Tonopah Belmont has 1,250,000 oz. unsold. Fair support is coming from India, and a considerable shipment left London in the week ended November 19. Stocks in London are about 20,000,000 ounces.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Nov. 26	Holiday	Oct. 21	3.50
" 27	3.80	" 28	3.50
" 28	3.80	Nov. 4	3.50
" 29	Sunday	" 11	3.50
" 30	3.80	" 18	3.70
Dec. 1	3.80	" 25	3.90
" 2	3.80	Dec. 2	3.80

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.36	3.86	Oct.	4.37	3.60
May	4.34	3.90	Nov.	4.16	3.68
June	4.33	3.90	Dec.	4.02	....

Stocks have been reduced by improved buying, and some producers report that they are sold out to the end of the year. The metal is stronger at St. Louis and ore at Joplin is $47 per ton, basis of 80% metal.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36 10	Oct.	40.61	30.40
May	49 10	33.29	Nov.	39.77	33.51
June	45.10	30.72	Dec.	37.57	....

The course of this metal in November is shown on the next page of this issue.

COPPER

Prices of electrolytic in New York, in cents per pound.

Date.		Average week ending	
Nov. 26	Holiday	Nov. 19	11.75
" 27	12.50	Nov. 25	12.25 to 12.50
" 28	12.50	Dec. 2	12.62
" 29	Sunday		
" 30	12.63		
Dec. 1	12.75		
" 2	12.75		

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16.54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14.19	Oct.	16.31	....
May	15.42	13.97	Nov.	15.08	....
June	14.71	13.60	Dec.	14.25	....

The figures, in tons, for three important companies are as follows:

	October.	September.	July.
Chino	3,060,000	3,237,869	5,087,750
Ray	3,278,348	3,180,000	6,008,061
Utah	6,765,396	6,672,194	13,768,958

The export situation is discussed in the New York letter of this issue.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slighly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb. are given below:

Week ending			
Nov. 5	55.00	Nov. 19	55.00
" 12	55.00	" 25	55.00
		Dec. 3	55.00

Monthly averages.

	1913.	1914		1913.	1914
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mar.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	53.00
May	40.25	39.00	Nov.	39.40	55.00
June	41.00	38.60	Dec.	40.00	....

This metal remains steady at $55 per flask. The Nevada Cinnabar Co. at Ione is producing 22 flasks per day. A shipment of 375 flasks has been sent to New York.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Nov. 26	Holiday	Oct. 21	4.73
" 27	5.20	" 28	4.90
" 28	5.20	Nov. 4	4.90
" 29	Sunday	" 11	4.85
" 30	5.20	" 18	5.00
Dec. 1	5 20	" 25	5.10
" 2	5.20	Dec. 2	5.20

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb	6.13	5.22	Aug.	5.51	5.45
Mch.	5 94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	4.75
May	5 23	4.91	Nov.	5.09	5.01
June	5.00	4.84	Dec.	5.07	....

English purchases have been heavy, and with the continued shut-down of the Butte & Superior, there has been a marked advance in prices. Ore at Joplin has risen to $42 to $45 per ton, basis of 60% metal.

CYANIDE

Mills using cyanide in the Philippine Islands are reported by the Bureau of Science to have been sufficiently supplied in October, but uneasy as to the future. In a special press bulletin the Bureau quotes from the 'Press.' The 'Sun,' carrying a cargo of cyanide from Rotterdam, has been delayed by rough weather on the Atlantic, but put into Boston, November 28.

New York Metal Review

The outlook in business generally is brighter. The effects of war buying are beginning to spread out to lines not benefited at first. Pig iron has been sold heavily, but at ridiculously low prices. The steel trade needs the stimulus which can only be given by more liberal railroad buying, and this will come only when the Interstate Commerce Commission renders a decision in the railroad freight rate case. Many machine tool builders have done splendidly in selling for export, and in selling tools to enable the fulfillment of contracts for war material. The Bethlehem Steel Co. has bought heavily of machine tools, likewise of motors to run them, and the motor company has in turn bought several machine tools. This Company and E. W. Bliss are making shrapnel, and the motor company has bought a great deal of machinery. So has the Fore River Shipbuilding Co. High-grade steel for shrapnel is being purchased. Hydraulic presses for making smokeless powder have been ordered. Steel has been bought for horseshoes. Makers of binoculars cannot fill the orders proffered to them. Gun and ordnance manufacturers have work ahead for many months. Many other articles are required which indirectly result in greater consumption of metals. In a way, this war business is unhealthy, but it will help tide things over.

All of the metals took on a better tone in November, and prices advanced without exception. In copper there was heavy buying, most of it being on domestic account, and the movement left the market on a much more substantial basis than it had been, despite the continuance of interference with exports. Lead was subjected to three advances, and a good buying movement was concluded for the time being. On the whole, spelter advanced as a result of support from abroad. Tin varied considerably as usual, through fears that there would be a shortage in the month's supply; but the destruction of the German man-o'-war *Emden*, and the arrival of 830 tons on one ship, allayed apprehension. Antimony maintained a high level throughout the month. Aluminum advanced about 1c., but was uninteresting. The New York Metal Exchange resumed trading in tin, lead, and spelter on November 9.

COPPER

Actual need on the part of consumers, and the low price of 11.25c. cash, New York, which prevailed in the first 10 days of November, brought about the heaviest buying movement of many months. The demand did not cease until about November 20; meanwhile quotations advanced steadily until, on November 23, 12.50c. cash was reached. Buying was almost entirely on domestic account, exports being seriously hampered by the refusal of Italian steamship lines to take copper as a part of their cargoes. Metal which was aboard the steamer *Kroonland* was confiscated at Gibraltar, and the consignors were notified by the English authorities that a prize court would determine its disposition. The action of Great Britain caused a second protest to be sent to Washington by the producers who made the shipment. The Italian government added to the complexities of the situation by prohibiting the export of copper from Italy, though it announced that it would not interfere with its transit through that country. If a guarantee were given that the metal was to be used in Italy or Switzerland, there would be no interference, though copper shipped subject to order would be under suspicion. The advances referred to began almost simultaneously with the buying, prices going up about ⅛c. each day from November 11 on. In the movement, several million pounds was taken, one large consumer alone taking over 5,000,000 lb. There also was good buying on the part of a large London metal house, whose representative was in New York. Makers of hot rolled sheet copper advanced their price, on November 19, ½c. to 17c., and on November 23 made a further advance to 17½c. Brass products were advanced also. The general belief of the trade is that the end of the movement left the market on a healthy and sound basis, though a few hold that the advance was too rapid and that the deadlock which will ensue must terminate in lower prices before another movement can be begun. Lake shared in the activity, it being reported that some producers' stocks had been practically exhausted. The quotations for Lake advanced from 11.50c. cash, at the first of the month, to 12.62½c. on November 23. Export figures for November are unavailable at this writing, but those from the United States in 10 months of this year, as compiled by C. Mayer, secretary of the New York Metal Exchange, total 312,964 tons, against 322,399 tons in the same months of 1913. The Waterbury average for October was 12.25c. per pound.

LEAD

Quotations advanced three times in November. From the first of the month until November 12 the New York price stood at 3.50c., when it went to 3.60c. On November 17 there was another advance to 3.70c., and on the 19th it went to 3.90c. Even at the price last named the metal is cheap. Heavy buying which began in October lasted into November, and thousands of tons were taken by both domestic and foreign buyers, and the activity left both producers and consumers in a comfortable position. Advices from England and Russia state the demand in those countries to be excellent, principally because of the war. The large interests led the way in the month's business.

SPELTER

The quotations for spelter dipped a little from 5.05c. New York in the first few days of November, then gathered strength and advanced steadily until 5.30c. was touched on November 24. October exports are estimated at 6175 tons, of which 4454 tons went to England. The good foreign demand was largely responsible for the advances. Domestic requirements were not heavy, but this did not impair the strength of the market.

TIN

The principal feature of the month consisted of recurring fears that there would be a shortage of tin, which caused prices to fluctuate in the manner so characteristic of the metal. On November 2 the quotation was 31.80c., at which figure a good business was done, the activity continuing until November 6. On the 4th the quotation was 33.25c.; 10th, 34.25c.; 17th, 32.50c.; 18th, 32c.; 24th, 33.87½c.; and 27th, 33.50c. was bid. Great relief was afforded to the market when the news came early in the month that the German cruiser *Emden* had been destroyed. With this menace to shipping removed from the Indian Ocean, it was felt that shipments from the Straits would come more freely. In the latter part of the month a good business was done, particularly in futures. A shortage was anticipated near the close of November, but fears were dissipated by the arrival of the steamer *Marquette* with 830 tons. The deliveries for consumption in October were good, amounting to 3700 tons. In that month arrivals at Atlantic ports totaled 2043 tons, and those at Pacific ports, destined for the East, 1200 tons. All deliveries in 10 months of this year totaled 36,147 tons, a decrease of 800 tons as compared with the same time in 1913. The total visible supply October 31 was 10,894 tons, against 14,452 on September 30. Arrivals to November 27 totaled 2410 tons, and there was afloat on that day 1800 tons.

ANTIMONY

Quotations early in the month were 16c. for Cookson's, 15c. for Hallett's, and 13.50c. for Chinese, but they soon advanced to 17 to 18c., 15 to 16c., and 13½ to 14½c., respectively, and these levels held throughout the month despite the fact that there was no great demand at any time. The price was maintained by continued reports of foreign requirements and the belief that domestic consumers' stocks were well nigh exhausted. The needs of war were also expected to revive demand.

Current Prices for Oils and Candles

(Corrected weekly by Standard Oil Co., California)

Prices are for Standard Oil Plants only except where otherwise noted. Prices are subject to change without notice.

Candle Mfg.	Per set.	Candle Mfg.	Per set.
	cents.	Candles	cents.
6s 2 oz-10s	8¼	6s 14 oz-20s	9½
6s 2 oz-12s	9	6s 16 oz-14s	10
6s 16 oz-10s	9¼	6s 16 oz-20s	10¼

Candles 1 cent per set higher than the above.

The following prices are for oils (Calol) in wood barrels, case goods 1 gal. 3c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Compressor oil	40	Light gas engine oil	28
Arctic gas engine oil	40	Red compressor oil	26
Castor machine oil	20	Red engine oil	17
Dynamo and motor oil	24	Turbine oil	35
Engine oil	24	Turbine oil, heavy	37
Gas engine oil	26	Diesel engine oil	40
Heavy gas engine oil	45	Cylinder oil	37
Heavy red engine oil	19	High-pressure cylinder oil	50
Heavy red journal oil	21	Low-pressure cylinder oil	37
Ice machine oil	28	Valve oil	44

The following prices are for oils in iron barrels, cases (2-5 gals.) 7c. per gallon higher, except on Eocene, which is 8c. per gallon higher.

	Per gal., cents.		Per gal., cents.
Pearl oil	9	Engine distillate	7
Headlight oil	10	Aroturps	23
Eocene oil	11	V. M. and P. naptha	11½
Red Crown gasoline	12½		

	Per bbl.
Star fuel oil, f.o.b. Richmond Refinery	$0.85

	Per ton.
Petromastic cement X	$13.00
Petromastic cement XX	12.00
Asphaltum	$5.50 to 12.50

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, per ton	$19.00	$21.00
Arsenic white, refined, per lb	0.05	0.06
Arsenic red, refined, per lb	0.12	0.15
Asbestos, chrysotile	100.00	350.00
Asbestos, amphibole	5.00	10.00
Asphaltum, refined, per ton	11.50	20.00
Barium chloride, commercial, per ton	50.00	60.00
Barium sulphate (barytes), prepared, per ton	20.00	30.00
Bismuth ore, 15%, per ton	*250.00	upward
China clay, English, levigated, per ton	15.00	20.00
Chrome ore, according to quality, per ton	7.50	10.00
Cobalt metal, refined, f.o.b. London, per lb	1.90	...
Coke, foundry, per 2240 lb	12.00	15.00
Diamonds (according to size and quality):		
Borts, per carat	2.00	15.00
Carbons, per carat	55.00	80.00
Feldspar, per ton	5.00	25.00
Firebrick:		
Silica, per M	50.00	55.00
Snowball, per M	40.00	45.00
Flint pebbles for tube-mills, Danish, per 2240 lb	24.00	28.00
Fluorspar, per ton	10.00	15.00
Fuller's earth, according to quality, per ton	20.00	30.00
Gilsonite, per ton	35.00	40.00
Graphite:		
Amorphous, per lb	0.01	0.02½
Crystalline, per lb	0.04	0.13
Gypsum, per ton	5.00	7.50
Infusorial earth, per ton	10.00	15.00
Iridium	55.00	....
Magnesite, crude, per ton	5.00	7.50
Magnesite, dead calcined, per ton	20.00	25.00
Manganese ore, oxide, crude, per ton	10.00	15.00
Manganese, prepared, according to quality, per ton	30.00	70.00
Mica, according to size and quality, per lb	$0.05	$1.00
Mica, splittings, per ton	1000.00	1500.00
Mercury, in sound 75-lb. flasks, per ton	150.00	200.00
Nickel metal, refined, per lb	0.45	0.60
Ochre, yellow, strictly best, levig. tol., per 100 lb	2.00	3.00
Osmiridium, per oz	30.00	40.00
Platinum, native, crude, per oz	30.00	45.00
Soapstone, ground to 100 mesh, per 2240 lb	35.00	45.00
Soapstone, crude, per ton	25.00	30.00
Talc, prepared, according to quality, per ton	20.00	50.00
Tin ore, 60%, per ton	425.00	450.00
Tungsten ore, 65%	400.00	425.00
Uranium ore, 10% min.	25.00	per unit
Vanadium ore, 15% V_2O_5 per ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, per ton	*15.00	20.00

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are f.o.b. San Francisco and subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l 66°, drums, per 100 lb.	$ 0.80	$ 1.10
Acid, sulphuric, com'l, 66°, carboy, per 100 lb.	1.25	2.00
Acid, sulphuric, C. P., 9-lb. bottle, bbl., per lb.	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, per lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, per 100 lb.	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., per lb.	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, per lb.	0.10½	0.15
Acid, nitric, com'l, carboy, per 100 lb.	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., per lb.	0.16	0.22
Acid, nitric, C. P., bulk, carboy, per lb*	0.12½	0.15
Argols, ground, bbl., per lb	0.10	0.20
Borax, cryst. and conc., bags, per 100 lb.	3.00	4.35
Borax, powdered, bbl., per 100 lb	3.38	4.50
Borax glass, gd. 30 mesh, cases, tin lined, per 100 lb.	10.50	14.00
Bone ash, 60 to 80 mesh, bbl., per 100 lb.	0.50	6.50
Bromine, 1-lb. bottle, per lb.	0.55	0.65
Clay, domestic fire, sack, per 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, per lb.	No quotes	
Cyanide, 98 to 100%, 200-lb. case, per lb.	"	"
Cyanide, 128%, 100-lb. case, per lb.	"	"
Cyanide, 128%, 200-lb. case, per lb.	"	"
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white broken, casks, per 100 lb.	10.50	10.75
Lead acetate, brown broken, casks, per 100 lb.	9.00	10.50
Lead acetate, white, crystals, per 100 lb.	12.50	13.25
Lead, C. P., test., gran., per 100 lb	13.00	15.00
Lead, C. P., sheet, per 100 lb	15.00	18.00
Litharge, C. P., silver free, per 100 lb	11.50	13.50
Litharge, com'l, per 100 lb	8.00	9.50
Manganese ox., blk., dom. in bags, per ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, per ton (85% MnO_2—3% Fe)	65.00	120.00
Nitre, double ref'd., small cryst., bbl., per 100 lb.	9.00	11.00
Nitre, double ref'd., granular, bbl., per 100 lb.	8.50	10.50
Nitre, double ref'd., powdered, bbl., per 100 lb.	9.25	11.25
Potassium bicarbonate, cryst., per 100 lb	14.00	16.00
Potassium carbonate, calcined, per 100 lb.	18.00	30.00
Potassium permanganate, drum, per lb.	0.20	0.30
Silica, powdered, bags, per lb	0.03	0.05
	Min.	Max.
Soda, carbonate (ash), bbl., per 100 lb.	1.45	1.75
Soda, bicarbonate, bbl., per 100 lb	2.00	2.50
Soda, caustic, ground, 98%, bbl., per 100 lb.	2.75	3.25
Soda, caustic, solid, 98%, drums, per 100 lb.	2.50	2.75
Zinc shavings, 850 fine, bbl., per 100 lb.	12.00	14.00
Zinc sheet, No. 9—18 by 84, drum, per 100 lb.	No quotes	

*Extra charge for packing nitric acid for shipment to conform to regulations.

Roessler & Hasslacher quoted as follows on November 16:

Ammonia, anhydrous, in 50-lb. cylinders, per lb	$0.27
Arsenic, white powder, in 500-lb. bbl., per lb	0.06
Cobalt oxide, black, in 10-lb. tins, per lb	1.05
Cyanide, potassium, 38-4% cyanogen, per lb	0.25
Cyanide, sodium, 51% cyanogen, per lb	0.23
Sodium, metallic, in 1-lb. tins, per lb	0.40

Foreign shipments of potash are being received regularly

COMPANY REPORTS

NEVADA WONDER MINING COMPANY

The [illegible] annual report of the Nevada Wonder Mining Company for the year ended December 31, 1913, has been received. The property is situated in the Wonder district, Nevada county, California, and is reached by a 3-mile wagon road from Wonder station on the Nevada County Narrow Gauge railroad. The following information is abstracted from the report:

Mine development totaled [illegible] ft. In the Nevada Wonder shaft was sunk, three compartments, a total depth of 1342 ft. and the Hidden Treasure and Wonder Extension were sunk two compartments from [illegible] and 400 to 611 ft. respectively. The deepest workings are at 1400 ft. and the horizontal extent is 3400 ft. from end to end. Work in the claims acquired from the Hidden Treasure and Wonder Extension companies has given good results. A new orebody called the Extension oreshoot, was opened on Last Chance No. 1 claim. At 500 ft. depth it is 200 ft. long. At 300 ft. there is 40 ft. of ore, and a drift from a crosscut from the Extension shaft at 800 ft. showed 35 ft. of ore assaying $20 per ton over 3 ft. The 1000-ft. drift

WONDER MINE AND MILL, LOOKING WEST.

from the Nevada Wonder shaft is yielding milling ore from the shoot, which has been opened at 300, 500, 800, and 1000 ft. A winze is to be sunk from 1300 to 1600 ft. to prove three orebodies. Mining cost $2.85 per ton of ore broken. Total cost of mining operations was $4.65 per ton, compared with $3.32 in the previous year. This is due to increased development and tramming broken rock, etc. A new 125-hp. hoist motor, with automatic magnetic control, increased the speed of hoisting from 400 to 500 ft. per minute. Two sets of Draeger rescue apparatus were purchased for the mine.

The mill superintendent, E. E. Carpenter, reported that the stamps worked 92.4% of the possible time, crushing 48,570 tons of ore, equal to 133.1 tons per day, or 13.31 tons per stamp-day. The cyanide plant made a recovery of 95.1% gold and 92.4% silver, the metals extracted being 10,005 oz. gold and 874,085 oz. silver, worth a total of $702,644. The direct cost was $2.743, and indirect, 68.2c., a total of $3.425 per ton. Another filter was added to the two in operation. Talcy ore hindered good work in January, February, and April.

The Company had a total net income of $247,783, which, added to the previous surplus, made $839,005 available. Two 10% dividends absorbed $281,636, leaving a surplus of $557,369 on September 30, 1914. Assets included silver worth $54,956, or about 110,000 oz., and cash $55,231.

The Simmer & Jack Proprietary, Transvaal, produced $3,840,000 from 769,600 tons in the year ended June 30, 1914. The cost was $2.96 per ton; operating profit, $1,540,000; and dividends, $1,630,000.

RECENT PUBLICATIONS

Annual [illegible] Colorado [illegible] September and October, 1914. P. 63. Illustrated.

Studies in Silver Enrichment. By Chase Palmer. Reprint from *Economic Geology*, October 1914. P. 11.

The Fernando Group near Newhall, California. By Walter A. English. P. 16. Illustrated. University of California, Berkeley, November 1914.

Oil and Gas in Bond, Macoupin, and Montgomery Counties, Illinois. By Raymond S. Blatchley. *Bulletin* 28. P. 51. Plans, chart, index. State Geological Survey, Urbana, 1914.

Proceedings of the Indiana Academy of Science, 1913. Edited by H. E. Barnard. P. 368. Ill., plans, index. Indianapolis, 1914. This contains a great deal of interesting matter, including papers by about 30 authors.

Report of the mine inspector for the Territory of Alaska to the Secretary of the Interior, for the fiscal year ended June 30, 1914. P. 36. Washington, D. C., 1914. An abstract of this bulletin appeared in the *Press* of November 21.

Annual Report of Dredge Mining and Hydraulic Sluicing in Victoria, Australia, in 1913. By D. B. Sellars. P. 16. Chart. Department of Mines, Melbourne, 1914. Abstracts from this publication will appear in the *Press* from time to time.

The Mineral Resources of Oregon. Petrology and mineral resources of Jackson and Josephine counties. By A. N. Winchell. P. 265. Ill., maps, index. Oregon Bureau of Mines and Geology, Corvallis, August 1914. An abstract of this work appeared in the *Press* of November 21.

Reprints from *The American Journal of Science:*

The Binary System, MgO—SiO_2. By N. L. Bowen and Olaf Andersen. P. 14. Illustrated.

The Stokes Method for the Determination of Pyrite and Marcasite. By E. T. Allen and J. L. Crenshaw. Microscopic Study, by H. E. Merwin. P. 61. Illustrated.

The Ternary System: Diopside-Forsterite-Silica. By N. L. Brown. P. 58. Illustrated.

North Carolina Geological and Economic Survey publications, Raleigh, 1914:

Forest Fires in North Carolina during 1913, and State Forest Fire Prevention in the United States. By J. S. Holmes. *Economic Paper* 37. P. 82.

Forms covering the organization of drainage districts under the North Carolina drainage law, and Forms for Minutes of board of drainage, commissioners. Compiled by Geo. R. Boyd. *Economic Paper* 38. P. 133.

U. S. Geological Survey publications, Washington, D. C., 1914:

Salines in the Owens, Searles, and Panamint Basins of Southeastern California. By Hoyt S. Gale. *Bulletin* 580-L. Contribution to *Economic Geology*, 1913, Part I-L. P. 73. Ill., maps. A résumé of this work appeared in the news section of the *Press* of November 21.

Production of Metals and Metallic Ores in 1912 and 1913. By J. P. Dunlop. P. 7.

Lead in 1913. General report. By C. E. Siebenthal. P. 37.

Zinc and Cadmium in 1913. General report. By C. E. Siebenthal. P. 51. Chart.

Colorado Ferberite and the Wolframite Series. By Frank L. Hess and Waldemar T. Schaller. *Bulletin* 583. P. 75. Illustrated.

New Machines and Devices

The 'Iron Finlander'

A new ore-loading device which is being offered to the public by the Lake Shore Engineering Works, has been nicknamed the 'Iron Finlander.' The loader is designed for use in iron, copper, and coal mines in drifts 8 by 8 ft. and possibly smaller. It has an extreme height from the top of the rail to the top of the machine of 5 ft., an extreme width of 3 ft. 9 in., and an extreme length of 14 ft., including the shovel; or with the shovel removed, 11 ft. It can be made to operate on any gage of track and is self-propelling, and has a total weight of 6500 lb. The conveyor-belt, which is of rubber, is 22 in. wide and is the only part of the machine which is not made of steel. The machine has a capacity of 40 tons of material per hour, and is designed to be operated by either air or electricity. It is expected that the air drive will be popular, as the exhaust from the machine will aid materially in the ventilation of the drift in which it is placed. The loader has six different motions, all of which are controlled by the operator. It propels itself forward and backward, operates the conveyor and shovel in a vertical arc of 30 degrees and in a radial arc of 60 degrees, and at the same time drives the conveyor-belt and operates the driving mechanism for the shovel. With such a combination of motions, as with the steam-shovel, a great deal will depend upon the ability of the operator to get the best output from the machine.

The ore loader is made of three distinct parts which may be disconnected with very little difficulty in order to move the machine from the surface to points underground or from one level to another. The truck constitutes one portion, the frame with driving mechanism the second, and the conveyor-belt and shovel the third. All of the chains for driving the machine are heavy automobile chains. The drive gear from the engine to the main shaft is of the Wuest patented herring-bone type. The machine is completely enclosed, compact, and securely covered so that dirt cannot interfere with its operation. The Lake Shore company's engineers have been working on the machine for the past five years. The patentees are V. C. Holby, N. P. Flodin, of the Company, and M. E. Richards, manager for the Judson Mining Co., and Joseph Hodgson, general superintendent for the Copper Queen Consolidated Co., Bisbee, Arizona. The Company intends to build three sizes of the machines which will be suited to the various conditions met in the conduct of ordinary mining operations. The demonstration machine is at present in operation at the Judson mine at Alpha on the Menominee range.

The accompanying electro is that of a postal card which is being used by the Dixon company to introduce a product which this Company is offering to the trade known as 'Dixon's Boiler Graphite.' Good engineering practice urges the use of graphite in many boilers, and the grade best adapted to this purpose has been the subject of considerable investigation by this Company. The purpose of boiler graphite is to reduce the fuel consumption, prevent the hardening of scale, give to the surface of the boilers a smooth polish, prevent pitting, and make the removal of scale easy by a gentle mechanical action. The Dixon company has a booklet for distribution entitled 'Graphite for the Boiler,' which will be sent upon application to the graphite department of the Joseph Dixon Crucible Co., Jersey City, New Jersey.

Commercial Paragraphs

The Continental Fibre Co., Newark, Del., has published a booklet entitled 'Insulation.' In this publication are enumerated some of the striking peculiarities of this Company's products and a few of their varied uses. The principal products of the Company are 'Vulcanized Fibre,' 'Bakelite-Dilecto,' and 'Continental Bakelite.'

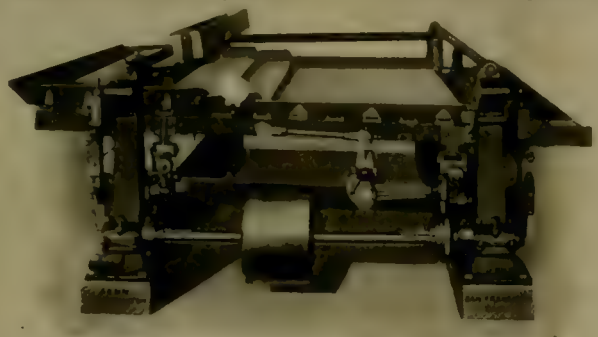
The Denver Quartz Mill and Crusher Co., Denver, Colo., has recently supplied the following equipment for the Kuykendall property in the Tarryall district of Park county, Colorado: one automatic Denver ore feeder; one 8 by 12-in. Denver crusher; one No. 2 Denver quartz mill; two 54 by 96-in. amalgamation plates; two No. 5 Wilfley tables; and one Monell slimer.

The Connersville Blower Co., Connersville, Ind., has recently added Catalogue No. 16 to the Company's literature. The present catalogue is most attractively published and devoted to the cycloidal pumps manufactured by this Company. The pumps are manufactured in quite a number of styles and for a great variety of uses. The rotary pump is not new, but its applications are perhaps not fully realized by the users of pumps generally. Among the uses for which this type of pump has been designed may be mentioned condenser service, circulating service, handling large volumes of water against low and medium heads, handling magmas and pulps, as fire pumps, also for cyanide plants and vacuum production in all stages. In construction these pumps are simple, compact, and powerful; they have no valves, springs, or small parts to get out of order or need renewing. Neither are foot or discharge valves necessary, and there are no internal parts requiring lubrication. There are no reciprocating parts and hence no reversals to limit the speed. They may be driven by belt, direct connected with an engine or water wheel, or by motor through gear and pinion. The pumps are built with displacements which vary from 1/20 gal. per revolution to as large as 70,000 gal. per minute. The catalogue is fully illustrated and contains a large amount of information on the subject of this type of pump. The discharge from the pump is continuous but not uniform, and in order to provide for the variation in flow, it is the practice to equip the pumps with ample air chambers on both the suction and discharge sides. These air chambers absorb the excess at the time of maximum flow and discharge same at the time of minimum flow, thus keeping the liquid in the discharge pipe moving at a uniform velocity and preventing the shocks which would occur if no air chambers were provided. The advantages claimed for this type of pump are that it has the same characteristic positiveness as a piston pump, but without the objectionable features such as numerous valves, ports, internal packing, friction, etc. It has the simplicity of the centrifugal pump, and is more efficient, it being claimed that the best centrifugal pump installations can be operated inefficiently while the cycloidal pump if properly installed cannot be inefficiently operated. The catalogue is fully illustrated and contains a large amount of information on the subject of this type of pump.

PAN AMALGAMATION

A length of two city blocks of amalgamating plates

would afford an exceedingly large surface for amalgamation. This is approximately the distance which a particle of ore travels in passing over the **Senn** pan motion amalgamator.



The amalgamating properties of such a machine has been proved to be a marked advance in the art of amalgamation and the results are worthy of the attention of all gold miners.

Let us confer with you regarding your present milling equipment and demonstrate to you at your property or in our testing laboratory **how we can increase your dividends.**

Write for details regarding the performance of this machine.

SENN CONCENTRATOR COMPANY

607 First National Bank Bldg., San Francisco, Cal.

It's The "Down-Keep" Drill

because it *keeps down* in the mine and *keeps down* the cost of drilling.

And because it accomplishes one is one of the reasons why it accomplishes the other.

"Laid up for repairs" is a distasteful phrase to the man of action, but when the fact is known that crystallization is the cause of breakdown of castings, and when, also, the fact is known that the parts of

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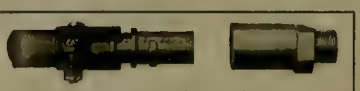

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EDITORIAL

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SINKING has begun at the mine which is to be below the floor of the Mines and Metallurgy building at the Panama-Pacific Exposition, and the superintendent, Mr. Edward Steidle, of the U. S. Bureau of Mines, is as busy as though a new Homestake were in process of development.

EXPERIMENTAL WORK with the Malm process at the Bunker Hill & Sullivan mill at Kellogg, Idaho, has succeeded to the extent that it has been demonstrated that technically the process is workable. Mr. Stanly Easton and his staff are now resolutely attacking the larger problem of where and how the process can be used, if at all, to produce a profit.

DAMAGE from underground water in the oilfields is a matter of serious public concern. The California State Mining Bureau has taken the initiative in submitting to the Legislative Counsel Bureau memoranda for preparation of a bill for an act providing for formation of districts empowered to levy a special tax and to employ assistants to study and abate such damage. When the bill is put in form, it will be submitted to oil producers and others for criticism.

THE always active Chamber of Mines and Oil at Los Angeles has undertaken the publication of a monthly bulletin of which Mr. J. Nelson Nevius is to serve as editor. The first number, now at hand, is attractive and readable. With the backing of the Chamber, Mr. Nevius will, we hope, be able to continue indefinitely the work he has so well begun. Such publications serve a very useful purpose in stimulating local interest in mining and in securing from business men of the community a friendly hearing and discussion of mining problems.

A SLIGHT ambiguity crept into the excellent article upon 'Application of Jigs to Gold Dredging,' by Mr. James W. Neill (not J. W. Neil) as printed November 28. The saving quoted, 38 cents per yard of gravel jigged, is really figured on the total amount of gravel handled by the dredge during the time the jigs were running, that is, 448,000 cubic yards, bank measurement. In fact probably not more than one-third of the gravel passed over the sluices and perhaps two-thirds of that which was jigged; the saving though was figured on bank measurement.

DECISION by the Register and Receiver of the Coeur d'Alene Land Office in the Star Silver Lead contest is in favor of the company and against the Forest Service. The point at issue was as to what constitutes valid discovery. The decision was that while "such a discovery as is usually required of mineral applicants had not been made," the evidence of good faith, the showing as to mineral character, and the well known mineral character of the adjoining lands, was sufficient to pass the application to patent.

CALIFORNIA ENGINEERS are taking an active part in the Belgian relief work. The efforts of Mr. H. C. Hoover and Mr. Edgar Rickard in London are being supplemented by vigorous work on the coast. The San Francisco Engineers Club contributed $280 directly to the fund, while probably every engineer has made one or more personal contributions. The necessities of the Belgians have touched hearts around the world. Among papers coming to our exchange table this week, those from Tokyo, Auckland, and Lima, to mention three places widely scattered, contain acknowledgments of contributions toward local funds.

WHITE ISLAND, described on another page as an important source of sulphur, was recently visited by an exploring party from New Zealand which reports that the immediate cause of the destruction of the camp of employees of the sulphur company was an immense landslide. The buildings were on the floor of the old crater and were buried by a mass of rock from an overhanging cliff, and mud from a recently drained lake. It is supposed that the exciting cause of the landslide was an earthquake, as several shocks were felt on the mainland at the time. Earth movements, due to volcanic disturbances, have been particularly numerous in New Zealand of late.

MINING problems are, in many particulars the same regardless of the material that is broken and hoisted, and one of the best features of the later development of the American Mining Congress is that it is really bringing together men prominent and successful in widely varied lines of mining. This year, meeting in Arizona, famous for its gold and copper mines, the Congress was presided over by Mr. Carl Scholz, the head of the Rock Island coal interests and an able engineer

who has been active in many of the efforts to better mining conditions both technologically and industrially. We are glad to note that Mr. Scholz reports the financial position of the Congress to be better, and we trust that the next and succeeding years may see still further improvement.

APROPOS of a story recently told by Mr. J. F. Kemp reciting that Mr. J. H. L. Vogt once remarked that there are two types of professors, those who are 'privy counselors' and those who are 'uncles,' our New York contemporary patronizingly remarks that Mr. Kemp will himself in time come to be known as 'Uncle Jim.' This is somewhat amusing, our colleague evidently being quite unaware that to all his students the beloved Columbia professor has long been known as 'dear old Jimmy.' There is a third and smaller group of professors, those whom their students regard with affection as inspiring and helpful elder brothers, and the professor of geology in Columbia is one of the finest examples of this class.

AS A COSMOPOLITAN publication the new *Mine Workers Journal*, published in English, Italian, and Slavic, has a wide field of usefulness. Reaching as it does an element of labor, which in large part is being schooled in the ways of America, the *Journal* has an opportunity to play an important part in the molding of the correct viewpoint; and the making of a better class of citizens from the thousands of laborers who come annually to work in the mines of America. We trust that in formulating this broad policy the *Journal* will build nobly on the foundation of "justice, organization, and education," and that narrowness, vindictiveness, and inflammatory speech will not displace broad thought, lofty morale, and a less bellicose attitude toward those who make mining possible. Let the newly arrived workman know that America is not a hotbed of anarchy, industrial warfare, and oppression, but a land of equal opportunity where a great percentage of the employers of today were the laborers of yesterday.

AMONG papers read before the American Mining Congress at Phoenix were a number that dealt with problems of the coal mining industry. We reproduce that of Mr. George H. Cushing, the well informed editor of *The Black Diamond*. Mr. Cushing presents the facts about a serious situation, but they are facts so well known to men in the coal industry that he probably does not realize how striking they will appear to metal miners. Here is one of the great basal industries of the country in a chronic condition of disorder, an expendable and necessary resource of the country being wasted, capital dissipated, and men subjected to hardship and unnecessary danger—and the main obstacle to better conditions is a misinformed public opinion which prohibits the coal companies from any effective form of cooperation. To those familiar with coal mining, such national disasters as the long-drawn-out strike in Colorado, now fortunately declared off, are inevitable incidents in the struggle to regulate in some fashion an industry which the law says must not be regulated. It will do metal miners good to become familiar with coal mining problems, and, having done so, to ask themselves whether there is not enough similarity with conditions in copper mining and the petroleum industry to warrant all working together to bring regulation within the light of reason. It may be difficult to define reasonable regulation, and we are undoubtedly suffering in some instances from too much regulation, but in those industries such as bituminous coal mining, where all forms of regulation are absent, the public is also a heavy loser.

ANNOUNCEMENT that the Butte-Duluth mine, at Butte, which was developed by Mr. A. B. Wolvin, has been sold by him to the Hayden, Stone & Company interests for a price said to be $4,500,000, is an event of importance in the copper-mining world. A large tonnage of silicious ore containing chrysocolla and other oxidized minerals of copper has been developed, and a 100-ton leaching plant was built and operated for some time. Many difficulties developed in the leaching plant, and early this summer it was shut down. It has been announced that a successful leaching process has been developed to treat the oxidized ores of the Utah Copper Company, and presumably this will now be used at the Butte-Duluth, since it is the policy of the Hayden-Stone enterprises, under the management of Mr. D. C. Jackling, to develop a standard form of practice for their properties, so far as this is feasible. The rapid growth of this organization as a metal producer is only comparable to that of the United States Smelting, Refining & Mining Company, which some years ago similarly developed in the space of a few years into one of the most important organizations in the mining and metallurgical field in this country.

NICKEL

Nickel is one of the commonest mining constituents of igneous rocks, especially those high in magnesia, and the frequent association of its ores with magnesian rocks, such as serpentine, is well known. The average content of nickel found in nearly 300 different analyses of igneous rocks, made by the United States Geological Survey, is given by Mr. F. W. Clarke as 0.0274 per cent. This would indicate that it is one of the most abundant of the useful metals, yet nickel ores are mined in comparatively few places throughout the world, the antipodean districts of Ontario, Canada, and New Caledonia having almost a monopoly of its output. Because of its use in the manufacture of armor plate and other munitions of war, the present catastrophe in Europe is commonly supposed to have stimulated the production of nickel, but reports from Canada indicate that the Canadian Copper Company, the principal producer, is decreasing its output rather than increasing it. This, together with the fact that a strong financial group which last year made preparations to develop an extensive tract in the same district discontinued its operations after developing a large tonnage of workable ore, would

seem to indicate that the supply of nickel is ample to meet present needs. Markets, rather than deposits, are in demand. The world's output more than doubled between 1906 and 1912 and seems well able to keep pace with the growth of consumption.

So much has been written about the operations of the International Nickel Company, with its mines and smelter at Sudbury, Ontario (operated by the Canadian Copper Company), and its smelter and nickel refinery in New Jersey; the Mond Nickel Company, with its mines and smelter in Ontario and its refinery in Wales; and the companies that operate in New Caledonia, that they are fairly generally known, and to attempt to summarize their features would require too much space. It is not so generally known that there is a not inconsiderable production of nickel, chiefly in the form of nickel salts, from ores mined in this country. In a valuable paper which has attracted less attention than it deserves, Mr. Anton Eilers has pointed out that the blister copper produced at the Tacoma smelting plant contains 770 pounds of nickel in 100 tons of blister, that from the Omaha plant 944 pounds, that from the Nevada Consolidated plant 64 pounds, from the Garfield plant 40 pounds, and from the Mountain Copper plant 11½ pounds. We further understand that the blister from the El Paso plant, chiefly derived from the Chino ore, also contains notable amounts of nickel. This nickel is recovered by evaporating the electrolyte of copper refining plants, and the amount thus recovered in 1913 is stated by Mr. F. L. Hess, of the United States Geological Survey, as equivalent to 481,565 pounds of nickel. A little known producer is the United States Nickel Company, which refines matte shipped from Europe to its plant at New Brunswick, New Jersey.

There are many places in which nickel occurs in this country. The old Gap mine, in Lancaster county, Pennsylvania, closed for the past twenty years, was a noted producer in its day. The Mine La Motte, in Missouri, is well known for the nickel which occurs with the pyrite associated with its lead ore. Nickel ores occur in Douglas county, Oregon, and near Webster, North Carolina, but have not yet been profitably exploited, while the deposits at Lovelock, Nevada, which were once regarded as promising, proved disappointing. Quite recently a deposit was reported near San Diego, California, but apparently, as elsewhere, the tonnage of ore available for mining has not yet been shown to be sufficient for profitable exploitation.

The many occurrences of nickel ores in Europe have of recent years had little more than mineralogical interest, as the output has been small. The Flaad mine, Saetersdal, Norway, is one of the best known, and a recent consular report states that in 1913 it shipped 28,000 tons of ore to its smelter at Evje for treatment. The same report states that the Ringerike plant, near Christiania, handled 19,000 tons of ore, and that the refinery in Kristiansand produced 1,200,000 pounds of nickel during 1913. As this is the only plant using the process patented by Mr. Victor Hybinette, a brief description of the method in use will be worth while.

Copper-nickel matte, produced in the ordinary way is ground, roasted and leached with dilute sulphuric acid, the operations of roasting and leaching being so controlled that most of the copper is dissolved out without removing much of the nickel. By repeating the operation and finally treating with hydrochloric acid, the nickel-bearing material is freed from copper and can be smelted to yield nickel anodes for further refining by electrolysis. The copper is crystallized out of solution as bluestone, and is free of nickel until the nickel content of the mother liquor becomes too high, when the whole is evaporated to dryness and calcined to break up the sulphates. On leaching the calcine with dilute sulphuric acid the copper is again largely dissolved out and the nickel left behind. It was at one time reported that the Hybinette process would be used by the new company in the Sudbury district, already mentioned, but later this was denied. The Mond process was described in the *Press*, September 13, 1913.

Nickel finds its chief application in the production of various ferro-alloys, used in the manufacture of armor plate, automobile parts, and other objects in which hardness and toughness must be combined. Nickel steel is even finding application in structural work, and the new Quebec bridge is being built of it. It is interesting in this connection that the occurrence of nickel in iron ores is common, the best known instance being the mines of the Spanish-American Iron Company, in Cuba, where the average nickel content of the ores is a little over 1 per cent. As the large steel plant of the Maryland Steel Company, near Baltimore, uses these ores exclusively, smelting many thousands of tons per year, this is an important factor in the consumption of ferro-nickel alloys. Mr. H. W. Turner last year described the occurrence of nickel ores associated with iron in the Ural region of Russia, and many other instances might be cited. The special alloys of nickel are well known and scarcely need any detailed comment. Its use for nickel plating is the most important application of the pure metal. Of recent years there has been a great increase in the use of aluminum and its alloys for domestic purposes, and it seems not unlikely that the use of nickel-plated objects is likely to decrease rather than increase, except in the case of nickel-plated plumbers' fittings, for which there is a growing demand. An important field is the growing use of monel metal, an alloy of about two-thirds nickel and one-third copper, which has a remarkable combination of properties, being strong, very ductile, and non-corrosive. This alloy, which was introduced but a few years ago, has already created a large field for itself and seems likely to have increasing application. It will have been seen that there is plenty of nickel in the world to meet our requirements, and conservation is not likely to need to concern itself with this metal for a long time yet, except in so far as the present rather abnormal relations of mining, smelting, and consumption may be a factor in international economics.

LOOKING FORWARD

Among the pleasant features of the meeting of the American Mining Congress at Phoenix, Arizona, this week was the reading of a letter to that body from the President of the United States, Mr. Woodrow Wilson. In these days of numberless organizations for promotion of causes and of almost unlimited demand upon the President for his sympathy and support, the sending of such a letter is notable in itself. It is even more significant that the President shows a real knowledge of the problems and work of the congress and a keen sympathy with its purposes. The work of the congress in securing establishment of the U. S. Bureau of Mines and the prominence given both by the bureau and the congress to introduction of safer methods of mining, commend themselves to both President and people. The President's letter follows:

"To the Members of the American Mining Congress: I regret exceedingly that, owing to the press of circumstances, it will be impossible for me to greet you in person at the seventeenth annual session of the American Mining Congress at Phoenix, Arizona.

"I am well aware of the important part played by your great organization in the creation of our Bureau of Mines, and am sure that the good work of that bureau in attempting better to safeguard the lives of the two million men employed in the hazardous mining and metallurgical industries will continue to redound to your credit as well as to the credit of the bureau itself. It will always be a tribute to your foresight and energy that this new federal organization, in the short period of its existence, with the kindly co-operation of the states and their agencies, has been able by persistent and intelligent effort, to turn an isolated local movement for greater safety into a great national movement for 'safety first,' and has already gone beyond the mining industry into every industry of the country. I venture to say that thousands of lives have been saved by that movement, and that many thousands more will be saved in the future.

"Gratifying as the results of this life-saving campaign may have been, however, there is still vigorous work for your congress to do. I am informed that during the last year more than 3000 men were killed and 100,000 injured in the mining and metallurgical industries of the country. At the same time those in authority tell me that from their observation and experience one-half of such deaths and three-fourths of such injuries may be regarded as easily preventable.

"I suggest this situation as an opportunity for further endeavor on your part to cut down this excessive toll of death and of injury. I can assure you of the fullest co-operation of all the proper governmental agencies, also of my earnest desire for your active and continued assistance.

"There is one other problem connected with the mining industry in which the federal government is vitally interested, and that is, proper conservation and proper use of the mineral resources of the nation. I realize that you, too, are interested in this problem, and I wish merely to call it to your attention because of its fundamental importance to the present and future prosperity of the nation. I am happy to say that the profligacy of the past in the use of these resources is not being continued on so large a scale. There is, however, great opportunity for further reform along these lines, and in this your organization can be of invaluable service.

"Sincerely yours,

"WOODROW WILSON."

Addressing the American Mining Congress at Phoenix, Mr. J. A. Holmes, director of the United States Bureau of Mines, said:

"From the humanitarian standpoint no one questions the seriousness of the need of safety reform. Its economic importance is equally apparent, for during the past year more than 3000 men were killed and 100,000 injured in our mining and metallurgical industries.

"In connection with its investigation of explosives the Bureau has brought about what is little short of a revolution through the introduction of new type of low-temperature, quick-flame powders, designated as 'permissible explosives,' of which, during the past year, more than 25,000,000 lb. was used in the more dangerous mines of the country. As rapidly as facilities are provided there will be developed a 'permissible' series of safety appliances and methods in all branches of the mining, metallurgical, and other mineral industries, which, as their use is enforced by state inspectors, cannot fail largely to decrease fatal and other accidents. As indicating the efficacy of certain of these explosive investigations, the president of the company operating one of the largest metal mines of the country recently stated in a public address that the results of the Bureau's explosives work—incomplete as it was—had brought about an actual saving to this Company in this one mine of $80,000 yearly."

Speaking to the American Institute of Chemical Engineers at Philadelphia last week, Mr. George Otis Smith, director of the United States Geological Survey said:

"Coming down to bottom facts, the United States will profit by the European war only as the nation makes larger and wiser use of its mineral resources. Foreign markets in the main can be won and held only as the quantity or quality of the 'Made in America' product rivals that of the goods offered by the other producing nations. The buyer, whether he be in the Far East or in South America, wants the most and the best for his money. Yet it would seem a safe rule of national conduct that industry should begin at home, and therefore every industrial opportunity in America should be improved. If these opportunities are recognized and grasped every one of us can indulge in optimism."

Seward Peninsula and Its Mining Problems

By F. LYNWOOD GARRISON

To a geologist and mining engineer, one of the most impressive things about the Seward Peninsula is the highly mineralized character of many of its rocks. I am reminded in this connection of the remark of an old farmer's wife near Joplin, Missouri, when she said to me: "That land ain't good for nothing, so there must be mineral in it." This would seem to be the case on the Seward Peninsula; the soil produces nothing of value save pasturage for reindeer herds and a little not very nutritious grass that horses may eat in the summer. There is no timber west of the Kiwalik river. The ground is mantled with tundra and perpetually frozen to bedrock.

The rocks of the Peninsula are largely Paleozoic schists and limestones, and on the extreme west there are considerable areas of granite which is tin-bearing in spots. The streams draining these areas yield gold and tin respectively. The source of the gold is evidently the innumerable quartz seams and stringers that traverse the schists, especially when near their contact with the limestones. The 'stream-tin' no doubt has its origin in veins in the granite. No lode mining whatever is done on the Peninsula, and the miners and prospectors of the region are usually ignorant of what they call 'quartz mining'; in fact nothing not susceptible to a panning test interests them in the least. The intelligent people of the Peninsula, of course, recognize that its future, as an abiding place for man, depends upon the finding of lode deposits. The alluvials will be entirely worked out before many years, and if quartz mining does not develop, the country is certain to revert to the Eskimo and his reindeer.

The alluvial gold deposits of Northern Alaska may be conveniently divided into three general classes: (1) gravels in present-day streams; (2) high-bench gravels (the remnants of a former drainage system); (3) beach sands or bars such as those in the present beach at Nome. The extraordinarily rapid development of the Seward Peninsula was brought about during the years 1900 to 1904 by the discovery of very rich spots or concentrations of gold in the beach sands and the gravels of the creeks flowing into the sea near Nome. The resulting stampede is without parallel in the history of the world; unrivaled for its folly and waste. The Peninsula was flooded with the riff-raff of two continents who came, failed, and returned to civilization, leaving behind many monuments of their incompetence. Dishonest and impractical schemes flourished in those wild days and but few survived to reform and develop into more or less successful undertakings. Such a history cannot but leave an aftermath of discredit in any mining district—a reputation not deserved by the honest hard-working community that exists there today.

The phenomenally rich deposits that made Nome famous are now a thing of the past, and it is highly improbable anything of like richness will ever again be found in Alaska. The poor man may yet earn a good living in operating the leaner deposits still to be found in many parts of the Peninsula, but discouragement and discontent that the hard conditions of the country engender, become more and more evident every year. The federal government could unquestionably make matters easier for these excellent people by giving them better mining laws, roads, postal service, cheaper telephone and telegraph service, and decent and safe steamship service to the north coast of the Peninsula. As it is, the

HYDRAULIC ELEVATOR ON INMACHUK.

HYDRAULIC ELEVATOR, PIONEER MINE, NOME.

HYDRAULICKING AT THE PIONEER MINE, NOME.

government is practising a paralyzing system of mistaken economy and the canker of politics is painfully evident.

Alaska ought to be governed by a non-partisan commission, subject only to Congress. Then, and only then, could the many and varied conditions peculiar to Alaska as a whole be properly studied and understood. We Americans are today living under the most inefficient and expensive form of government in the world, which seemingly becomes worse instead of better, although I do not myself believe that it actually is as bad as it once was, or as we sometimes think it is. We are slowly but surely learning the art of self-government, although as compared with Germany our government inefficiency is appalling. But if inefficiency be the price of personal liberty, I for one am willing to pay it.

I told my friends in Nome I believed that the government officials in Washington do not always know the whole truth about conditions in Alaska, and that the facts were often so befogged and juggled for political purposes that the public is at a loss to know what may be the real needs of that far-off dependency. I suggested to them a plan of co-operative publicity on their part to make known Alaska's conditions and desires, believing, as I surely do, that the government and public opinion will concede to all their reasonable demands once they are understood.

The world today is facing a steady decline in its production of gold. In 1912 it was $472,090,431; in 1913, $454,269,275, a decrease of $17,821,158. The production in the United States during the same period fell off $5,150,477 ($93,451,500 from 1912, as compared with $88,301,023 for 1913).

The ever-increasing demands for gold in commerce and industry must be met, not to mention the enormous drain on our gold resources the rehabilitation of Europe will require. Unless we once again resort to bi-metallism, new gold deposits must be found and old ones worked more economically. No part of the United States offers such opportunities for doing this as Alaska, and there is no disguising the fact that placer mining on the Seward Peninsula, if not all over Alaska, is surely but certainly declining, and except at Juneau, lode mining is yet in its incipiency.

I fully believe this discouraging outlook is needless and undeserved. Alaska is a white man's country, a territory gloriously healthy and undeveloped, in fact quite unexplored in places. But the natural difficulties to be overcome in its development are serious, and the encouragement of large capital is necessary. In fact, mining the world over is no longer a poor man's business; the cream of our mineral deposits has been fairly well skimmed, and in the future we must depend upon low-grade ores and relatively lean alluvial deposits, which cannot be worked without expensive equipment and large financial resources.

There is plenty of good coal in Alaska, but it costs something like a million dollars to open and equip a good modern colliery. How many individuals, or corporations, are there today ready to go into an enterprise of this kind? As long as fuel oil is as cheap as it is on the Pacific Coast, we may safely assume that no large coal operations are likely to be attempted in Alaska. The local demand is small and will not increase where water-power or cheap fuel oil may be had. In brief, Alaska cannot be developed without large capital, and to invite capital the government must first provide railroads and harbors, and not count the cost.

Alfred H. Brooks, of the U. S. Geological Survey, estimates that there are about 210 square miles, or 650,496,000 cubic yards, of gold-bearing gravels on the Seward Peninsula, averaging 3 feet in depth, which contain something like $300,000,000 in gold.* I am disposed to think that these estimates are too high as to value per cubic yard and too low as to area in square miles. The total production of gold on the Peninsula from 1897 to the present time has been something like $68,000,000.

But there are serious difficulties to be overcome in gold mining operations in this far northern country. The most important is the fact that the ground, as a rule, is frozen to bedrock, is mantled with a thick blanket of turf, called tundra, or 'muck,' which is a

*U. S. Geol. Survey *Bull.* 328, pp. 135-137.

most excellent non-conductor of heat. As a consequence the summer sun has little or no opportunity to thaw the underlying gravel. This 'muck' carries practically no gold, and the expense of removing and thawing it is a dead loss. A second difficulty is the shortness of the working season, which is usually reckoned as about four months, namely from June to October. It has been found, however, that with proper precautions a dredge may successfully operate until late in November and in some seasons begin as early as the middle of May. No doubt a well equipped and managed dredge, carefully protected from the weather, could operate a full five months, if not a little longer, under favorable conditions.

The question of fuel and power is usually a very serious one to overcome on the Seward Peninsula. Fuel is, or can be made, cheap enough on the coast, but without decent roads it becomes almost as precious as gold a few miles from the water's edge. During the early prosperous days at Nome, a little narrow-gage railroad was built from that town to a place called Lane's Landing, in the interior, a distance of some 80 miles. I am told it paid for itself in the first two years and earned a fair return thereafter until the federal government found it necessary to impose a tax upon this commendable enterprise of $100 per mile per year. In other words, instead of subsidizing, it actually penalized an institution that was doing much to develop the country. One may understand the logic of a policy that demands a moderate royalty on the gold produced from the public domain, but the wisdom of taxing to death an enterprise so important to a wild and undeveloped district is past finding out. The Kougarok district, which is tapped by this railroad, is one of the richest and most promising on the Peninsula. It contains some rich ground that is being worked at a fair profit by a number of small dredges, despite the enormous costs which they have to meet for fuel and power. Once this district is supplied with cheap hydroelectric power to operate the dredge, and fuel to thaw the ground, there is no doubt but that the number of dredges therein will be largely increased. Sites exist in the neighboring mountains which afford convenient opportunities for such power plants, and the rehabilitation and operation of this little railroad by the government should provide reasonably cheap fuel and supplies to the miners of the district.

A chapter might be written about the dredging operations at Nome. It may be said in brief that they have been, on the whole, financial failures, despite the presence of some of the richest alluvials in the world. A cursory inspection of these dredges here is depressing. They are great big machines that have cost a mint of money, but are today either partly finished, wholly idle, or are running so feebly that one fears to look at them too intently lest they stop altogether. These dredges are controlled chiefly by one organization, whose headquarters is in Philadelphia. This company, as far as I could ascertain, has no engineering staff, nor has it, apparently, followed a sound system of business management. As a consequence, its credit is impaired and its equipment is today little better than piles of scrap and a monument to incompetency. In extenuation, however, of this deplorable condition, it should be said that the present management is acting as a sort of residuary legatee for several older 'busted' or decrepit concerns. The risky experiment of compounding failure without a drastic reorganization, sufficient new capital, and the best engineering talent, could bring about no other result. Moreover, the natural conditions for dredging on the Seward Peninsula are not easy, the ground is usually frozen to bedrock, the seasons are short, labor expensive, and the machinery must of necessity be the best and strongest that can be made.

Dredging in the Council and Solomon districts appears to be fairly successful this year. Not having myself visited the districts, I cannot speak from personal knowledge. I understand, however, that at least one dredge on the Solomon river has been equipped with Diesel engines, which have given notable results as to efficiency and economy.

The Buck Creek tin dredge is reported to have done well this year, but some difficulty due to the European war has been experienced in disposing of its tin concentrate. Heretofore this has been shipped abroad for smelting, as there are no tin smelters in the United States. In this way, advances could be obtained on the product by the dredge people, and the capital necessary

QUARTZ VEINS IN BEDROCK, ANVIL CREEK, NOME.

to carry on the enterprise thus reduced. With the interruption of such shipments, some local smelting must be found or the dredge probably cannot continue operating next year.

Except for assessment work, no other tin mining appears to have been undertaken this year in any of the tin districts of the Peninsula. As tin is becoming almost a semi-precious metal, it is unfortunate that more

THE NOME BEACHES.

systematic prospecting is not being carried on in this promising region. Here again is the same old difficulty that has been encountered in all attempts to prospect the country—namely, lack of funds and experience.

The gold production by small operators appears to be, on the whole, steadily but surely decreasing with the exhaustion of the richer and more easily worked gravels. This is a real misfortune for the Peninsula, because miners of this class are the backbone of any gold-producing community, and as a rule they deserve every possible encouragement from both the federal government and the large operators who may be their neighbors.

Lode mining on the Peninsula has so far proved a failure, as no large rich outcrops appear to have been discovered. That workable lodes of gold and possibly other metals exist on the Seward Peninsula, I have not a particle of doubt. The miners of the region with but few exceptions, are unfamiliar with the character of the prospecting necessary to develop deposits of this class; in fact, the pan is their sole assay outfit, and the pick and shovel usually their only tools. The alluvial gold must have originated in veins, and such veins certainly do exist in the country rocks not far from the gravels in which the gold is found. A few years ago a small stamp-mill was erected near Nome, but it failed for the reason that sufficient ore could not be obtained to make it pay.

On the whole, the season of 1914 will probably turn out to have been a fairly good one. Last year few of the operators made anything; water was scarce because of light snowfall the previous winter and an unusually dry summer. As a consequence, the large ditch operators, like the Pioneer and Fairhaven, either just made expenses or had an actual loss.

Dredging operations in 1913 were not so seriously affected; some of the smaller plants appear to have done well. This year may have been a little better for the dredges, but on the whole it is doubtful if any of them are earning what they ought, or what the ground would justify, and until the Peninsula has good roads and cheap hydro-electric power it is doubtful if the dredging business will ever be on an actually sound and solid basis. It is now fairly up to the people interested in the Peninsula to work together in making their needs known, to get from the government what they require, and what I for one believe the United States will gladly give them once the facts are understood in Washington. The congressional delegate cannot be expected to do this for them, as he has other and more important things to attend to. The salvation of Alaska is in the hands

MOTIVE POWER ON AN ALASKA RAILWAY. ANVIL MOUNTAIN IN BACKGROUND.

of those whose interests are there; if they do not get together and make known the truth, so much the worse for their interests and Alaska.

THE TRANSVAAL CHAMBER OF MINES reports as follows for September:

Ore mined, tons	2,446,532
Sorted out, per cent	9.79
Ore milled, tons	2,188,939
Stamps working (26.44 days)	9,296
Tube-mills working	283
Duty per stamp-day, tons	8.97
Total gold yield	£2,875,983
Working costs per ton (50 companies)	$4.02
Profit	£989,859

GOLD AND SILVER BULLION received at the San Francisco mint in November was 305,629 and 75,559 oz., respectively, worth a total of $6,354,182. The coinage executed amounted to $2,120,000 gold, $122,000 silver, and $23,000 nickel. Coin, bullion, etc., on hand at the end of the month was valued at $259,581,566.

The Coal Trade Problem

By GEORGE H. CUSHING

*Modern coal mining requires an enormous and a constantly increasing investment. The exhaustion of coal reserves and the limited available acreages are increasing coal land values at an alarming rate. The people are demanding a refinement of preparation which is compelling the erection of costly coal preparation plants. Mine labor is continually demanding better wages.

To offset this constantly increasing investment, the operators are beginning to realize the extent to which they are forced to submit to a gradual but cumulative reduction in the selling price of coal. With rising cost of production and decreasing selling price, whatever margin of profit there once was in the coal business is now wiped out. The net results, as far as the present period is concerned, are that the coal trade, as a whole, has no undivided surplus—no reserve financial energy—upon which to draw to tide over the present period when losses must be encountered. Therefore, individual companies are passing into actual bankruptcy, while it must be confessed that the trade itself is in a state of constructive bankruptcy. To avoid the development of this general constructive bankruptcy into actual bankruptcy, the coal producer is induced to rob his own mine, which, of course, results in a lack of national economy as to fuel.

Bankruptcy of Mining Companies

Regarding the companies which actually pass into bankruptcy, the members of the coal trade who remain solvent see themselves in a peculiarly dangerous position. The conditions which threw the various companies into bankruptcy also leave those which remain temporarily solvent with no money and no credit with which to absorb into their own organizations the plants of those concerns which failed. Because of the absence of any surplus money, those now in the coal trade cannot absorb the properties which are thrown by forced sale upon the market. Still, those bankrupt represent an enormous investment and a necessary productive capacity. The mere fact of bankruptcy does not annihilate the properties, nor does it remove the national need for a great many of them.

The natural result is that the ownership of these bankrupt mines becomes vested, not in men already in the coal trade, but in business concerns outside of the coal trade which take the mines, not because they want them, but to protect interests which they have in fuel. Therefore, every failure of a mining company means, not the extension of the powers of some company already in the coal trade, but a gradual infiltration to the coal business of outside and really antagonistic interests. As coal men see it, it requires only some such event as that through which we are now passing to cause the crystallization or solidification of these outside holdings. When that comes, we will have what the people for so long have feared—a bituminous coal 'trust' or monopoly. With this the other operators and the whole people of the United States would have to contend.

Idle Time in Coal Mines

This curiously complicated and dangerous financial side of the coal trade is only one of the problems confronting the operator. Another, and a very serious matter, is the idle time, not only of the plants themselves, but of the men who work in those plants. Counting out of a full year 65 days for Sundays and holidays and 25 additional days for extraordinary holidays and mine accidents, there is left a potential working time for the mines of 275 days per year. The average made by all of the mines of the United States, the anthracite mines included, was 225 days. This means that the coal miner, on the average in the United States, lost in 1912 50 working days, or exactly two months. He worked 10 months out of 12, whereas he should work, of course, 12 months out of 12. Some of the larger producing states, like Illinois, Indiana, and Ohio, made far less than the average time. Illinois, the third largest producer of the nation, put in only 194 days, which is for that state a very high average. Indiana made 182 days, which is about the average for that state. Ohio made 201 days, which is a good average for that state. Thus the best of these three major producers lost 75 working days in 1912, or three months' time in 12. The others showed a loss to the workers of 3½ or nearly 4 months in 12. This is a definite and serious loss of time to men, and it simply means this: At present the men are not making more than a fair daily wage. They are making good money when they get work, but the trouble is that they do not get enough work to cause their yearly income to be what they consider sufficient. The miners, as a consequence, are eternally striking for more money. Every time the industry passes through a strike it faces a further complication of the labor and the financial disorders of the coal trade.

That is to say, through and during the strike of the miner there is a temporary reversal of the price tendencies. Coal prices, due to a fear of a shortage or to an actual shortage, rise rather rapidly. This temporary period of high prices misleads a great many men who have a little money into the belief that such times are customary in the coal trade, and hence that the coal business is a good thing for them to engage in. These recurring periods of high prices due to strikes, therefore, constantly invite new competition into the coal

*A paper written for the Phoenix meeting of the American Mining Congress and printed with the preliminary program.

field. This additional competition is just so much additional waste. This constitutes one of the very serious problems of the trade.

Another big problem of the coal industry is in the matter of production. It has been said from time to time that the real difficulty is overproduction. Of course, everyone recognizes that there cannot be any such thing as actual overproduction of coal without there being an accompanying and actual waste of coal. In the old days there was real overproduction, and in those times the excess, represented mainly by fine coal, was dumped on the ground and not infrequently was used as ballast for railways. The time when such things were possible in the coal trade has long since passed. No actual overproduction occurs now. The trouble of the market does not come from that source. However, there is potential overproduction, or the capacity of the mines to produce from 25 to 40% more coal than is actually being bought and consumed. It is this potential overproduction—expressed eloquently in the fact that all mines of the nation are idle two months in the year—that brings the constant pressure upon the market. No market can possibly be strong, or even reasonably stable, while there is the constant possibility that at any minute the mines may throw upon the market one-sixth more coal or one-quarter more coal than the market can possibly absorb. It is this potential overproduction, induced mainly by periods of labor disturbance, that is causing one of the biggest problems of the coal trade.

But there is in the matter of production some difficulty more substantial than merely a potential overproduction. That is, untimely production. That is to say, as is well known, there is in certain months a demand for the steam sizes and practically no demand for the domestic sizes. Still, the domestic sizes must be made in order to get the steam coal. In the remaining months of the year, the situation is reversed. When steam demand is predominant, domestic production is untimely. When domestic demand is predominant, a certain percentage of steam production is untimely. The coal trade recognizes that it has no mechanism and certainly no system of temporary storage that will take care of the surplus of any period until the time comes around when that coal is going to be required.

Closer Sizing Increases Trouble

This difficulty of sizes is emphasized by present tendencies in the mining and marketing of coal. It is literally true that as the number of sizes made at the mines is increased, automatically the proportion of the mine's output which goes, because of its size, into the steam trade, increases. That is, the domestic trade today wants the larger coal; the steam trade is forced to absorb the smaller coal. Every new act of mechanical preparation increases the percentage of small coal through the breaking up of the lumps. This automatically increases the amount of coal which the steam trade must absorb, also every act of preparation increases the production of the smallest of these various sizes. It is the rapid increase of these smaller sizes that is causing the complication of the coal trade. This is so for the reason that the production of the fine coal is an increasing factor due to the fact that mechanical handling and re-screening plants are being built faster than are modern furnaces in which to burn these fine sizes of coal. The problem therefore, in production—the real problem—is what to do with the fine coal.

Several suggestions have been made along that line. One is that the fine coal should be stored in the winter time to take up the excess demand in the summer time. There involves the difficulty that an adequate storage plant would cost millions of dollars and the coal trade, because of the financial conditions already outlined has not enough credit with the banks to permit it to borrow all the money that would be necessary. The coal trade sees the possibility of making this reform, but it is without the financial resources to take advantage of so big an opportunity.

No Capital for Storage

Another big difficulty in the same direction is that these storage plants requiring enormous sums of money cannot be created by individual enterprise, but must spring from a co-operative movement, which the spirit of America at the minute opposes, and which is, in fact, directly contrary to the laws now operative and at present being enacted at Washington.

Another suggestion that has been made has been that briquetting plants should be established at central points in mining districts to convert into the domestic sizes a certain percentage of this fine coal. However, a briquetting plant costs an enormous sum of money. Moreover, the cost of manufacture of briquettes is close to a dollar per ton. The coal trade sees that there is not a difference of a dollar per ton between the price of the rejected fine coal and the market price of the prepared coal, at which price briquettes would have to sell. Because of the absence of enough margin between the selling price of the raw coal and the selling price of the manufactured product, the coal operators cannot induce men of money to lend them enough to engage in briquetting as a general practice. Besides, briquetting on any such scale as is here presupposed would be an enterprise entirely too big for individuals, and hence would require a co-operative movement against which the objections have already been enumerated.

Another suggestion which is common is that seeing the need for by-products obtained from the manufacture of coke, the coal trade should build coking plants and ship to them the excess of fine coal. This is an attractive suggestion from a national point of view and has a great many merits from that of common sense. The people who should naturally do the coking of the country are the coal men. But it is difficult to see how they can do so.

For example, an ordinary small sized coke plant costs $1,000,000. To handle the excess fine coal at any one

producing district it would take a coking plant which, to do nothing more than to distill the crudest possible by products of coal, would cost $5,000,000. To get another plant that would work over those by products into marketable articles would cost an equally large sum. If the cost of this plant for one district—namely about $10,000,000—be multiplied by the number of coal producing districts in the United States, an outlay, at the very start, of not less than $100,000,000 is indicated; the actual, necessary outlay possibly amounting to several times that amount.

It is submitted here that if individual coal companies have not the credit with which to borrow the money to carry on their ordinary business—for this reason many coal companies are constantly going into bankruptcy—there is no hope that coal men can borrow the untold millions of dollars necessary to go into the coking business on any such scale as a solution of the fine coal problem would involve.

At the same time, the coal trade problem for the United States must be solved. This country cannot, for long, endure the loss of coal involved in the present extravagant methods. It cannot, for long, endure the economic loss incident to the enforced idleness of over a million men for several months out of every twelve. It cannot endure the financial loss incident to a constant over-productive capacity in its second industry of 40%. Some solution of the problem, therefore, must come and must be started quickly.

The purpose of this article is to show that the primary need is for some form of co-operation that will put a financial foundation under this business that is sufficient to permit the beginning of some of these needed reforms. For example, briquetting, coking, and the storage of surplus of certain periods should be provided. But to get these things there must be co-operation. Before co-operation can be effected, the consent of the government must be obtained. The first need, therefore, is the consent of the government that the coal men may work together to solve a national problem regarding the nation's supply of fuel.

After that is permitted, credit and the money that is necessary to carry on certain of these reforms will follow. Then there will be a little more profit in the trade than there is now. This will create a surplus, or something of reserve financial energy which will permit the coal trade to extend, naturally, into those refinements of coal mining, namely, coking and recovery of the by-products. In giving the operator that money the public will likewise give greater earning capacity to the miner; more employment to a greater number of men; bigger and better business for various communities, and all of these things spell definite national progress.

The one barrier between the situation as it is and the situation as it might be and ought to be, is the governmental prohibition of anything like sensible co-operation.

White Island Sulphur Deposit

By W. D. HORNADAY

One of the largest and most remarkable sulphur deposits in the world is situated on White Island, which is a volcanic mountain that belongs to New Zealand. Although this island is several miles from the mainland of New Zealand, its thermal wonders attract thousands of interested visitors each year. The first efforts to utilize this sulphur in a commercial way were made in 1886. At that time the island was so isolated that the exploiters found it impossible to keep a working force. This, together with a lack of transportation facilities, caused the industry to be abandoned. In 1912 interest in the possibilities of the industry was revived. What is known as the New Zealand Sulphur Co. was organized with a capital working stock of $125,000 and a reserve capital of $100,000 for the purpose of acquiring and operating the deposit. Since then a well equipped permanent camp has been established, retorts for the refining of the sulphur erected, and other facilities installed for handling the product. The output of the plant is now about 1000 tons per month, and this is to be greatly increased. Excellent arrangements are in effect for the transportation of the product to the different ports of New Zealand, Australia, the Straits Settlements, and islands in the Pacific Ocean. It takes about 30,000 tons of sulphur annually to supply the Australian market, and it is planned that all of this shall come from the deposit on White Island. The annual consumption of sulphur in New Zealand is about 3000 tons, and it is increasing.

WHITE ISLAND SULPHUR DEPOSIT.

The boiling lake upon White Island is one of the great awe-inspiring sights of New Zealand. It is surrounded by precipitous cliffs which give the lake the appearance of being the crater of an active volcano, which it doubtless is. After the Company had spent $100,000 in preparation for mining, a volcanic disturbance wrecked the camp and killed 10 men, as reported in the *Press*, October 31.

A Plan for Reviving Hydraulic Mining

By C. S. HALEY

As the early history of the American occupation of California is forever associated with the gold-hunters of 'forty-nine,' so is the economic development of the state indissolubly bound up with the development of hydraulic mining. During the period from 1848 to 1860 and later, the working of gravel by hand was extremely easy, owing to the thousands of acres of light gravel whose shallow banks held the concentrated burden of the ancient eroded auriferous channels. After the cream had been skimmed, however, the miners turned their attention to the deeper heavier gravels, and the hydraulic giant was evolved. Its development, and the progress of the mining industry under its use, are not within the scope of this paper. It is sufficient to say that in 1876, when hydraulic mining had obtained its maximum growth, there was over $100,000,000 invested in plants, equipment, and property, and the annual yield was from $11,000,000 to $13,000,000. Compared with the $50,000,000 to $80,000,000 of the annual yield before 1857, this does not loom very large; but without it, during the decade of 1870-80 the annual yield of California gold would have been insignificant.

Growth of Agricultural Interests

While the hydraulic mines were flourishing, however, the owners apparently overlooked the growth of another industry, which was one day destined to drive them from their own field in the battleground of the courts. The broad valleys where the mountain rivers debouch into the Sacramento and San Joaquin rivers teem with fertility, and these soon attracted the attention of immigrant farmers. Land which the miners could originally have bought for little or nothing and held as a perpetual dumping ground steadily mounted in value, and its increasing productivity permitted the farming interests gradually to overshadow the mining.

The accumulation of débris in the rivers was long a source of annoyance and considerable damage to the farmers. Even during the days of ground-sluicing, the great flood in the winter of 1862 covered the richest bottom and orchard lands along the Bear and the Yuba rivers with tons of débris from the gold washing. At this time, however, mining was regarded as the more legitimate and powerful industry, and but little protest was made. As the strength of the agricultural interests grew, protests against the overloading of the rivers became more and more frequent and more powerful, until the struggle culminated in the famous 'Sawyer decision,' on January 23, 1884. This decision, handed down by the U. S. Circuit Court, in the case of Edwards Woodruff *v.* the North Bloomfield Gravel Mining Co. *et al.*, wiped out at one blow property values exceeding $100,000,000, and indefinitely postponed the addition to the world's wealth of what has been roughly estimated at from $500,000,000 to $1,000,000,000 in placer gold.

The Sawyer decision was, however, but the culmination of a long struggle. The farmers of Sutter, Yuba, Sacramento, and a few other of the valley counties, organized in the early seventies the Anti-Débris Association, to take their struggle into the courts. They were opposed by the once powerful California Miners' Association, and the struggle was long and bitter. The story of the fight from the miners' point of view, is especially interesting and from it one can gain an idea of the principles for which each side was contending. To that end, I quote from a circular issued by the Miners' Association on June 15, 1883, which briefly reviews the then existing situation.

History of the Litigation

"* * * I deem it proper to revert to the services of this Association in the defence of the mining industry. The first case of importance was that of Keyes *v.* Little York and 38 other defendants, begun July 29, 1876. After a long trial, wherein the best legal and engineering talent in the state was employed, a judgment was rendered against us. We appealed the case to the Supreme Court of California, where it was reversed on a point raised by demurrer, on the ground of misjoinder of parties defendant.

"The City of Marysville then brought suit (September 15, 1879) against the North Bloomfield Gravel Mining Co. and 32 other companies. They included about 200 other persons as defendants. The defendants appealed to the Supreme Court from the injunction issued in that suit and also demurred and applied for change of the place of trial. The motion was refused and an appeal was taken to the Supreme Court, where it is now pending.

"* * * Simultaneously with above action (State of California *v.* Miocene Mining Co.) the Attorney-General commenced suit (June 28, 1881) against the Gold Run Mining Co. of Placer county. Defendants, through the counsel of the Association, demurred and answered. The trial came on in October 1881 and occupied the court 60 days. The presiding judge (Temple) rendered a decision June 12, 1882, sustaining the injunction, with a qualification that on a proper showing of the construction of dams to restrain the coarse material he would entertain a motion to dissolve the injunction. The point raised on demurrer as to want of authority of the Attorney-General to use the name of the state, was not decided, but referred to the Appellate Court. Neither party fully acquiesced in the decision. Defendants appealed to the Supreme Court. Appeals were taken by both, and the day of argument is not yet set.

"Then the County of Yuba sued the Excelsior Water & Mining Co., the Eureka Lake & Yuba Canal Co. Con.,

the Blue Tent Consolidated Hydraulic Gold Mines of California, Ltd., and the Yuba River Gold Washing Co. The last had further time to plead, which is now about expired. Injunctions were issued in all these cases, *ex parte* and without notice to the defendants. Then came the suit of the County of Sutter *v.* J. F. Hickey *et al.*, commenced April 14, 1882, in the county of Colusa. The defendant's mine is in Nevada county. Also about the same time a suit against the Birdseye-Creek Co. of Placer county.

"The last action brought is that of Edwards Woodruff *v.* North Bloomfield Gravel Mining Co., Milton Mining & Water Co. and some eight other companies. It is substantially of the same nature as the others, praying for a perpetual injunction. Woodruff being a citizen of another state the suit was brought in the Circuit Court of the United States, Judge L. B. Sawyer presiding. Defendants demurred on ground of misjoinder of parties defendant. The demurrer was argued by the ablest counsel in the state, occupying the court two weeks, and was overruled. The testimony is now being taken before commissioners for the main trial in September.

"All of the above actions have been defended by the Miners' Association, at an aggregate expense of not less than $200,000."

The Fatal Decision

The decision in the case last referred to may be quoted in its principal part as follows:

"And that the defendants herein * * * and each and all of their servants, agents and employees, are perpetually enjoined and restrained from discharging or dumping into the Yuba river, or into any of its forks or branches, or into any stream tributary to said river or any of its forks or branches, and especially into Deer creek, Sucker Flat ravine, Humbug creek, or Scotchman's creek, any of the tailing, boulders, cobble stones, gravel, sand, clay, débris, or refuse matter from any of the tracts of mineral land or mines described in the complaint. And also from causing or suffering to flow into said rivers, creeks, or tributary streams aforesaid therefrom, any of the tailing, boulders, cobble stones, gravel, sand, clay, or refuse matter resulting or arising from mining thereon. And also, from allowing others to use the water supply of said several mines or mining claims, or any part thereof, for the purpose of washing into said rivers and streams, any earth, rock, boulders, clay, sand, or solid material contained in any placer or gravel ground or mine. * * * That the defendants, or either of them, may, at any time hereafter apply to this court, upon due notice to the complainant * * * for a modification or suspension of this injunction * * * upon any showing which the court may deem sufficient that the conditions have been so changed that the discharge of such mining débris by said parties or party * * * may be resumed or otherwise conducted, so as not to create or continue the nuisance complained of, or a nuisance of similar character, and so as not to injure or damage said complainant, or upon any other grounds hereafter arising satisfactory to the court. And for the purposes aforesaid, the court hereby reserves the power to modify or suspend said injunction in whole or in part, as the exigencies and equities of the case hereafter arising, may require."

The result of the Sawyer decision has already been stated. The decree of the court was not against hydraulic mining in name, but against dumping the débris into streams and ravines. On the large mines operations were suspended, as injunction after injunction closed them down, and property worth millions went into disuse and decay.

Secret Mining and Spies

Of the smaller mines, however, many persisted in continuing to work, and the Anti-Débris Association, composed of farmers of the valley, carried on an organized opposition to hydraulic mining. Long and costly litigation resulted, and continued for years. As injunctions had to be secured in each and every case, the Anti-Débris Association had to keep men in the field securing evidence, and among the miners feeling ran high against these 'spies.' Gradually, however, the operators gave up the struggle. Thousands of people were thrown out of employment, the gold production of the state dwindled, and property values in the mountain counties were decreased by millions. For about nine years, this continued, growing from bad to worse. A review of the situation, already growing serious in 1881, by the Miners' Association, sets forth the losses resulting from the closing down of hydraulic mining in very emphatic fashion. I quote some extracts, which may throw some light on the attitude of that body.

"California has produced (1848-1880) * * * between $1,100,000,000 and $1,200,000,000 of gold, of which very much the larger portion has come, either directly or indirectly, from the ancient or pliocene river channels. * * * As the (surface) placers became exhausted, the miners naturally turned their attention to the sources from which the placer gold had been derived. Commencing in 1851, they have steadily prosecuted the development and working of the ancient river beds, until the yield from them amounts annually (1881) to a sum varying from $11,000,000 to $13,000,000, with the prospect for many years to come of equally great returns. In order to accomplish this result, the expenditure of large sums of money has been required in building dams, canals, and tunnels. The Bloomfield and Milton companies afford a good illustration of the large capital necessary for the successful development of such properties. Work was vigorously commenced on the mines of these companies in 1854, since when about $4,000,000 has been expended—all representing capital account—until 1878, when their works were finally completed. All this $4,000,000, with unimportant exceptions, was furnished by stockholders resident in California.

"We roughly estimate the present actual value of these mines in California to be $80,000,000; adding to this the property whose value is dependent on the existence of these mines, there results a total present value of probably $100,000,000."

These statements, made in 1881, show how strongly the danger of extinction of the hydraulic mines was felt at that time. They also serve to emphasize what a tremendously important effect upon the economic progress of California hydraulic mining has had. To continue:

"In the early days of placer mining, when there were literally hundreds of thousands of miners washing the soil in every gulch, ravine, and river of the Sierras, the aggregate quantity of material washed into the rivers must have exceeded the amount which by improved, but similar appliances, is now being placed in them. * * * The gravel channels of California have yielded in the past nearly $1,000,000,000 of gold, which has been a mighty force in bringing about the existing prosperity of the civilized world. A still greater quantity remains in our unworked but developed channels, ready for extraction. * * * Can California—can the United States—suffer this great treasure to be forever locked up in our mountains? * * *

Extent of Damage

"The State Engineer in January 1880, after detailed and careful examination, reported that 43,546 acres of land had been depreciated in value by the flow of mining débris, with a resulting damage amounting to $2,597,635. * * * That the Feather and Sacramento rivers have been injured is conceded by all, but we have the official statement of Captain Eads—as competent an authority on such matters as can be found in the world—that if the flow of heavy sands is kept from entering those streams, they can easily, by proper treatment, be brought into excellent condition. * * * It seems to be taken for granted that we have to deal with engineering problems more difficult of solution than have before been encountered. This is not the case, for both in France and Italy many of the rivers carry larger quantities of earthy material in proportion to the water than does the Sacramento. In these countries no great difficulty has been experienced in protecting the lower lands and rivers.

"From the examinations and reports of our engineers, we became satisfied, several years since, that it was practicable, at a comparatively moderate expense, safely to store for many years to come all the injurious flow of mining débris in the Yuba, Bear, and American rivers by forming reservoirs by the construction of brush and stone dams in the bottoms and cañons of those streams. * * * the now famous 'Débris Act' was strongly advocated by both miners and farmers, who, in that measure, asked for state aid, so that the necessary funds could be secured to establish a thorough system of protection. In this legislation the miners showed their willingness to pay their full share of the burden, by being taxed in three different ways, and much more heavily than any other class. Under the operations of this act two restraining dams were built in 1880, one across the Yuba, and the other across Bear river, at a cost of nearly $200,000. The residue of the money procured by the taxes levied under the authority of the act, amounting to some $290,000, was spent chiefly in building levees, for the purpose of confining the rivers, so that they might, by a scouring action, deepen their beds."

The results of the court decrees already foreseen at this time have been stated above. For seven or eight years the industry was gradually paralyzed by the activities of the Anti-Débris Association in serving injunctions. Then, in the fall of 1891, the fight was taken up anew. At this time, a number of miners in Placer county, who had suffered from the closing down of the hydraulic mines, met and decided to call a county convention to see whether anything could be done to revive the hydraulic mining industry. This convention was called in Auburn, with the object of formulating a plan for a state miners' convention and memorializing Congress as to needed legislation for the industry. This state convention was called in San Francisco, and representatives of both the mining and farming interests were invited. Contrary to expectation, the meeting was entirely harmonious, and a common plan was agreed upon readily.

The basis of this agreement was the report of a government commission of engineers. This commission was appointed by a special act of Congress, upon suggestion of the legislature of California. It appeared from their report that dams and other restraining works could be erected in many of the cañons for the restraining of débris caused by future mining operations, as well as débris already in the rivers from former operations.

The convention of miners then asked Congress to accept and adopt the report of the Commission, and to take steps at once to put into practical operation the plan suggested, so that mining might be again carried on under specified conditions, and the débris restrained from the rivers and farming lands. The result of this was the so-called 'Caminetti Act,' introduced into Congress in 1892, and passed in 1893. It is under the provisions of this act that whatever hydraulic mining is done in the state at the present day is carried on.

The provisions of this act are, essentially, as follows: A commission of three officers of the Corps of Engineers of the United States Army are appointed by the President, with the advice and consent of the Senate. This Commission is charged with the enforcement of the provisions of the act. The owners and operators of hydraulic mines are required by law to comply strictly with the requirements of this Commission. An extreme penalty of $5000 fine and one year's imprisonment is provided for violation of the act.

Requirements of the Law

Hydraulic mining is defined as embracing all mining operations where water is used under pressure through a nozzle against any bank of earth, gravel, or similar material, thus eroding the bank. The law requires that in all cases a license or written permission from the Commission must be obtained before hydraulic mining can be legally carried on. Licenses are revocable by

the Commission, and will not be given unless their requirements as to restraining barriers or dams are complied with; and unless these dams are properly maintained, and all information asked for by the Commission is at all times forthcoming, licenses may be revoked arbitrarily by the Commission

Licenses Under the Caminetti Act

Licenses are not transferable and are valid only for the operations of the special individual, company, and property named in the license. An application for license must be advertised in the newspapers to allow any protests to be filed with the Commission. As soon as practicable after advertising an application, the sites proposed for restraining works are visited, and if found satisfactory by the Commission, authority is given for construction of the barrier or dam, together with specifications and instructions for the work. Any variation in location or change in character of work from that specified by the Commission may cause rejection of the dam. If the work, after inspection, is found satisfactory by the Commission, a revocable license to mine is issued. Until a license has been issued, it is illegal to mine. When mining has been begun, a report every month must be submitted in regular form to the Commission. In case of any accident to the barrier or dam, mining must cease at once and the Commission be promptly notified.

When a dam becomes full of débris, mining must cease until more impounding capacity is provided, either by raising the dam or the construction of new dams. In either case, the permission of the Commission must be obtained, and the work when completed must be inspected and approved by the Commission before work can be resumed. Dams must be kept water-tight and a pool at least two feet deep must be maintained as a settling basin while mining is in progress. Leaks must be promptly checked. Names of mines cannot be changed without due notice to the Commission.

While the above is not the wording of the Caminetti act, which allowed a certain amount of latitude to the Commission, it is in effect an abstract of the conditions necessary for the present-day hydraulic miner, in any of the drainage areas affected, to observe in order to keep within the requirements of the law. It will be observed that the power of the Commission is arbitrary. This is, of course, necessary for the efficiency of the act; but it seems a necessary corollary that the men to whom this arbitrary power is entrusted should be thoroughly familiar with the conditions governing the work which they control.

The area embraced under the provisions of the Caminetti act includes all of the country drained by the Sacramento and San Joaquin rivers and their tributaries. In the northern portion of the state, tributary to the Klamath and Trinity rivers, hydraulic mining is carried on unrestricted, owing to the extreme grade of the rivers and the comparatively small area of valley land along their banks.

At the time of the passage of the Caminetti act there was great jubilation in the eastern mountain counties of the state. Anvils were fired, celebrations organized, and the general idea among the miners was that their ancient prosperity and flourishing condition would be in a measure restored. It was, of course, not expected that mining could be conducted on the same scale as before restrictive measures were adopted; but it was hoped that at least two or three millions a year would in a short while be added to the then dwindling gold production of the state. In the course of a much longer period of time, it was expected that the five to ten thousand millions of dollars still locked up in the Sierras would be added to the wealth of the nation. Another cause for congratulation was that the conditions governing the passage of the act showed that the miners and farmers of the state could act harmoniously and co-operate for the general good of all. As the act was passed for the purpose of reviving the mining industry, it was rightly expected that the débris Commission would not assume an attitude that was either hostile or suspicious of the good faith of the miners.

For a time this seemed to be the case. The then members of the débris Commission seemed to bend every effort to the serving of the best interests of the state. While friendly toward the mining interests, there was still no partiality shown at any point where their interests seemed prejudicial to the good of the commonwealth. With this attitude, the miners were well content, and a certain amount of work was resumed. Restraining barriers were built in conformance with the act, and the sound of the bumping boulder was again heard in the sluice-boxes and ravines of the Sierras.

But not for very long. Changes came in the débris Commission, as was natural in a body composed of army officers, in accordance with the exigencies of the service. New men came in, unfamiliar with the requirements of the mining industry and inclined to regard it as somewhat of a trespasser.

The System of Graft

In addition, the Anti-Débris Association, like many another body originally organized for a worthy purpose, when its purpose was accomplished, speedily degenerated. The employment of scouts, or 'spies' as the miners were disposed to call them, was perhaps the first branch of the activities of the Association to show decadence. Petty graft crept in, and men who were disposed to pay for the privilege of working unrestrained, especially if the property in question were out of the way and inaccessible to the officers of the débris Commission, found out that it was very easy to avoid complaints. On the other hand, men who operated in good faith under the law, if they did not pay tribute to certain individuals, found themselves subjected to continual annoyance and complaint.

This does not in any way reflect on the membership of the débris Commission. Consisting as it does of officers of the United States Army, they are above sus-

picion of connivance with a few petty grafters. The chief trouble with the Commission, as at present constituted, is this: In the first place, they serve without pay, and while the service is given whole-heartedly, their duties in connection with river and harbor work are so exacting and onerous that they must of necessity work in part on hear-say evidence in deciding where to conduct their investigations. Complaints filed by the Anti-Débris Association being their principal source of information, it follows that the latter body has a certain amount of influence, and its petty influence is embarrassing. Add to this the fact that as soon as a man has served long enough on the débris Commission to gain a practical idea of the work of the miners he is apt to be sent to another part of the country, and a new man has to be broken in.

On the other hand, the California Miners' Association, which for many years was the most powerful backer of the hydraulic miners, has, with the development of the quartz interests, paid less attention to the matter and devoted itself to the thoroughly 'legitimate' forms of mining. So the would-be hydraulic miner is left in the lurch. The attitude of the débris Commission is somewhat like that of the corner policeman watching the small boy near the apple cart. The Anti-Débris Association has already been brought into this paper more than the questionable character of its activities deserve; but it is at the present day more in need of a policeman than the miners. And the Miners' Association is now far from being the powerful organization it once was.

The result of all this is that, instead of the tens of millions which were formerly produced annually, and instead of the millions which should now be produced, the production of hydraulic mines in the Sierras is only hundreds of thousands of dollars.

(To be continued.)

COAL-MINE FATALITIES in the United States in September totaled 195, against 173 in that month of 1913. Nine months of this year record 1778 deaths compared with 1916 last year.

MINERAL EXPORTS from Argentina, South America, during the first half of the current year totaled ₱56,131, a decrease of ₱42,657 compared with that period of last year.

COAL PRODUCTION of the Chinese Engineering & Mining Co. during the week ended October 17 amounted to 55,395 tons.

Darrow Tailing Treatment at Bunker Hill

By FRANK LAWRANCE

A clever and most successful slime concentrating plant is in operation on the waste tailing from the concentrating mill at the Bunker Hill mine in Amador county, California. The process used is the outcome of long and persistent experiments made by Wilton E. Darrow, who has finally brought it to a successful issue. The tailing here carries a large proportion of slime in which is fine mineral not caught on the vanners. In the Darrow plant there are four machines treating 200 tons of tailing per day.

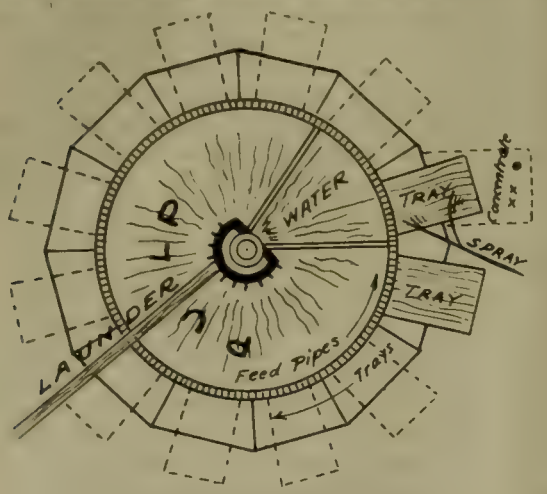
DARROW SLIME TABLE SHOWING CATCHMENT PLATFORM.

DARROW SLIME TABLE WITH THREE TRAYS IN POSITION.

An important feature of the Darrow plant is the elimination of all rubbish such as pulverized wood before the tailing enters the plant. Another feature is a diaphragm-cone classifier which separates the sand from the slime. The sand, containing only 5% that will pass

a 100-mesh screen, is leached in ordinary vats filled by a distributer. The slime is passed over the patent machines, herewith illustrated, after dilution with clear water.

A machine consists of ten tiers of trays each 2 by 4 ft. in area. There are 14 trays in each tier. The feed pipes to each tray are so arranged that each has an equal and even supply of the pulp and the part of the mechanism which supplies the pulp, or in other words carries the feed pipes, revolves in the opposite direction to that which carries the trays, which are on the outside. A small baffle tray at the head end of each big tray distributes the pulp uniformly. Each tray is covered with a piece of common felt roofing paper which has been prepared by painting with B. & B. paint and sprinkled with sand to form a rough surface like sandpaper.



PLAN VIEW OF DARROW SLIME TABLE.

A plan view of the machine shows a circular table with a slight fall toward the periphery made of thin cement. This table is stationary. The table has two small ridges which cut off one-sixth of the circle to allow clean water to pass down the feed pipes and wash the loaded trays just prior to their approaching the sweeping water sprays which wash the concentrate completely off into a receptacle below. The pulp flows down the surface of the cement table into the trough around the edge, and the feed pipes are screwed into the trough in such manner as to convey the pulp to the different trays. The sprays, of which there are two to each tier, have a sweeping movement and thoroughly wash off all concentrate remaining on the trays after the water wash. When the concentrate is washed off it flows into a general sump and is pumped up into agitation vats and treated by cyanidation and decantation. An excellent extraction results.

The plant requires only one man to look after it, and he does not need to put in more than four or five hours daily. Mr. Darrow has a new plant erected below the Fremont property and has started to treat the tailing from that mill. When one considers that a profit has been made on the Bunker Hill tailing which averaged about 65c. per ton, it is evident that a considerable field exists for this process.

Mineral Production of New Zealand

The *Mines Statement* of the Department of Mines for 1913, recently to hand, shows the following output:

	1913.		1912	
	Quantity.	Value.	Quantity.	Value.
Coal used, tons	1,676,256	£ 838,128	1,948,603	£ 974,301
Coal exported, tons	211,749	205,010	229,012	216,170
Coke, tons	28	50	4	7
Gold, ounces	376,161	1,459,499	343,163	1,345,131
Kauri gum, tons	8,780	549,106	7,908	401,305
Silver, ounces	975,616	103,866	801,165	84,739
*Sundry minerals, tons	2,927	31,532	1,729	20,571
Total value		£3,187,191		£3,042,224

*Includes scheelite, 221 tons of concentrate worth £22,933, which is recovered from gold quartz mines in the provinces of Otago and Marlborough.

Lode mines produced 464,508 tons of ore yielding £1,071,813, and £287,088 in dividends. Hydraulicking recovered £295,704, and dredges £195,848. There were 74 boats working at the end of 1913, against 87 in 1912 and 201 in 1902. Dividends last year amounted to £18,750.

Eight companies are drilling for oil in the provinces of Taranaki, Wellington, and Hawke's Bay. One concern drilled a well which gave 1000 bbl. in the first two months of 1914. The yield of oil in any of the districts, although of excellent quality, has not been found in commercial quantities. Regulations are being prepared to control drilling and water. Coal decreased 289,610 tons, due to the strike throughout the Dominion. The state collieries produced 196,284 tons. There were 9191 men employed in all operations, the fatal accident rate being 1.74 per 1000.

The total mineral production to date is as follows:

Metal or mineral.	Quantity.	Value.
Antimony ore, tons	3,768	£ 54,941
Coal used, tons	33,812,787	16,814,583
Coal exported, tons	3,536,032	3,254,932
Coke, tons	16,491	24,975
Chrome ore, tons	5,869	38,002
Copper ore, tons	1,495	19,198
Gold, ounces	20,884,312	82,058,543
Kauri gum, tons	330,775	16,759,563
Hematite ore, tons	76	444
Manganese ore, tons	19,364	61,905
Shale, tons	14,423	7,215
Silver, ounces	17,783,621	1,938,714
Sundry ores and minerals, tons	41,442	313,597
Total tons and total value	37,782,522	£121,346,612

SOAPSTONE of commercial grade is reported to occur at various points in southern California, and Los Angeles men are preparing to place it on the market.

THE SHAMVA MINE, Rhodesia, produced $150,000 from 48,489 tons of ore in October. Working costs totaled $1.82 per ton, and the estimate of profit $62,000.

The Cyanide Situation

At a recent meeting of the New York section of the Mining and Metallurgical Society, Mr. Ruhl, of the Roessler & Hasslacher Chemical Co., discussed the beginnings of the American cyanide industry as below:

I really did not expect to speak tonight, and have not prepared an address, therefore can only make a few general remarks on the present cyanide situation; all well known history. Our firm began the manufacture of cyanide in this country in 1890, at Perth Amboy, New Jersey, making the first potassium cyanide of 98 to 99% guaranteed purity, by the old method from potassium ferro-cyanide, using both domestic and foreign raw materials, the latter permitting us to export cyanide made in the United States to Mexico and other Central American countries.

It was seven years before we sold the first carload at 45c. per lb., a most memorable event, although we were told, after the success of the cyanide process in the Transvaal was assured, that cyanide would be wanted here also, by the carload, every hour of the day. The first carload was not sold for gold extraction, but for the fumigation of orange trees, the only recognized remedy against the San Jose pest.

Among our first customers were the Mercur gold mines at Mercur, Utah, and the Brodie cyanide plant at Cripple Creek, Colorado, where I first met your secretary, Mr. Ingalls. J. R. Delamar placed the first carload order for the Nevada Gold Mines, which he had just acquired, after his failure with the Rothwell chlorination process. He only then came to the conclusion that cyanide in its concentrated form was by far a better material to transport than chloride of lime, in large, bulky casks, as the contents of these casks of his first supply were strewn all along the 175 miles from the Milford railroad station to his mine at Pioche, Nevada.

Delamar started with 6 to 8 lb. of cyanide for each ton of ore, the value of the ore at that time being $60 in silver and $15 in gold per ton. As he was anxious to recover the precious metal, he did not mind how much cyanide was used so long as he could secure big results, but it also did not take him long to discover that he was wasting cyanide. The price at which we sold him the first 100 tons was 32½c. per lb., f.o.b. New York. We tested the feed and tailing of the Nevada Gold Mines and advised the neutralization of the ore with lime or caustic soda before cyaniding, which would cut down the consumption of cyanide to 4 lb. per ton of ore. Several years later Delamar's manager, Hartwig A. Cohen, openly boasted of having reduced the consumption of cyanide to 1 lb. per ton of ore, but failed to mention that the refractory ores had fallen in value to $10 per ton.

With the enactment of the Dingley tariff act of 1897, reducing the rate of duty from 25 to 12½% *ad valorem*, we were compelled to cease the manufacture of potassium cyanide. For several years, during the period of the Transvaal war, we resorted to the importation of cyanide. In 1902 we took up the manufacture of sodium cyanide, producing it synthetically, according to an invention of an American chemist, Hamilton Y. Castner. It took fully ten years to reach the high standard of sodium cyanide which we are now producing, equivalent to 128 to 130% potassium cyanide, now universally recognized as the only proper material for electroplating, fumigation, and gold extraction purposes.

Unfortunately for the United States' mining industry and ourselves, after the enactment of the Wilson tariff act of 1913, putting cyanide on the free list, the output of our cyanide factory at Perth Amboy, New Jersey, was not equal to the growing needs of this country; thus it was necessary to import cyanide to meet the increasing requirements of the United States.

At the outbreak of the present unexpected European war, we immediately proceeded to rehabilitate our factory at Perth Amboy, by obtaining additional and sufficient supplies of raw materials so as to operate our works on a much larger scale than heretofore, and thus meet the extraordinary conditions. In addition to this, arrangements have now been made to procure a 1000-ton shipment of cyanide from Germany, which is to come forward on an American ship, and this will also relieve the situation in Mexico, as all the cyanide we intend to import is to provide for Mexican consumption.

If, in common with all other countries, the United States were on a free-trade basis, no protection would be necessary; but with a protective tariff on some things and cyanide on the free list, we are handicapped in the cost of production by reason of the higher cost of raw material, labor, land, equipment, and capital investment compared with European conditions. The total annual consumption of cyanide in the United States is about 2000 tons, and in Mexico 5000 tons. With the enlargement of our Perth Amboy plant, which is now almost ready to begin operation, we shall be able to supply the whole consumption of the United States, but must continue to rely on importations to supply the Mexican demand. Under the Dingley tariff of 12½% *ad valorem*, an amount of protection with which we were quite satisfied, we were able at all times to supply the whole American demand. The raw materials we consume are sodium, ammonia, and carbon.

ALL MINING OPERATIONS, railway construction, and other work on the uplands are at a standstill in Bolivia as a result of the financial crisis precipitated by the European war, according to W. Andrews and his son, mining men who recently returned to Lima, Peru. Patiño's tin mines have closed down, the Pulatayo silver mine has let its 2000 employees go, and every other important corporation in the republic has reduced its force. The Incaoro gold mine, in which Horace G. Knowles is interested, is practically the only exception. It is understood that the automobile service between Potosi and Sucre has now been established.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Uwarra Mill

The Editor:

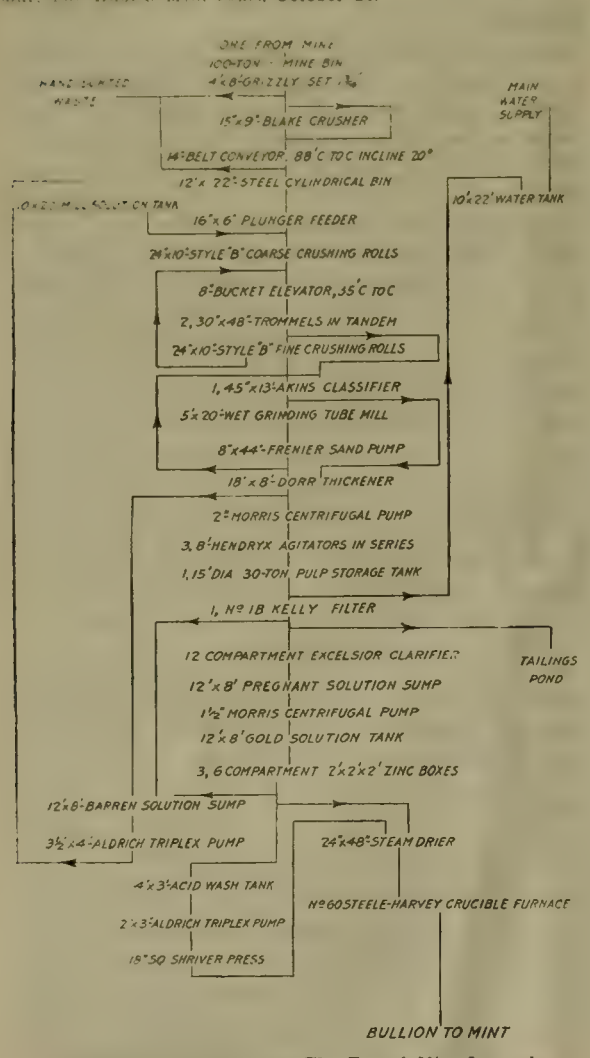
Sir: In connection with Mr. Barbour's description of the cyanide mill of the Uwarra Mining Co.,* the following operating data of the mill he describes will be of interest to those who read it. I succeeded Mr. Barbour here in May and the following would only apply from that time to the present. At the time he wrote, the flow-sheet was as below, the figures being reproduced from his article. Radical changes were made in this flow-sheet of the mill by the elimination of the second set of rolls, all the mechanically operated agitators, and numerous minor power consuming parts of the original equipment. At the present time the ore as mined is relieved of 31% of barren slate at the surface before treatment. Heretofore this amount was considerably less. This has naturally resulted in changing the character of the ore treated, by removing a greater amount of slate which is tough, of larger size, and more resistant to grinding than the gold-bearing fractured quartz and accompanying calcite. An average screen analysis of the feed to the first set of rolls as delivered by the jaw-crusher is given below:

Mesh.	Per cent.
On 1½-in.	7.1
On 1-in.	17.8
Through ½-in.	75.1

The product from the rolls is elevated to a trommel with half-inch screen from which the undersize goes directly to the 20 by 5-ft. tube-mill after hydraulic classification. With the coarser feed, the tube-mill satisfactorily produced a pulp 95% of which passed a 200-mesh screen. At the present time, after provision had been made for the prevention of settling, the tube-mill delivers a coarser product, as it was found that the same extraction could be obtained on a product between 150 and 100 mesh.

Cyaniding these ores presents but few chemical difficulties. The gold is free, in a clean gangue, and contains but 3% of non-auriferous pyrite in the slate adjoining the vein. The great difficulty experienced in the plant has been the high settling rate of the pulp. I am at a loss to understand the poor performance of the mechanical agitators in the plant. I gather that they choked soon after the plant was started, as about 80% of the tank capacity was occupied by settled pulp when I first saw them. It is evident that the plant has operated since it started with but a fraction of the agitator capacity for which it was designed. The inferences that were drawn from this were that little if any agitation was necessary for an ore of this character. In the pulp storage tank that supplied the Kelly filter, no provision was made to keep the pulp in suspension, and settling resulted. This has been remedied by compressed air. Besides keeping the pulp in suspension, the tank now acts as an agitator during the shift the filter-press is not working. To eliminate the consumption of power, oil, attention, and cause of delay in operating, the three mechanical agitators were thrown out, one of which was

*"The Uwarra Mill, Candor, North Carolina," by Percy Barbour. *The Eng. & Min. Jour.*, October 24.


ORE FROM MINE
100-TON MINE BIN
4'x8' GRIZZLY SET 3/4"
MAIN WATER SUPPLY
15"x9" BLAKE CRUSHER
14" BELT CONVEYOR, 88'C TO C INCLINE 20°
12'x 22' STEEL CYLINDRICAL BIN
10'x22' WATER TANK
16"x6" PLUNGER FEEDER
24"x10" STYLE "B" COARSE CRUSHING ROLLS
8" BUCKET ELEVATOR, 35'C TO C
2, 30"x48" TROMMELS IN TANDEM
24"x10" STYLE "B" FINE CRUSHING ROLLS
1, 45"x13" AKINS CLASSIFIER
5'x20' WET GRINDING TUBE MILL
8"x44" FRENIER SAND PUMP
18'x8' DORR THICKENER
2" MORRIS CENTRIFUGAL PUMP
3, 8' HENDRYX AGITATORS IN SERIES
1, 15' DIA 30-TON PULP STORAGE TANK
1, Nº 1B KELLY FILTER
12 COMPARTMENT EXCELSIOR CLARIFIER
TAILINGS POND
12'x8' PREGNANT SOLUTION SUMP
1½" MORRIS CENTRIFUGAL PUMP
12'x8' GOLD SOLUTION TANK
3, 6 COMPARTMENT 2'x2'x2' ZINC BOXES
12'x8' BARREN SOLUTION SUMP
3½"x4" ALDRICH TRIPLEX PUMP
24"x48" STEAM DRIER
4'x3½' ACID WASH TANK
Nº 60 STEELE-HARVEY CRUCIBLE FURNACE
2"x3" ALDRICH TRIPLEX PUMP
18" SQ SHRIVER PRESS
BULLION TO MINT

ORIGINAL FLOW-SHEET, FROM *The Eng. & Min. Journal.*

dismantled and converted into an air agitator. This was accomplished while the plant was in operation, and during this time the pulp was sent from the Dorr settler directly to the filter storage tank, where it received some agitation before filtering. There was no perceptible increase in the value of the tailing discharged by the filter during this time. At the present time, the pulp from the Dorr is discharged into the converted agitator, where it is air agitated for half an hour. The new agitator has been in operation for two months now and the tank is absolutely free from settled pulp. An arrangement whereby 70% of the contents of the agitator can be siphoned over to the filter storage tank, prevents the necessity of keeping the agitator in operation to prevent settling, over holidays and repair days. The pulp storage tank is emptied through the filter during shut-downs. The filter-leaves are acid treated periodically, one set being in the acid tank while the other is in use. Since the plant was readjusted the filter discharge has consistently averaged less than 30c. per ton, of which about 40% is soluble. The recovery was 93.7% in June and July, and in October it was 94.2% on the basis of smelter receipts from the shipments of precipitate for the three months. In October the plant operated 90.7% of the total available operating time in the month.

The Shriver press for clarifying the gold solution was replaced by automatic decanting devices which allowed settling before going to precipitation, and excelsior was placed in the upper compartments of the zinc-boxes. The gold solution is clear and no difficulty is experienced in precipitating solutions having only 1.2 lb. of cyanide per ton. The precipitate is of high grade and the last shipment averaged $36 per pound.

Since the changes were made the plant has operated smoothly, made a consistent recovery by bullion, increased the grinding capacity, and eliminated the shut-downs caused by overloaded belt-conveyors and getting ore to pass through a $\frac{3}{16}$-in. screen that fed the second set of rolls. The air agitator in conjunction with the agitation in the filter storage tank, hardly seems to be necessary at this time, on the ore at present treated. It takes two hours for the pulp to reach the filter storage tank from the time it strikes the rolls where it comes in contact with solution. The cyanide consumption for October was 0.32 lb. per ton of ore treated. The mill or circulating solution averages from $2 to $3 per ton. It was found that the value of the overflow solution from the Dorr thickener was richer than the solution going to precipitation. This solution which was worth from $6 to $7 per ton was run to precipitation. The precipitation was so regulated that about 40 tons per day goes through the boxes. The capacity of the boxes is in excess of the requirements of the plant, but the surplus compartments are used as excelsior clarifiers.

The net result of the various changes in the plant and the elimination of the second set of rolls and mechanical agitators which included the use of steam for heating the solutions, is reflected in our coal bills to the extent of 6½ tons per day. Coal in the bins costs $4.20 per ton. I am not prepared to state definitely if stamps would have been better than rolls. However, I am inclined to think that if a five-stamp battery had originally been installed, the superfluous idle equipment would have been saved. The saving in power resulting from high elevator-belts, trommels, etc., would have been appreciable. I am convinced that stamps would have increased the capacity of the plant, as on ore of this character, which is fresh and hard, the rolls are of no assistance whatever to the tube-mill in making slime. The quartz is fractured and readily falls to pieces when the rolls take it. I think Dorr's continuous decantation process would have been ideal for the ore and such a plant would have required less power.

ANDREW WALZ.

Candor, North Carolina, November 10, 1914.

Upper Yenesei Valley and Adjacent Mongolia

The Editor:

Sir—In your issue of October 31, appears an article on the 'Upper Yenesei Valley and Adjacent Mongolia.' Having recently returned from an examination of alluvials in this region and having also just completed a description of my trip, the above article is of especial interest to me.

Referring to the Uriankhai, the writer states: "It is hardly known whether this land belongs to Russia or China," and further on he refers to "the nebulous state of the frontier question." The frontier question in this district has now been definitely and finally settled. The accepted border between Mongolia and Southern Siberia is a line roughly parallel to the Tanna-ola range and passing through points 100 to 150 versts south of the centre ridge of this range and thereby placing all the Tanna-ola territory within Siberia. This line had been defined by the Burin treaty between Russia and China, dated August 20, 1727, but it is only recently that Russia has formally laid claim to it. Soyot or Uriankhai camps and villages on the south of Tanna-ola are named in this treaty, and through these the boundary line passes.

The majority of the maps of this region, including the one you publish, are inaccurate. Those showing the boundary, designate it as a line either following the main Tanna-ola ridge or in some cases 100 miles north of this ridge.

North of the boundary line, in Siberian territory, mining titles now possess the same validity as do those in any other part of the Russian Empire. All mining claims in the Uriankhai region come within the jurisdiction of the Minusinsk district mining engineer.

Although a new district, its inaccessibility, together with the fact that all the promising creeks have been already located by the Russians and Siberians, discourages prospectors from the world outside. Mention is made in the article of "lack of water," also "The

hydraulic method is impracticable in the district, for lack of water, the absence of suitable places for installing a system of hydraulic washing, and other mechanical difficulties." As a matter of fact, I found conditions for hydraulicking excellent, and my clients, following my suggestions, are next year, equipping one of the creeks with a hydraulic plant. The country I visited is well watered and from 1000 to 2000 miner's inches of water under 800 ft. head can be had from two creeks by constructing in each a ditch six miles long. Next year I hope to be able to publish a detailed description of some of the properties in this interesting district. The dredge referred to on the Saphyanoff property is a 7½-cu. ft. bucket, open-connected, Russian built dredge. It cost in Petrograd R.100,000, while R.100,000 additional was spent in freight and erection. The gravel is about 10 ft. deep, of which half is overburden. Bedrock is very hard. The dredge was expected to dig at the rate of 2500 cu. yd. per day, but in actual operation it is only digging 800 to 900. During the early part of this summer the dredge was running at a loss; its daily clean-ups amounting to only 20 to 40 zol. of gold ($48 to $96). Later in the season, however, it yielded 2 lb. of gold per day ($460). It burns wood which must be carried a distance of 5 versts and employs a crew of 40 men.

NEWTON B. KNOX.

London, November 11, 1914.

We are fortunate in being able to add this to our previous note on this far off but promising country. Visitors to it have been rare and thus Mr. Knox as the engineer last returned is able to make material corrections.—EDITOR.]

Experimental Development of the Hall Process

The Editor:

Sir—Mr. H. F. Wierum deserves the thanks of the smelting fraternity for his very frank and complete article on the Hall process of smoke treatment, published in the *Press* of October 3. Mr. Wierum is right, the impression made on the public, by the repeated shutdowns, and explanations thereof, was that the method was a complete failure, not a simple question of getting the right washer for the sulphur.

I would like to call Mr. Wierum's attention to a possible help in the method, suggested by a series of experiments carried out at Butte, Montana, while I was in charge of the operations of the Montana Ore Purchasing Co.'s smelter. At that time the 'Eldred Process Co.' proposed to save us some 30% of the fuel used in the reverberatory smelting furnaces. We listened and disbelieved, but consented to make experiments at the expense of the Process company. This was done—and the results justified our disbelief, though the method is of interest, and of possible application to the smoke problem, I think.

Eldred's method was to regulate the combustion of the fuel by the introduction of spent gases, carrying little oxygen, taken from the furnace flues, and forced under the grate of the fire box by means of large fans. It was possible by this means to delay the combustion of the coal to a point where the greatest heat was at almost any desired position in the length of the furnace, or to produce a really reducing flame at will. The mechanics of the method are simple, providing only that the gases are not so hot as to melt the pipes and fans.

The results did not show a benefit for our furnaces, chiefly because ours was a question of forced operation, a question of how much not how little coal we could burn. The furnaces were the old short type, and we had never any trouble getting the flame of the fire to the chimney; but I believe that with furnaces 90 to 100 ft. long this method would show better results. Its application to the Hall process would seem simple; exhaust the gases from one of the upper roasting hearths and introduce them at such point below, as would seem best both to retard the combustion and exclude the outer air. An apparently simple combination of pipes and valves might be rigged, which would permit of the taking of the gases from any hearth and introduction into any other.

I ought, in justice to the Eldred method, to say, that it has been very successful in lime burning, and also in the long cement kilns where economy of fuel is important, and regulation of temperature a necessity.

JAMES W. NEILL.

Pasadena, California, November 30.

Dredging and Hydraulicking in Victoria

*At the end of 1913 there were 119 properties covering an area of 12,863 acres being worked in this state of Australia. Fifty-one bucket-dredges handled 14,946,933 cu. yd. of gravel, yielding an average of 6.4c. per yard, also a total of 7.25 tons of tin worth $4000. One boat recovered only 3.2c. per yard. There were 694 men employed. Each plant yielded 27.4 oz. per week, and the total cost of operation was 19.7 oz. gold. The greatest amount treated by one boat was about 14,000 cu. yd. per week. The output was a decrease compared with the previous year. Dividends totaled $173,000. Twenty-six pump-sluicing plants moved 1,191,817 cu. yd., yielding 14.4c. per yard, also 25 tons of tin, valued at $14,500. There were 325 men employed. Average weekly yield of gold per plant was 31.9 oz., and expenses 21 oz. One plant treated up to 9000 cu. yd. per week. The sum of $4900 was paid in dividends. Fifteen jet elevators treated 567,273 cu. yd. for 12.4c. per yard. They employed 80 men. Five gravitation sluicing plants recovered 12.7c. per yard from 90,562 cu. yd., and employed 31 men. A total of 16,706,023 cu. yd. was treated by all plants in 1913.

*Abstract from report of the engineer, D. B. Sellars, for the state government.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

SILVER worth $185,270 was produced from the Kongsberg mines of Norway in 1912-13.

CONSUMPTION of potassium and sodium cyanide combined, in the mills of South Dakota in 1913, was 502,688 lb. in treating 1,855,000 tons of crude ore and amalgamating mill tailing. This is equivalent to 0.37 lb. per ton of material milled.

AMBER is a light yellow, fossilized, vegetable resin, mostly mined from deposits near Danzig and Königsberg in East Prussia. The output in 1913 was 427 metric tons. Some amber is also found on the Baltic coast near Libau in Russia.

AMALGAMATION MILLS of South Dakota in 1913 used 12,150 lb. of quicksilver. There was 1,540,961 tons of ore treated by this process, yielding 224,648 oz. gold. One ounce was used in recovering each 1.55 oz. gold; one pound was consumed for each 127 tons of ore milled.

IRON ORE amounting to nearly 1,000,000 tons was mined from the Sydvaranger property, county of Finmarken, Norway, in 1913. Seventy per cent of the product went to Germany. There were 1300 employees, who received $536,000 in wages, or $412 per man per year.

OIL is recovered from whales in large quantities, and in 1913 Norwegian companies operating in all parts of the world had a total production of 595,000 bbl., worth, with by-products, $9,648,000. Prices for whale oil, according to quality, varied from $5.11 per 100 lb. for No. 0 to $4.13 for No. 4.

PRODUCTS valued at $40,200,000,000 per year are made by all industries in the United States under the following heads: factories, $27,000,000,000; farms, $9,750,000,000; forests, $1,250,000,000; and mines, $2,200,000,000. The proportions of the world's mineral output supplied by this country are as follows: pig iron, 43%; oil, 65%; copper, 55%; zinc, 34%; lead, 31%; and coal, 40 per cent.

CONTRABAND OF WAR is a subject not understood by many, and the list of articles affected is at present being continually added to. Some of the 'absolute' contraband are as follows, as declared by England: Aluminum, armor plate, copper (unwrought), chrome ore, and ferro-chrome, ferro-silicon, iron, iron ore (hematite), iron pyrite, lead in all forms, mineral oils and motor spirit (except lubricating oils), nickel and nickel ore, powder and explosives prepared for war, and sulphuric acid. 'Conditional' contraband includes fuel other than mineral oils, glycerin, gold coin or bullion, powder not prepared for war, silver coin or bullion, and sulphur.

ANOMALIES in trade are difficult to understand sometimes. On the island of Hawaii, of the Hawaiian group, a lumber company is cutting a small quantity of *ohia*, a dense hardwood, railroad ties from which are sent to the United States for the Santa Fe line, while California redwood ties are sent to the island for the Hilo line, over which the *ohia* ties are hauled for shipment to California. Both the white ant and carpenter bee damage lumber on the islands.

IN BOARD MEASURE a foot means one foot both in length and breadth, and one inch thick; consequently to obtain the number of feet board measure (b.m.), of a board, or a square timber, multiply the length in feet by the breadth in feet by the thickness in inches. To find the volume of round timber in cubic feet when all dimensions are in feet, multiply the length by one-quarter of the product of the mean girth and diameter, and the product will be the measurement required. To find the volume of square timber when all dimensions are in feet, multiply together the length, breadth, and depth, and the product will be the volume in cubic feet.

THE WELLAND CANAL is one of the most important waterways in Canada, being a channel between Lake Erie and Lake Ontario. It has 25 locks, each 270 ft. long, with 14 ft. of water on the sills. This canal has outlived its usefulness, and the new Welland ship canal is now being constructed, 2000 men being employed. It will be 25 miles long, 200 to 310 ft. wide, 30 ft. deep, and will have seven locks each 800 ft. long. The total lift will be 325.5 ft. Panama and Sault Ste. Marie Canals' lock gates miter, but these will be of the single-leaf type, being 3 ft. longer than the width of the canal, making it slant into the opposite wall. The waterway is to be finished in 1918, at a cost of $50,000,000.

THE EFFICIENCY of a steam power plant when operating in parallel with a hydro-electric system is discussed by Edwin A. Rogers in the *Pacific Service Magazine* for November. In a modern boiler plant heat losses are 21%, made up by 3% for loss of steam for atomizing, 15% stack losses, and 3% by radiation. Another 4% of heat is lost in pumps and auxiliary plant, and 1% in radiation and friction in a turbine. Of 74% of the original heat available at the turbine, 60% is rejected to the condenser, leaving only 14% efficiency from the engine in the form of electric energy. In other words, starting at the oil tank with $1 worth of heat, the switchboard yields only 14 cents worth of work.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

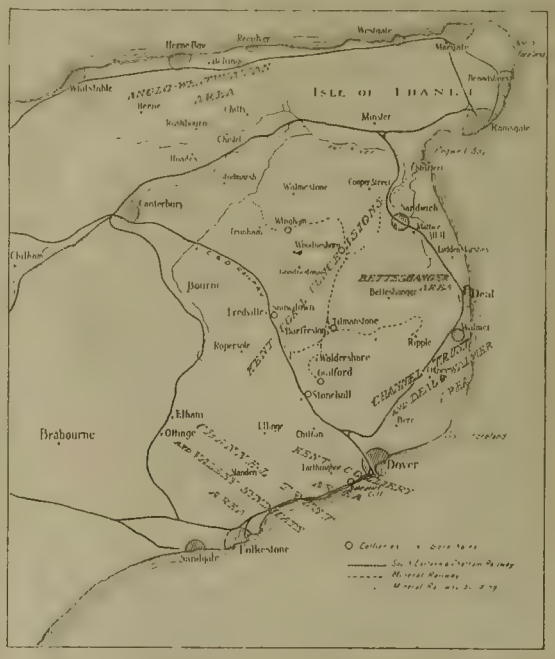
LONDON

GERMAN INTERESTS IN ENGLISH COALFIELDS, AND THE SUPPOSED PURPOSE OF THESE INTERESTS EXPLODED.

Matters connected with the war continue to absorb a large part of the attention of mining men, and I cannot do better than to continue to recount in these columns some of the antagonisms real or assumed between English and German patriotisms. Some notes on the so-called invasion of English coalfields by German capital should be of interest. In south Wales, in Yorkshire, and in Kent are to be found examples of Germany having acquired a foothold in the way of ownership of one of Britain's most cherished natural resources. English people have not generally objected to the sale of coal in the ordinary way of business to German mercantile firms for delivery to Germany, or to other parts of the world, though among the perfervid the propaganda has been popular for the absolute prohibition of coal exports in any shape or form. This refers of course to pre-war times. But it has been somewhat bitter to know that English coal lands should be sold to Germans. That such a thing should be possible hurt our proper pride. Consequently when J. C. A. Henderson, one of the lesser Rand magnates, connected with the East Rand Proprietary and Henderson's Transvaal Estates, acted as intermediary in 1905 in the sale of the Whitworth estate at Fforchdwm in Glamorganshire, south Wales, to Herr de Freitas, of Hamburg, there was a loud howl of execration throughout the country. Those in the know in south Wales, however, did not feel much concerned, as the colliery had not up to that time proved workable, owing to the tremendous inflow of water from the overlying strata; and in any case there were serious doubts as to the alleged existence below the workings of the seam of high-class smokeless coal that is the source of so much wealth to coal estates several miles east. Sinking to the expected horizon of this seam was undertaken by the de Frietas company, but the water difficulty was never overcome, and two years ago the two shafts were abandoned at 1450 and 1100 ft. respectively. The unfortunate part was that English investors were induced to subscribe some of the capital. Massive concrete foundations had been prepared for the power house, and during the past month or two these have provided the inevitable scare, a sensitive public being easily induced to believe that they were to be used as emplacements for guns. Seeing that the pit is 10 miles from Swansea, and 5 from Neath and Port Talbot, inhabitants of these towns began to fear. The pit is also near the main line of the Great Western railway from London through south Wales to Fishguard, and is within striking distance of the collieries in the Rhondda valley. The only weak point about this scare was the fact that no guns were erected by the alien enemy or were likely to be.

The next wave of indignation occurred three years ago, when German money and German sinking and boring methods were used in north Kent between Canterbury and Margate. The company formed to work the estate was called the Anglo-Westphalian Kent Coalfield, Limited, and the mineral rights were obtained from the owners, the ecclesiastical commissioners, that is to say, the government department handling the property and revenues of the Church of England. Among the shareholders are the Allgemeine Tiefbohr und Schachtbau Aktiengesellschaft and the Kolonial Handelsbank, while on the list of directors are such names as Peritz and Seitz. Germany is by no means in control, however, for some of the big colliery owners in south Wales have important interests. Nevertheless the boring at Chislet was held by the military authorities to be on a site suitable for a gun that would command the entrance of Thames and Medway rivers, and within striking distance of warships passing to and from Sheerness and Chatham. So the site has undergone inspection, and will no doubt not be forgotten by the military authorities.

At the other end of the Kent coalfield is the old original sinking on the shore under Shakespeare cliff, two miles west of Dover. Here the Channel tunnel workings were commenced in 1880 by the South Eastern railway. After the suppression of the tunnel scheme by Parliament, the railway company adopted W. Boyd Dawkins' suggestion to use the sinking for the purpose of testing Godwin-Austen's theory of the existence of a coal-basin under the Mesozoic rocks of Kent. In 1891 borings below the shaft proved the theory to be correct. But as a commercial project the venture has been a failure, and many have been the vicissitudes of the company having the matter in hand. It happens that at the last reconstruction, a London financial house of semi-German constitution, L. Ehrlich & Co., undertook to provide funds. This firm did much good work in early days in financing the Spassky copper mine in Siberia, and is well known in South Africa. Three of the partners are of German or Austrian birth, though naturalized here for business purposes. The fourth partner and the consulting engineer are, on the other hand, strongly British. At the outbreak of war the connection of this firm with the Shakespeare colliery induced 'scaremongers' to write to *The Times* alleging that the foreigners in control had schemes on hand for undermining the Dover fortresses. Not only was this to be done from the colliery itself, but, ac-



MAP OF THE KENT COAL AREAS, SOUTHEAST ENGLAND.

cording to these 'know-alls,' two bores had been sunk, one two miles northeast of Dover castle, and another two miles to the northwest. No doubt this would be a glorious scheme for the destruction of the magnificent defences of Dover. But it is only German spies or lunatics that would suppose the English military authorities at Dover not to be cognizant of what is going on in their immediate vicinity. The scaremongers' insinuations are, of course, absurd.

The German invasion of the South Yorkshire coalfield is a much more serious affair than those quoted above. A year ago Hugo Stinnes, one of the large German coal merchants, intimately connected with the government of his country, and also with its coal enterprises in Turkey, bought the Harworth estate on the borders of Yorkshire and Nottinghamshire, a few miles east of Sheffield. Mr. Stinnes has worked through a limited company registered in England as a coal buyer, and has offices in practically all the coal ports, so that he has figured largely in the export coal trade. The mineral rights in the Harworth estate were sold to him through Arnold Lupton, who was formerly professor of mining in the University of Leeds, and more recently an eccentric member of Parliament. The purchase was completed about a year ago and sinking was commenced in March last. A colony of German workmen was introduced to conduct the sinking. When war was commenced, most of them were interned and operations were suspended. The pits had not reached the seam, which was expected at 2400 ft. The estate is an extensive one, and the coal resources are estimated at 750,000,000 tons. The scale of operations was designed to handle 1,500,000 tons per year. English coal owners are prepared to purchase the property, but terms of payment cannot be considered until after the war. It will be seen from the above records that the Harworth venture was the only purely German enterprise connected with English colliery development, and that no coal has yet been won from collieries partly or wholly under German influence.

In *The Mining Magazine* for November the Kent coalfield is described by E. B. Lichtenberg, from which article this map is reproduced.

NEW YORK

Butte-Duluth Acquired by Hayden, Stone & Co.—Jumbo Extension Rise.—Anyox Smelter.—Copper and Zinc.—Alaska Ebner Mine.

The taking over of the Butte-Duluth copper mine by the Hayden-Stone syndicate is the most interesting of recent events and this addition to its holdings in the Butte district considerably increases the importance of this group in that district. The Butte-Duluth and the Bullwhacker have been doing a great deal of experimental work in the endeavor to develop their leaching processes to a point where there is a good working profit, but neither of them has so far attained any great degree of success. Following the announcement made some months ago that the Utah Copper was to use a leaching process to treat its oxidized ores, the acquiring of this property, in which the ores are chrysocolla in a silicious gangue, is of a great deal of interest. The price reported to have been paid for the property is $4,500,000; which seems large on the basis of what has so far been done on it, though earlier this year Walter H. Weed reported on the property and seemed quite hopeful of its future.

Jumbo Extension of Goldfield shares, which on December 1 were up around $4 each, sold the next day down to $2.37. The decline is doubtless due to the growing belief that there is little possibility that the mine will eventually produce enough ore to justify the price of about $6,000,000 which the higher quotation placed on it. High-grade ore is always likely to cause excitement in mine shares, but the profit is usually made out of large quantities of lower-grade material. It is sincerely to be hoped that the Jumbo Extension will make good and justify the advance in share quotations which it has made, and has caused the other minor Goldfield issues to advance in sympathy with it. Such an advance would tend to cause a good feeling in the Curb market; but, on the other hand, if it has the same dénouement that the North Star had a short while ago, the effect in a market which is only just beginning to get back to normal in recovering from the effects of the war will be bad indeed.

Reports from the Anyox property of the Granby company state that two furnaces are in operation and that during October 1,794,308 lb. of copper was produced, at a cost of 8c. per pound. The smelter is now making a satisfactory showing, and it is probably not generally known that this is due to George A. Guess, who is professor of metallurgy at the University of Toronto. The ore at the Anyox is so high in sulphur that it was expected that the ore could be smelted without other fuel than the sulphur. When the furnaces were blown in, however, they failed to work satisfactorily, and Mr. Guess was called upon to diagnose the trouble and point out the remedy. He found that the design and operation of the furnaces were such that it was hard to get enough air through them for the proper conduct of operations, and by changing the character of the charge and the design of the furnace slightly, he was able to remedy this difficulty, with the good results that are shown. The incident is worth repeating, since the general public belief is that college professors are more likely to get plants into trouble than to be able to remedy the mistakes of operating men.

There was not much change in the copper situation last week, except a stiffening of the price and a probable further decrease of accumulated stocks, which can only be estimated, since the Producers' Association has not given out its figures for the past three months and has no immediate intention of doing so. Several Italian steamship lines, notably the Navigazione Generale Italiana, Italia Societa di Navigazione, and La Veloce Navigazione Italiana, have announced that they will accept shipments of copper, but it is still impossible to secure insurance unless the shipper waives his claim to loss through detention by England. At the steamship *Ran*, bound for Sweden with a small amount of copper on board, has been taken into Liverpool, and the *Sigrun*, bound for Malmoe, was taken into Newport, a few days earlier, it seems rather probable that shipments will be detained, as Sweden is one of the countries which has given guarantees against re-export with which Great Britain has expressed itself as satisfied. Shipments from New York during the first week of November are reported as follows: Havre, 3,138,406 lb.; Gothenberg, 2,800,172; Liverpool, 2,611,605; Genoa, 672,318; Christiania, 448,472; Lisbon, 336,135; and Glasgow, 60,730 lb. Copper exports in October, according to figures just given out by the Custom House, amounted to 55,980,643 lb. of pigs, ingots, and bars, 2,683,994 lb. rods and wire, 174,681 lb. plates and sheets, and 4577 lb. of other forms. Italy ranked first in the list of countries to which the metal was exported, with total takings of 21,270,187 lb. England took 17,940,371 lb., and France 5,351,864 lb. The total value of all forms of the metal exported was $7,213,700.

The high record in the exports of zinc made in the last three months is reflected in the strong price of spelter. The exports in September alone, 38,090,144 lb., exceeded the total of any previous year. Most of this, or 28,000,000 lb., was sent to England, 3,000,000 lb. each to Scotland and France, and 333,000 lb. each to Denmark and Italy, while 1,250,000 lb. went to British Africa and 250,000 lb. to Australia. Exportation of 65,504,574 lb. of zinc for the three months ended with October represents about 10% of the annual domestic product. During the first week of November 672,885 lb. was shipped to Archangel, 224,071 to Genoa, 1,120,126 to Havre, 1,030,568 to Liverpool, and 224,069 lb. to Sydney.

The Consolidated California-Nevada Co. is to be organized in Delaware with $5,000,000 capital, in $5 shares, to hold the assets of the Alaska-Ebner Gold Mines Co., which was sold at a foreclosure sale recently for $225,000. The assets do not include the 100,000 shares of Ebner Gold Mines Co. which has been optioned to the United States Smelting, Refining & Mining Co. A. W. Middleton has proposed to the shareholders of the defunct Alaska-Ebner Gold Mines Co. that they pay a 10c. assessment and receive one share in the new Company for each share of the old. Most of the properties, outside the Ebner mine, which is not included in the assets of the new Company, do not appear to be of much promise.

AUSTIN, TEXAS

DEPOSITS OF MINERALS IN THE STATE READY FOR DEVELOPMENT AND EXTRACTION.

Commercial deposits of many minerals which are obtained from Europe are known to exist in this state, and William B. Phillips, director of the bureau of economic geology and technology at the University of Texas at Austin, has received numbers of inquiries regarding certain mineral products which the bureau has been importing. He states that in view of the war, and that these deposits occur, and there is a demand for these products, the time is opportune to develop such resources of the state.

Two large deposits of celestite (strontium sulphate) are found near Austin, while there is one in Lampasas county and another near Strickling, Burnet county.

An asphaltic limestone area near Burnet has been purchased by New York people, who intend extracting ichthyol from it, a product obtained exclusively from Austria. This mineral

SULPHUR IN CULBERSON COUNTY, TEXAS.

deposit is also valuable as road-making material and may be mined by steam-shovel methods.——At Pilot Knob, near Austin, is a large deposit of basalt, excellent for paving and road construction.——The alleged large deposit of nitrate of potash in Brewster county does not exist, there being only small quantities of it.——Not much encouragement is offered for the development of radium-bearing ores of the state.——There are some deposits of asbestos and graphite in Llano and Burnet counties, but are not exploited.

In Culberson county, in the western part of the state, 15 miles from a railway, there is a fine deposit of sulphur, estimated to contain 300,000 tons within 30 ft. of the surface. One test-pit was still in sulphur at 41 ft. A small refining plant was operated for a short time several years ago. The sulphur could be extracted at less cost than that underground at Freeport, Texas.——Iron ore exists in Mason county, in close railroad communication with the Thurber coalfields.

The University of Texas has a splendid collection of specimens of all the state's minerals, but which is not in a place easily found by inhabitants of or visitors to Austin.

WASHINGTON, D. C.

MINING BUSINESS PROMINENT IN CONGRESS. CODIFYING MINING LAWS. SAFETY IN MINING, AND CONSERVATION.

To what extent there will be mining legislation in the short session of Congress, will depend on the excitement that may occur during the session. If there is to be lots of it, there is little chance for legislation worth while, as there will be so little time. If the session is to be humdrum, much of it may go through. The chief measure before Congress of interest to mining men, apart from the leasing bill, is the bill to create a commission to codify the mining laws of the country. It has already passed the Senate, and awaits action in the House, where a bill to create a commission is on the calendar, but different from the Senate bill. It is believed that this bill will have no mean chance of passage. It has heretofore been chiefly fought by the leaders, because it carried an appropriation of $25,000 to defray the expenses of the commission; but it is not thought the paltry sum will stand in the way in the short session, when the statesmen are not likely to be bothered by thoughts of economy; there is no immediate election at hand. What is of graver moment is the fear and opposition in mining circles that the commission would in its codification change the mining laws appertaining to apex mining, which many desire not disturbed. It develops that there is a considerable sentiment, certainly in Congress, for a change in the law of extralateral rights. M. D. Foster, of Illinois, the chairman of the House Committee on Mines and Mining, permits himself to be quoted as saying that the apex mining laws ought to be changed. That the codification commission is expected to do, in his opinion. Of course, whether or not the commission does so will have the force only of a recommendation to Congress, as the codification would have to be ratified by both houses of Congress.

Mr. Foster is also anxious to have action by Congress on his bill for additional safety in mining practice in rescue stations, but apparently this bill will have to take its chances on the state of the calendar of the House on Wednesdays. There will be but few Wednesdays in the session, and the mines and mining committee is fairly down on the list in the call of committees. The prospects are not good. In the House there is a special rule for the calling up and consideration of the radium bill, a conservation measure, but should this even pass in the House, its prospects in the Senate look poor. The Senate has so far presented insurmountable obstacles to the Walsh bill to the foregoing effect.

The Senate presents an interesting situation on the bills there in other respects that interest mining men. There is the leasing provision in the bill sent to the Senate after having passed the House, for the encouragement of the exploration of coal mining lands on the public domain, etc. The Administration is very fond of this bill and all the conservation proposals. It has set its heart on them, and caused them to be passed by the House. There is energetic opposition to them in the Senate by powerful Senators, and especially those in the West who are not keen on conservation principles, and they seem in control of the situation. It would seem that no legislation would eventuate on the bills except through compromise. Both sides are obstinate, but the Administration is a great force, and the Interior Department, through Secretary Lane, is most enthusiastic to see the bills through. By threatening an extra session to consider the conservation bills should Congress in the short session fail to pass them, the President could hold quite a club over Congress, so to speak, as it does not, by a good deal, want to be called into extra session.

JOPLIN, MISSOURI

Activities of the Picher Lead, Commerce, and Cornfield Companies at Miami, Oklahoma.—Hopaloosa Prospecting Co. at Joplin.—Mining on an Island.

The Picher Lead Co., operating a sublimed white lead plant at Joplin, has gone into the mining and leasing business on an extensive scale, having acquired more than 1000 acres of land, mostly Indian property, lying on the high prairies north of Miami, Oklahoma. Over 100 drill-holes have been sunk, many of them showing ore. Lessees are starting on tracts of the Picher land, several shafts have been started, and one or two mills are in prospect. This work represents development in an entirely virgin field, which for more than a year past has been prospected extensively. The average depth of the ore is from 250 to 300 ft., and no water is encountered in the shafts that have thus far been sunk until 200-ft. depth is reached. Below this level it becomes necessary to use pumps. The William M. Sheridan Co. (Inc.), of Chicago, has one 40-acre sublease of the Picher land, on which a number of drill-holes show the deep run of ore. A substantial derrick has been erected and a large shaft, 7 by 9 ft. in the clear, has been started, and is now down 40 ft. The Picher company has blocked out an extensive formation of sheet ore at a depth of more than 200 ft., far to the northeast of any present mining development. The Company will probably mine this tract on its own responsibility.

South of the Picher holdings, which reach north into Kansas, the Commerce Mining & Royalty Co., operator of some of the largest mines in the Miami district, has been instrumental in bringing in some good drill-holes in virgin territory. A recent drill-hole went into ore at a depth of 250 ft., continuing down to 275 ft. Little lead ore was met with, the 'dirt' being rich in zinc-blende. Clippings for a distance of 5 ft. showed 43% blende; the average for the entire 20 ft. being better than 15%. The heaviest producer in the Miami district at the present time is the King Jack mine, which until recently was not looked upon as an especially rich property. The Commerce company took over this property after a previous company had given it up. Prospect driving revealed good ore in the upper ground, and new drifts have been driven at a depth of 120 ft. The record day's run consisted of a production of 30,000 lb. blende, 12,000 lb. galena, and 1200 lb. sludge. This production came from 225 cans of ore, the recovery for the day being 14½%. The same Company is sinking a new shaft to a depth of 205 ft. on the Tango lease in the west part of Miami, where previous operations had been in the upper ground.

In the extreme northeast part of the developed portion of the Miami field, the Cornfield Mining Co. has completed the framework of a 250-ton mill, the cost of which, when finished, will be $18,000. This is one of the few entirely new mills of the district. It has a capacity of 250 tons per day, and is equipped with modern devices for complete concentration. ——Some distance to the northwest of this property the Blue Goose Mining Co. is sinking two shafts to a depth of 260 ft. One of the shafts is into ore at 150 feet.

The Hopaloosa Prospecting Co. has been organized with the view of obtaining leases on various tracts of land, prospecting them with drill and either subletting them or operating them on its own responsibility. In the Company are George Gist, Bert McCullough, Bert Pearson, and Ben F. Wurzel, all of Joplin. Leases have been acquired on 20 acres of the Rose land, 10 acres of the Nelson land, 40 acres of the Kincheloe land, and 15 acres of the Wier land, all situated a short distance south of the city limits of Joplin. A prospect drill has been started. On the Boruff land, in this same district, some good shallow lead ore is now being mined.

A shaft has been sunk on an island in the centre of Spring river near the Kansas-Missouri state line, some distance northwest of Joplin, by the Chicago Mining Co., and although the scene of these mining activities is surrounded on all sides by water, there is barely enough water in the drifts to supply the mill, which is situated on the mainland on the Kansas side of the river. An aerial tramway carries the ore from the island shaft to the mill. A. M. Gaines is manager of this property, which was formerly operated by the Lynas Mining Co., previous mining having been done on the mainland. Steady turn-ins of ore are being made from a working depth of 100 feet.

Operators are encouraged by the reported decrease in spelter supplies in this country, the heavy exports to Europe having cut down the surplus tonnage of zinc and having created a better demand for ore, the price of which now ranges from $43 to $46, basis of 60% metallic zinc, a material increase over the offerings of a few weeks ago. At the recent rate of exportation, the entire zinc production of the Missouri-Kansas-Oklahoma district would barely supply enough metal to meet the foreign demand. This condition, coupled with the fact that importations of ore, which usually are heavy, have been reduced to a minimum, would seem to mean that a much stronger zinc market may be anticipated in the near future.

HOUGHTON, MICHIGAN

Taxes.—Osceola, Centennial, Copper Range, Calumet & Hecla, and Mineral Range Companies.—Copper Shipments.

A review of the Houghton County assessments was held in Houghton, December 3, by State Tax Commissioners Kearney and Horton. The equalization review resulted in the reduction of $100,000 from Franklin township. During the hearing the fact was brought out that, through an error of the equalization committee, the Franklin Mining Co. had been assessed too high. When assessments were made earlier in the year, the Company was not operating, but it was assessed as a producing but non-dividend-paying mine, and thus valued $125,000 higher than it should have been. This error, however, could not be rectified in an equalization review.

The Osceola and Centennial mines are now working full time instead of at 75% capacity. Practically all work will be done on contract, and the men have willingly accepted a reduction in wages. Even with the reduction, the present monthly wages will mean more money to the miners than the higher pay at reduced time. This plan will also mean an increased 'rock' tonnage for the companies, and will make it possible to keep the mines operating without a loss.

The Copper Range Consolidated contemplates no change this year. The mines of this Company are now operating 15 days per month.

With the close of navigation on the Great Lakes, the copper country docks are cleared of all copper on hand. The last shipments of the season were made December 1, when two large cargoes left for Buffalo. All available metal was shipped, and the clean-up during the last month has been most unusual. The vessels carried copper that was smelted even on the day of sailing. It is reported that approximately 45,000 tons of copper was shipped by boat during the past season.

The Calumet & Hecla company reports that it is operating at 75% capacity. Wages are 10% and salaries 15% lower than prior to August 1.——Revenue of the Mineral Range Railroad in October was $70,082, with $10,379 net; since July 1 the total was $281,018, an increase of $156,685, with $32,537 net. The railroad is handling a large tonnage of rock from the mines to the mills, there being only about 19 or 20 working days at the mines each month. In November, in 19 days, the line moved 7384 cars containing about 295,360 tons. In normal times the movement is over 10,000 cars per month.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press

ARIZONA

Gila County

A contract for 112 double-deck tables has been let to the Deister Machine Co. by the Inspiration Consolidated Copper Co. for its new mill at Miami.

Mohave County

It is proposed to form a Chamber of Commerce and Mines at Kingman, and a committee of investigation was appointed at a preliminary meeting of those interested——The Tom Reed mine produced gold worth $116,000 in October, but in November the yield was about $100,000, the normal output.

The Pittsburg mine has been opened to 187 ft. and the workings show about $20 ore throughout.——The Golden Eagle and Silver Bell claims are in the Cedar district and are opening satisfactorily.——Molybdenite-copper ore of the Copper Cañon mine show a good recovery by the Minerals Separation process as tried in San Francisco.

CALIFORNIA

The California State Mining Bureau, San Francisco, has just issued *Bulletin* No. 68, 'Mineral Production for 1913.' While somewhat belated, it is of value, and contains some interesting new features. The publication covers 138 pages, with an index, and has 20 county maps showing the latest information. Many inquiries having been made regarding mining laws, 30 pages are given to the federal and state statutes governing mining, the California mine bell signals, and forms of location notices. The mineral output of the state last year was valued at $98,644,639, compared with $88,972,385 in 1912. These figures, as far as possible, refer to the value at the property of crude mineral substances. In the total value of mineral products, California leads all states west of the Mississippi river. Every county of the state contains some deposit, and in 1913 56 of the 58 counties reported a commercial output, from Kern with $28,486,193 to Alpine with $541. Dividends amounting to $20,000,000 were paid from the past year's output. The following table shows the yield of mineral substances as compiled from the returns received at the Mining Bureau in answer to inquiries sent to producers:

Substance.	Amount.	Value.
Asbestos, tons	47	$ 1,175
Barytes, tons	1,600	3,689
Bituminous rock, tons	37,541	78,479
Borax, tons	58,051	1,491,530
Brick	358,754,000	2,915,350
Cement, barrels	6,167,806	7,743,024
Chromite, tons	1,180	12,700
Clay, tons	231,179	261,273
Coal, tons	25,198	85,809
Copper, pounds	34,471,118	5,343,023
Feldspar, tons	2,129	7,850
Fuller's earth, tons	460	3,700
Gems	.....	13,740
Gold	.....	20,406,958
Graphite, pounds	2,500	25
Gypsum, tons	47,100	135,050
Infusorial earth, tons	8,645	35,968
Iron ore, tons	2,343	4,485
Lead, pounds	3,640,951	160,202
Lime, barrels	613,444	528,547
Limestone, tons	301,918	$ 274,455
Magnesite, tons	9,632	77,056
Marble, cubic feet	41,654	113,282
Mineral paint, tons	303	1,780
Mineral water, gallons	2,350,792	599,748
Natural gas, cubic feet	14,210,836,000	1,053,292
Petroleum, barrels	94,494,532	48,578,014
Platinum, ounces	368	17,738
Pumice	.....	4,500
Pyrite, tons	79,000	218,537
Quartz rock, tons	4,040	7,756
Quicksilver, flasks	15,661	630,042
Salt, tons	204,407	462,681
Sand, glass, tons	14,578	14,143
Sandstone, cubic feet	62,227	27,870
Silver	.....	832,553
Soapstone, tons	1,350	6,150
Soda, tons	1,861	24,936
*Stone industry	.....	6,168,020
Tungsten ore, tons	7,592	234,673
Zinc, pounds	1,157,947	64,845
Total		$98,644,639

*Including granite, macadam, rubble, paving blocks, sand and gravel.

Of the increase of $9,672,254, oil accounted for $6,649,670; cement, $1,668,363; gold, $693,480; and the stone industry, $694,092. There were a number of fair decreases in various products.

MAP OF CALIFORNIA, SHOWING GOLD DREDGES.

The mine safety work of the California Industrial Accident Commission was started in January of the present year, under a co-operative agreement with the U. S. Bureau of Mines. Under this one of the engineers of the Bureau was assigned to California, half of his expenses being paid by the Commission and half by the Bureau, it being understood that all of his time should be spent in the state.

During the period January 1 to October 31, 1914, 77 mines were visited, and 503 safety suggestions were made. These suggestions affected the safety of approximately 5392 employees (3661 underground and 1731 surface). This first series of inspections was made as rapidly as possible in order that the Commission might have available, at the earliest possible date, first hand information about mining conditions in California. Almost without exception the mine managements expressed their intention of complying with all suggestions that were made, and in most instances expressed their appreciation of the help which was given and their desire to co-operate in every possible way in the 'Safety First' movement.

At the request of the Commission, the Bureau detailed one of its first-aid miners for work in California, with the understanding that this man's salary should be paid by the Bureau and his traveling expenses by the Commission. He started work in June, and up to October 31 had visited 26 mines, and had given 10 hours' first-aid training to each of 256 miners. First-aid clubs have been organized to continue the work at practically all the mines which have been visited. On Labor Day, as has been mentioned in the *Press*, a first-aid contest was held at the miners' picnic grounds between Sutter Creek and Jackson. Three teams entered for the contest and quite a large number of spectators witnessed it. Cash prizes were offered by the Miners' Union and the various mine operators. This meet aroused a great deal of interest in the first-aid work.

Arrangements were made for mine-rescue car No. 5 to visit some of the California mining districts and give training in rescue work, and first-aid-to-the-injured practices. The car visited 10 mines, where it trained 78 men in first-aid and 26 in mine-rescue work. It also visited Stanford and California universities, where it trained 46 mining students in first-aid and 37 in rescue work. To show its hearty co-operation in the safety-first movement, the Southern Pacific Railway Co. furnished free transportation for this car in California.

Amador County

A reinforced-concrete dam, 440 ft. long and 60 ft. high at the centre, has been built across a ravine to impound tailing for the Kennedy company, near Jackson. This was to complete an agreement with farmers along Jackson and Dry creeks, who alleged that their land was being covered by mill residue.——At Plymouth, the Plymouth Consolidated is building a hospital for miners, and it is said that there will be a resident physician.

Eldorado County

A 5-stamp mill is now crushing ore at the Pacific mine, near Placerville. This property is under lease to P. D. Burtt and J. H. Santo, and has not been operated for 8 years.——The Invincible Mines Corporation's properties in the Horseshoe Bar and Volcanoville districts of this and Placer county have been deeded to John A. Britton and others of San Francisco.

Inyo County

The Cerro Gordo mine is described with illustrations in *The Inyo Register*, published at Bishop. During the current year, to October 1, 2779 tons of silver-lead ore has yielded $223,125. Mining is being done to 700 ft., and the ore averages about 80 oz. silver, 20% lead, 4% copper, and $1.60 to $1.80 gold. It also contains 45% silica and 2% zinc, apart from the real zincy ores. The product goes to Midvale, Utah. There are 56 men employed, L. D. Gordon being in charge, with J. C. Climo as superintendent.

Los Angeles County

The Chamber of Mines and Oil of Los Angeles has issued the first number of its *Oil and Mining Bulletin*, under the editorship of J. Nelson Nevius. The *Bulletin* will be published monthly at 15c. per copy or $1.50 per year. The Chamber has been in existence for eight years, and has endeavored to foster the mining industry. This issue contains discussions on proposed oil and gas legislation, the Plymouth mine, Federal Reserve banking system, California Metal Producers' Association, the Southern California section of the American Chemical Society, growth of the oil industry of California, mining industry in relation to state accident insurance, oil engines operating on the Deisel principle, and silt problem of the Colorado river. There is also a map of the southwest included.

Nevada County

Gold-bearing quartz has been cut at 300 and 710 ft. in the Union Hill mine, and is an important development. A. D. Cox is in charge of the property, which is fully equipped with a 20-stamp mill. It is owned by San Francisco and Los Angeles people.

Shasta County

San Francisco people are thoroughly reopening the old Niagara mine.——A diamond drill is exploring the Franklin claim of the Milkmaid Mining Co. The shaft is to be sunk deeper. H. F. Musser is manager.——Work will probably be resumed at the Afterthought copper mine near Ingot.——The Mammoth company's smelter produced 1,100,000 lb. of copper in November.

On Wednesday last, December 2, Judge W. C. Van Fleet, accompanied by his staff, officials of the farmers' association, Mammoth Copper Co., and others interested, inspected the smelter and bag-house of the Company at Kennett. Demonstrations on a working scale were given, showing the effect of the bag-house on fume from the furnaces.

Solano County

In the suit of residents of Benicia and adjacent agricultural land *v.* the Selby Lead & Smelting Co., regarding alleged damage done by fume from the latter's smelter on San Francisco bay, the commission of investigation, consisting of J. A. Holmes, Edward C. Franklin, and Ralph R. Gould, reports that the Company has changed its mode of operation since the suit started in 1905, and can operate within the terms of the 1906 injunction. By installing the Cottrell process, a bag-house, new roasting system, and sending certain ores to other smelters, the difficulties have been met.

Tuolumne County

(Special Correspondence.)—It is reported that a rich discovery has been made in the Mohican mine, situated a few miles southeast of Tuolumne. During recent years work has been conducted on a small scale under the direction of R. E. McHale, superintendent.——The Tuolumne Deep Channel Mining Co. has suspended operations at its property near Confidence until next spring. Prospecting has been done with a Keystone drill, and it is said results so far have been most encouraging.——The Peoria Flat gravel mine, recently bonded by William Pereira to R. A. Lewis and others, is to be the scene of extensive mining operations. A number of buildings have been erected for the accommodation of the men employed and for other purposes, and a traction steam-shovel of great capacity, a Quenner gravel mill, and other machinery have been taken to the property. The gravel deposits are large, and good prospects have been obtained in the tests made.

Sonora, November 28.

Active work is under way at the Republican property of five claims. Over 4500 ft. of development has been done to 700 ft. depth, and the gold output is over $300,000. The Mammoth claim is sending good ore to the mill.

The injunction suit against the Mammoth company was

resumed at San Francisco on December 8. A large number of farmers, fruit growers, and stockmen from the county are present at the hearing.

COLORADO

Fremont County

After 17 days of examination, during which time 440 veniremen were questioned, a jury was secured at Canon City on December 4 for the trial of the seven members of the United Mine Workers of America who are charged with the killing of William King, a non-union miner, in connection with the attack on the Chandler mine last April. The taking of testimony began on December 7.

Ouray County

It is estimated that this county will produce a total of $1,980,000 from its gold, silver, lead, copper, and spelter this year, an increase of about $510,000 over that of 1913. The tonnage was 97,336 in 1913, and estimated at 135,000 in 1914.

The Camp Bird company reports as follows for the third quarter of 1914: Development totaled 795 ft. Work on the hanging-wall orebody shows an average length of 130 ft. On No. 6 level east No. 2 the shoot is 165 ft. long, 3 ft. wide, assaying $30 per ton. On No. 8 level, the east heading was advanced 194 ft. in vein formation, of which 150 ft., as shown by cross-cuts, is from 20 to 30 ft. wide. In the last 44 ft. it has narrowed considerably. The formation is quartz, worth nothing except where associated with hematite, which assays from $20 to $100 gold per ton. This mineral occurs in wavy streaks of great irregularity, and in bunches 10 to 30 in. wide, it being better on the floor of the level. The ore is very hard, and that mined varies from the sample plan. The stamp-mill crushed 7843 tons of ore, yielding $235,023 from bullion and sale of concentrate. The net profit was $125,000, and $72,000 from the Santa Gertrudis company of Mexico.

Shipments from Ouray during November were as follows: crude ore, Wedge, 195; Wewissa, 10; and Bachelor-Khedive lease, 27 tons; concentrate, Camp Bird, 495; Wanakah, 328; Atlas, 214; and Cumberland, 33 tons; and matte, Wanakah, 196 tons.

Fire at the Revenue mine destroyed buildings and stores worth $5000 last week.

Teller County (Cripple Creek)

The gold output of the district in November is estimated as follows:

Plant.	Tonnage.	Av. val.	Gross val.
Golden Cycle	29,000	$20.00	$ 580,000
Portland (Colorado City)	9,820	20.00	196,400
Portland (Cripple Creek)	16,550	2.85	47,167
Smelters	4,300	55.00	236,500
Colburn-Ajax	4,900	7.50	36,750
Stratton's Independence	9,142	2.16	17,587
Neville-Free Coinage	800	5.00	4,000
Gaylord-Dante	1,500	2.50	3,750
Wild Horse	1,000	3.00	3,000
Kavanaugh-Jo Dandy	1,400	2.00	2,800
Isabella	950	2.00	1,900
Total	79,362		$1,129,854

This yield was about $20,000 above that of October, in spite of a shorter month and one holiday, also the El Paso fire.——Dividends were as follows: Golden Cycle, $300,000; Elkton Consolidated, $50,000; and Gold King, $10,000. On December 19 the Vindicator mill distributed $90,000, this being an 'extra' of 6c. per share. The Golden Cycle company's distribution this year totals $1,005,000.

A 100-ton mill and cyanide plant is to be built by the Gold Bond Leasing & Development Co. on Gold hill. The plant will cost about $60,000. S. L. Herber is superintendent. Besides a large tonnage of $4.50 to $6.40 ore in the mine, dumps contain about 75,000 tons averaging $3 to $5 per ton.

IDAHO

Shoshone County (Coeur d'Alene)

Dividend No. 207, equal to $81,750, was paid by the Bunker Hill & Sullivan company on December 1. The total to date is $15,710,250. A rise from No. 4 adit of the Tuscumbia mine, in Sunset peak near Wallace, has opened a large orebody.

The Morning mine of the Federal Mining Co. has been closed, putting 125 men out of work. This is due to low-grade ore and the low price of lead. This mine and its mill were a great support to the town of Mullan.——After being closed for six months, the Federal company's Frisco mine, at Frisco, was reopened last week. The mill has been altered to suit the refractory ore, including a process of drying and slightly roasting, with magnetic separators.——Three feet of high-grade mill ore has been cut in the Nabob on Pine creek.——Net profit of the Stewart, near Kellogg, is said to have been $100,000 in November.

MISSOURI

Jasper County

The Southwest Missouri Mine Safety and Sanitary Association has been formed at Joplin. Thirty operators attended the organization meeting on November 28; also Edward Higgins of the U. S. Bureau of Mines, and A. J. Lanza of the U. S. Department of Public Health. Fourteen important mining companies have become members of the society. H. I. Young, of Webb City, is president; W. A. Rhea, of Carthage, secretary; and T. J. Munson, of Webb City, treasurer. The object of the Association is to lessen the tuberculosis among miners of the zinc-lead mines. Mr. Higgins said that four important things should be investigated: a water supply for every working face in the mines, no squibbing or boulder blasting while the men are underground, a thorough wetting of the faces every morning, and the improving of ventilation.

The McDonald Mining Co., operating a lease of the Connor land, has bought the Portland 300-ton mill, northeast of Carterville, from the Landreth Machinery Co. It will be reconstructed in about two months. Sheet-ore formation in the area worked by the McDonald company occurs at 195 to 208 ft. depth, and the weekly output is 60 tons blende and 20 tons of lead.

MONTANA

A new map of this state, in two sheets, each 40 by 46 in., has been issued by the U. S. Geological Survey, price 45 cents. It contains the latest information connected with mining, railways, rivers, etc.

The Anaconda Copper Mining Co., on November 30, paid taxes amounting to $675,739 in 18 counties of the state, of which nearly half was in Silverbow county. This was $76,794 less than in the previous year.

Silverbow County

Taxes paid by the Butte & Superior Copper Co. on November 30 totaled $28,300; and the North Butte Mining Co. about $11,000.——The estate of F. August Heinze is indebted to the defunct State Savings Bank at Butte for $221,292, according to the first report of the receiver, F. D. Williams.

The suit of the Clark-Montana Realty and Elm Orlu Mining companies against the Butte & Superior Copper Co., involving apex rights to the Rainbow vein of the Black Rock claim, has been set for hearing June 15, 1915, by federal Judge George M. Borquin.

NEVADA

Esmeralda County

The estimated output of the Goldfield Consolidated in November is $327,000 from 28,396 tons of ore, yielding a profit of $143,000.——The net realization from the Jumbo Extension last month was about $100,000, $24,000 over that of October.

Five to six feet of $15S to $1S3 ore is being broken from drifts off the vertical rise. These developments in the Velvet claim of the Company are attracting considerable attention.——Six feet of $12.20 ore has been cut at 590 ft. in the Booth mine. ——At 250 ft. in the Florence, 15 ft. of quartz has been opened worth $4 to $25 per ton.——The new shoot at 500 ft. in the Silver Pick is improving.

HUMBOLDT COUNTY

The ore-shoot in adit C of the Nevada-Packard lease is a remarkable one. Ore worth $34,549 has been extracted during the past two months.

LINCOLN COUNTY

The country near the Black Ledge winze has been drained to the level of No. 1 shaft of the Amalgamated Pioche, about 1425 ft. deep. No. 14 level was connected with the winze, and good ventilation resulted. Mining can now be done economically below 1200 ft. Rise No. 5 from this level is in good zinc ore.

NYE COUNTY

Three mills at Manhattan have produced $167,436 from 45,429 tons of ore during 11 months of the current year. About 15,000 cu. yd. of gravel was sluiced at the placers, yielding $45,000. Most of the deep gravel properties in the main gulch have been worked out under the present method of operation.——The White Caps mine is estimated to contain $300,000 of ore, averaging $17 per ton, to the 200-ft. level. This ore is refractory.

Six Tonopah mines yielded 9448 tons of ore, worth $186,024, last week.——Forty stamps and four tube-mills are now working at the Extension mine, crushing 235 tons per day. Eight concentrating tables, a Dorr thickener, and six zinc boxes were added to the old plant, with the 10 stamps and a tube-mill.——The Jim Butler v. West End suit started on December 7. A new head-frame is being erected at the Jim Butler by Campbell & Kelly.——Six feet of good ore has been cut by rise 579 in the West End.——The Montana has made a shipment of 31 bars of bullion worth $23,000.

Interesting prospecting continues at Tonogold.——The

TONOGOLD, NEAR TONOPAH. HEAD-FRAME IS ON THE CAMPBELL & KELLY LEASE.

Campbell & Kelly lease is down 82 ft. in good looking quartz. This claim is equipped with a hoist.——Cross-cutting is under way at 55 ft. in the Miner.——A whim is to be erected at the Last Chance, which is down 45 ft.——Mineralized formation, similar to andesite in the Midway at Tonopah, is being driven on in the Rabbit Foot.

WHITE PINE COUNTY

(Special Correspondence.)—After considerable discussion, the State Tax Commission has reduced, after raising it to $1,500,000, the Nevada Consolidated assessment to $1,000,000. The county commissioners agreed to cut their 1915 budget $20,000. This action, it is thought will allow the Company to continue work; otherwise there was a disposition to shut down and contest the increased tax, which is unjust. The Company would prefer to produce copper here rather than in Utah plants. All married men are working nearly full time. The Company is installing oil flotation machines in No. 2 unit of the mill.

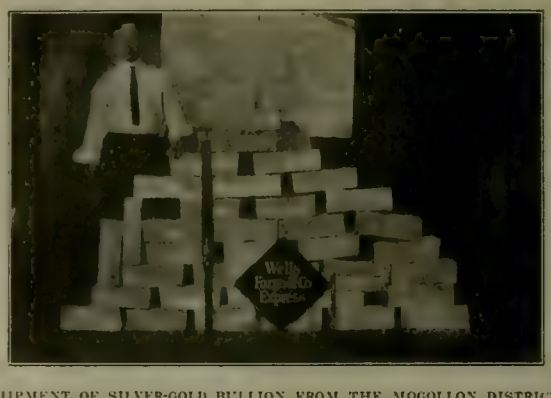
The driller of the county well for artesian water lost the hole and casing at 703 ft.——On the Jennie A. mine at Hamilton, mining is stopped and the owners are jigging the dump. ——The U. S. government well, on Black Rock desert, was put down to 1500 ft. The casing has been left in the well, so as to go deeper if desired.

Ely, November 27.

NEW MEXICO

SOCORRO COUNTY

(Special Correspondence.)—Heavy shipments of silver-gold bullion and concentrate have been made from Mogollon of late, the Ernestine sending 16 bars on November 19, and the Socorro 12 bars and 5 tons of concentrate on the same date. The



SHIPMENT OF SILVER-GOLD BULLION FROM THE MOGOLLON DISTRICT, SOCORRO COUNTY, NEW MEXICO, THROUGH SILVER CITY. WEIGHT, 3159 LB., OR 45,800 OZ., WORTH $42,485.

cyanide situation is somewhat acute there.——The Mogollon mail contract has been let by the government to C. A. Bennett of Silver City at $10,000 per year, until June 1918. After January 1, 1915, there will also be a telephone exchange at Mogollon.

Mogollon, November 24.

OREGON

BAKER COUNTY

There are several promising mining claims on the side of a mountain in the Greenhorns, west of Sumpter, known as Olive Butte, especially the Big Elk mine.——The Greenhorn district seems to be more prosperous than usual. The new 10-stamp mill of the Golden Gate is about finished.——The Powder River Gold Dredging Co. has been granted permission to allow its boat to cut through a county road near Sumpter. The road must be remade and $50 paid for the privilege.

SOUTH DAKOTA

LAWRENCE COUNTY

The Homestake Mining Co. has published the following notice: "Additional wages, amounting to 7% of the total wages paid for the year 1914, will be paid to all employees whose names are on the December 1914 payroll. Checks for the amount payable will be delivered on the regular pay-days in January 1915." This is a regular distribution now.

UTAH

Juab County

Following a visit of George Dern Theodore P. Holt, and James Dick to the Tintic district is a rumor that a mill similar to that erected at Park City by these mining men may be constructed at Tintic. A good deal of experimental work is being done in the district generally.——Sulphide ore has been opened at 1000 ft. in the Iron Blossom. The annual meeting of the Iron Blossom Consolidated Mining Co. was held at Provo on December 5. Dividends paid during the year amounted to $400,000, and on December 1 there was $340,000 cash on hand.

Millard County

The Westwood Oil Co., owning land north of Fillmore, is to resume drilling. Three rigs will be working in a week or two. One well is down 1120 ft., and shows oil from 600 ft. G. W. Westphal is in charge.

Salt Lake County

The Utah-Apex Mining Co. made a net profit of $49,651 during the third quarter of 1914. Development during the year ended August 31 cost $48,850. A good tonnage of ore has been opened. Generally the year was a profitable one.—— In enlarging the mill it was necessary to suspend treatment for two months, while the search for a bandit also resulted in a complete shut-down of the mine and mill. The revenue from 121,675 tons of ore and royalty was $916,907. The gross profit was $167,467. Owing to the low price of lead the earnings were considerably lower than usual.——Ohio Copper shares are only worth 15c. each, compared with $8 before reorganization, making the entire property valued at $187,500, about 10% of what the equipment cost.——Ore worth $40 per ton has been opened for some distance by T. W. Blake, a lessee in the Wasatch Mines Co.'s property, in the Alta district.

Summit County

At the Daly West, the new hoist and compressor are ready for work. Second-class ore is being sent to the new mill.

CANADA

British Columbia

Ore shipments from Rossland mines are increasing, and during November the Consolidated smelter at Trail received 24,485 tons, 4775 tons more than in October. Contributors were as follows: Centre Star, 13,150; Le Roi, 10,100; Josie, 1235; and United Copper at Chewelah, Washington, 704 tons.

The annual report of the West Kootenay Power & Light Co. shows that the revenue-producing load was 8029 hp. Gross revenue from all the subsidiaries was $175,788, and expenditure $119,718. The sum of $248,474 was brought forward from the previous year, and the total on hand was $302,061. The preferred stock 7% dividend amounted to $34,600, and common stock 5%, $100,000. Assets are $4,436,179. A third unit, of 8000 hp., was installed during the year.

Ontario

Bullion shipments from Cobalt last week totaled 83,234 oz. ——No. 4 shaft of the Coniagas mine is down 225 ft., equal to the fourth level of the main mine.—Seven inches of 3000 to 4000-oz. ore is being opened at 460 ft. in the Beaver. This shoot was opened at 530 ft. some time ago.—The most important work in the Temiskaming is at 750 ft. Drills are working at 350, 575, and 650 ft. Twenty stamps are crushing ore.

During the four weeks ended November 4 the Hollinger mine produced $162,885 from 18,645 tons. Operating costs totaled $4.48 per ton. The surplus is $1,173,640.

Yukon

The Yukon river closed in front of Dawson at 10:26 a.m. on November 15, the latest recorded by three days. No damage was done by ice jams.

PERSONAL

J. H. Mackenzie is in New York.

B. B. Thayer has gone to Montana.

C. W. Merrill has gone to New York.

H. K. Rogers was in New York last week.

A. B. Wolvin has been in New York on business.

Kuno B. Herrlein was in New York and has gone to Mexico City.

H. F. Grondys, manager for Cia. Minera de Oruro, is visiting mines through the West.

James C. Ray has just returned from professional work in the northern part of California.

Information is wanted of the present whereabouts of J. S. Neall, last heard from at Goldfield, Nevada.

John M. Callow, president of the General Engineering Co. of Salt Lake City, left recently for New York.

William Wallace Campbell will lecture before the National Academy of Sciences on 'Stellar Evolution and the Formation of the Earth.'

J. H. Riddle, general manager for the Nevada Cinnabar company, is at the plant near Ione, Nevada, where he expects to be for a month.

George Guess was in New York, on December 2, to attend the meeting of the New York section of the American Institute of Mining Engineers.

S. H. Brockunier, of Nevada City, California, is at Cave Creek, Arizona, making an examination of the property of the Pittsburgh Tungsten Mines Company.

J. Kojima, metallurgist for the Furukawa Mining Co., having completed his tour of mining districts in this country, sailed from San Francisco for Japan on November 28.

Owen Letcher, of the editorial staff of *The South African Mining Journal*, and contributor to the *Press*, has joined the South African forces fighting in German Southwest Africa.

Among Utah men to attend the meeting of the American Mining Congress at Phoenix were George H. Dern, R. J. Evans, Arthur Thomas, W. H. King, Ernest Gayford, Ernest L. Godbe, H. S. Joseph, J. T. Hodson, Charles Moore, Jesse Knight, W. Lester Mangum, and L. A. Friedman.

Obituary

John Denton Feidt, who died at Bellevue Hospital, November 23, was one of the pioneer miners and contractors of the West. After experience in convoy of wagon-trains and other characteristic work of pioneer days, he went to Montana in 1864. He was one of the discoverers of the Big Bowl Basin mines at the head of the Missouri river and later of the Big Bear Gulch mines. In 1869 he went to New York, by way of San Francisco and Panama, with $40,000 in gold dust as a result of his work, but the lure of the West drew him back, and from 1870 to 1882 he carried on contracting work at various points in the Western States and territories. In 1882 he was locating claims at Leadville, and in 1888 building water works at Chicago. Later he studied the zinc deposits of Arkansas and grew oranges in Florida. His last years were passed at Clearspring, Maryland, surrounded by friends, busy and happy. He was an early convert to Mr. Carnegie's philosophy that one should give while still living, and he accordingly divested himself of almost all of his large fortune, retaining merely sufficient to meet his needs. He was born in 1837, and his long busy life covered the period of maximum expansion of pioneer work in which he and men of his type found a fitting field for their restless energy.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

San Francisco, December 10.

Antimony	15 —15¾
Electrolytic copper	13¼—13½
Pig lead	4.05— 5.00
Quicksilver (flask)	$52.50
Spelter	6½— 6¾
Tin	34½—36
Zinc dust, 100-kg. zinc-lined cases	10

EASTERN METAL MARKET.

(By wire from New York)

NEW YORK, December 10.—Copper is quiet but firm, lead is also quiet, while spelter is strong. Calumet & Hecla company has passed its dividend, the second time this year.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.		Average week ending	
Dec.	3	Dec. 2	49.33
"	4	Dec. 9	49.91
"	5		
"	6 Sunday		
"	7		
"	8		
"	9		

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59 32	54.35
Mch.	57.87	58.01	Sept.	60 53	53.75
Apr.	59.26	58 52	Oct.	60 88	51.12
May	60.21	58.21	Nov.	58.76	49.12
June	59.03	56.43	Dec.	57.73	....

The market has shown fair strength during the past week, but until the Orient requires more silver there can be no definite rise. The 'China' took metal worth $100,328, say 210,000 oz., from San Francisco to the Far East, on December 5.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Dec.	3	Oct. 28	3.50
"	4	Nov. 4	3.50
"	5	" 11	3.50
"	6 Sunday	" 18	3.70
"	7	" 25	3.90
"	8	Dec. 2	3.80
"	9	" 9	3.80

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4 60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.36	3.86	Oct.	4.37	3.60
May	4.34	3.90	Nov.	4.16	3 68
June	4.33	3.90	Dec.	4.02	....

Better prices at Joplin have stimulated production, realizing $47 per ton, basis of 10% metal, against $49.50 at this time of 1913.

COPPER

Prices of electrolytic in New York, in cents per pound.

Date.		Average week ending	
Dec.	3	Nov. 19	11.75
"	4	" 25	12.25 to 12.50
"	5	Dec. 2	12.62
"	6 Sunday	" 9	12.73
"	7		
"	8		
"	9		

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16 54	14.21	July	14.21	13.26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14 19	Oct.	16.31	11.10
May	15.42	13.97	Nov.	15.08	11.75
June	14.71	13.60	Dec.	14.25	....

The New York letter of this issue discusses several points regarding this metal. The Anaconda output in November was 12,700,000 lb., compared with 11,800,000 lb. in October, and 25,250,000 in November of 1913. The market was firm last week, advancing continuously until the end of the week. The Italian steamship lines have agreed to accept shipments of copper, but insurance is hard to get. The visible supply in England, France, and afloat thereto is given as 30,626 tons on December 1, a decrease of 216 tons during the two weeks preceding, but above the average for this year.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slighly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb, are given below:

Week ending			
Nov.	12	Nov. 25	55 00
"	19	Dec. 3	55.00
		" 10	52.50

Monthly averages.

	1913.	1914		1913.	1914
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug.	40.50	80.00
Mar.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	53.00
May	40.25	39.00	Nov.	39.40	55.00
June	41.00	38.60	Dec.	40.00	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Dec.	3	Oct. 28	4.90
"	4	Nov. 4	4.90
"	5	" 11	4.85
"	6 Sunday	" 18	5.00
"	7	" 25	5.10
"	8	Dec. 2	5.20
"	9	" 9	5.50

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	4.75
May	5.23	4.91	Nov.	5.09	5.01
June	5.00	4.84	Dec.	5.07	....

As discussed in the New York letter of this issue, the exports to Europe are making a strong market. The total for the past three months is more than that for seven years. Blende has been selling for $43 to $46.50 per ton, basis of 60% metal, at Joplin. This week last year the price was $37 to $39.

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37.85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	50.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36.10	Oct.	40.61	30.40
May	49.10	33.29	Nov.	39.77	33.51
June	45.10	30.72	Dec.	37.57	....

Tin is quiet at 32 to 33c. per pound, and £146 per ton for spot metal in London.

SPECIE MOVEMENTS

Exports of gold from New York for the week ended December 5 were $100,000 to Vera Cruz; of silver, $619,671, mostly to London. Since January 1 the total is $128,324,883 gold and $40,238,062 silver, against $69,211,146 and $45,936,874, respectively, for the same period of 1913. Imports of gold at New York last week were $197,180, and silver, $483,270. Since January 1 the total is $9,188,997 gold and $9,917,981 silver, against $24,659,661 and $10,375,604 in that period of last year.

OIL STATISTICS

The following data covering the year 1913, is from the U. S. Geological Survey:

Final figures of the production of petroleum of the United States and the world are now at hand in the 356-page bulletin by David T. Day. This publication covers everything connected with the oil industry.

A study of the domestic production shows a story of progressive maxima for the past seven years, until in 1913 the product reached 248,446,230 bbl., or 33,126,164 metric tons, while in 1912 it was 222,935,044 bbl., or 29,724,673 tons. In the previous year the value was $164,213,247, or 73.7c. per bbl., against $237,121,388, or 95.4c. per barrel in 1913.

As to the production of individual fields, there was no variation in their relative importance. It is noteworthy that the normal decline in the oilfields of New York and Pennsylvania was changed into a slight increase under the spur of greatly increased prices. West Virginia and Ohio declined, but only slightly. Even in Indiana the decrease was subnormal, because of new developments on the western border of the state. The decline in Illinois was decided, nevertheless 'wild catting' is still active in many widely separated regions of the state. The great gains in production came from the Mid-Continent fields and from California. A large flow was struck in a well on the edge of the Cushing region, which started a general policy of drilling to the thick and prolific Bartlesville sand, and oil came with a rush. Stocks were accumulating heavily at the end of the year. At the close of 1912, consumption in California had so nearly balanced production as to encourage the producers, and to defeat concerted effort toward the restriction of drilling. Many of the wells in 1913 were gushers of the phenomenal type, and aided greatly in increasing the supply. As to Texas and Louisiana, the Electra and Burkburnett fields in the former state progressed satisfactorily, and a new area was developed at Moran.

Stocks in the United States at the end of 1912 and 1913 amounted to 122,869,702 and 122,934,188 bbl., respectively, which is considered extraordinary, taking into account the large production. These stocks are equal to about six months' supply, which California oil men think is necessary to be on the safe side. The value of raw material in such stocks is about $125,000,000, a hazardous investment of money which has not proved tempting in any country except the United States. Of the stocks held at the close of last year, 48,302,392 bbl. was held in California (now about 57,000,000 bbl.), 53,749,257 bbl. in Kansas and Oklahoma, and 8,243,421 bbl. in Illinois.

Production by states in the past two years was as follows:

State.	1912 Quantity.	1912 Av. price per bbl.	1913 Quantity.	1913 Av. price per bbl.
Alaska	(a)	.....	(b)	.....
California	(c)187,272,593	$0.454	97,788,525	$0.467
Colorado	206,052	0.973	188,799	0.926
Illinois	28,601,308	0.851	23,893,899	1.296
Indiana	970,009	0.913	956,095	1.337
Kansas	1,592,796	0.688	2,375,029	0.947
Kentucky	484,368	0.877	524,568	1.288
Louisiana	9,263,439	0.758	12,498,828	0.981
Michigan	(d)	.....	(b)	.....
Missouri	.....	.....	(b)	.....
New Mexico	.....	.....	(b)	.....
New York	874,128	1.604	902,211	2.404
Ohio	(c)8,969,007	1.347	8,781,468	1.997
Oklahoma	51,427,071	0.674	63,579,384	0.937
Pennsylvania	7,837,948	1.644	7,963,282	2.487
Texas	11,735,057	0.754	15,009,478	0.978
West Virginia	12,128,962	1.643	11,567,299	2.492
Wyoming	1,572,306	0.507	2,406,522	0.493
Other states	.....	.....	(f)10,843	1.777
Total	222,935,044	$0.737	248,446,230	$0.954

(a) Included in California. (b) Included in other states. (c) Includes Alaska. (d) Included in Ohio. (e) Includes Michigan. (f) Includes Alaska, Michigan, Missouri, and New Mexico.

The well record for the past two years was as follows:

Year.	Oil.	Gas.	Dry.	Total.
1912	12,514	1,811	2,855	17,180
1913	19,101	2,207	4,282	25,590

A review of foreign oilfields includes the following notes: In Canada, exploration for oil and gas was done in Manitoba and Alberta, with excellent results. Work in Mexico was active in spite of unsettled conditions. Trinidad's output increased. Central America attracted attention. The industry in Peru is making rapid progress, especially the Lobitos field. The older districts of Russia continued to decline, but prospecting in the Ural-Caspian region gave encouraging results. The Baku field yielded 48,563,985 bbl. Galicia, in Austria-Hungary has been declining continuously since 1909 at the rate of about 2,000,000 bbl. per year, but last year it was less than 1,000,000 bbl. In spite of the Balkan war, Rumania increased its production. Burma also had an increase and the Dutch East Indies. Exploration has been done in many other countries with fairly satisfactory returns.

The world's production of crude petroleum in 1913 and in 1857-1913, by countries, in barrels and metric tons, is as follows:

Country.	Production, 1913 Barrels.	Metric tons.	Percentage of total.	Total production, 1857-1913 Barrels.	Metric tons.	Percentage of total.
United States	248,446,230	33,126,164	65.12	3,069,694,605	409,292,614	59.16
Russia	60,935,482	8,124,731	15.97	1,553,314,449	207,108,593	29.93
Mexico	25,696,291	3,426,172	6.74	68,965,294	9,195,373	1.33
Rumania	13,554,768	1,885,225	3.53	105,155,895	14,020,786	2.03
Dutch East Indies	11,966,857	1,534,223	3.14	125,573,184	16,743,091	2.42
Galicia	7,818,130	1,087,286	2.05	126,840,251	16,912,033	2.44
India	*7,500,000	1,000,000	1.98	65,549,770	8,739,969	1.26
Japan	1,942,009	258,934	0.51	24,312,780	3,241,704	0.47
Peru	1,857,355	247,647	0.49	12,113,264	1,615,102	0.23
Germany	*995,764	132,769	0.27	11,969,805	1,595,974	0.23
Canada	228,080	30,410	0.06	23,278,805	3,103,841	0.45
Italy	*50,334	7,000	0.01	765,759	102,101	0.02
Other countries	517,616	69,015	0.13	1,493,616	199,149	0.03
Total	381,508,916	50,929,576	100.00	5,189,027,477	691,870,330	100.00

*Estimated.

BOOK REVIEWS

PETROLEUM YEAR BOOK, 1914. Compiled by Sydney H. North. P. 104. Index. Wilkinson Bros., Ltd., London, 1914. For sale by the *Mining and Scientific Press*. Price $2.

This is a decidedly useful little book on an important product, the world's output of which in 1913 was 382,961,526 bbl., or 51,704,951 tons. Briefly, the work contains the following information in concise form: Statistics relating to the yield of each oil-producing country, with prices; asphalt and shale mined; imports of petroleum products; geology of the oilfields of the world; chemistry of various oils; use of oil fuel and types of burners; oil-engines; and miscellaneous data.

ELECTRICITY IN COAL MINING. By David R. Shearer. P. 84. Ill., index. McGraw-Hill Book Co., Inc., New York. For sale by the *Mining and Scientific Press*. Price $1.50.

While the use of electric power in coal mines is not without a certain amount of danger, yet its use is making headway and the power finds an increased demand. This is so in Pennsylvania especially, and notes on this subject have appeared in recent issues of the *Press*. About coal mines electricity is used for hoisting, pumping, ventilating fans, signaling, coal-cutting machinery, in locomotives instead of mules for haulage, and many other purposes. Types of generating plant suitable, motors and haulage equipment, operation of coal-cutters, and other information are given in a practical manner.

ASSAYING IN THEORY AND PRACTICE. By E. A. Wraight. P. 323. Ill., index. Longmans, Green & Co., New York, and Edward Arnold, London, 1914. For sale by the *Mining and Scientific Press*. Price, $3.

This is an addition to the already large number of books on this subject. It covers both dry and wet methods, more especially those needed by laymen and the mine assayer. These methods are those taught by the author at the Royal School of Mines during the past 12 years, and with which he has had actual practical experience. The arrangement of the book is somewhat new. It opens with tables of the elements, weights and measures, logarithms, list of apparatus and chemicals necessary, and minerals and their characteristics, which are generally found at the end of most books. In the former position they attract the immediate attention of the student. Chapter II gives some hints for prospectors, and the next chapter is on the important subject of sampling. Then follow the dry assays of lead, tin, gold, silver bullion, mercury, and the examination of solid fuels and refractory materials. Part III deals with the analysis of iron, copper, zinc, and aluminum, lead and bismuth, tin, arsenic and antimony, manganese, chromium, sulphur in ores, vanadium, uranium, and molybdenum, and cobalt and nickel. The concluding chapters describe mill and cyanide testing by the newest methods. The index is very complete, and the book of practical value.

GREAT COLLIERY EXPLOSIONS, AND THEIR MEANS OF PREVENTION. By W. Galloway. P. 130. Ill., plans. The Colliery Guardian Co., Ltd., London, E. C.

Unfortunately, explosions occur far too frequently in coal mines, usually with a great loss of life. No particular field in the world is free from them, hence their causes, and steps taken to minimize further occurrences have been the subject of considerable investigation. The author has had a long experience with collieries, and has been insistent on the elimination of dust from the main drifts of these mines. This book is partly made up of papers prepared for the Royal Society, and Royal Meteorological Society. Fire-damp was generally supposed to be the principal agent in all great colliery explosions, although they took place in well ventilated workings. In 1875 the author was convinced that coal-dust was the main source of trouble, and fire-damp a secondary one. The papers discuss the connection between explosions in collieries and weather, experiments with safety lamps, the influence of coal-dust in colliery explosions, and notes on commissions. The explosions described are accompanied by plans. An interesting book for coal operators and others.

U. S. Geological Survey publication, Washington, D. C., 1914: PRODUCTION OF PETROLEUM IN 1913. By David T. Day. P. 356. Charts and table. Each year this bulletin grows in size, and is a most valuable publication. An extensive extract from this book appears on the page ahead.

MINING DECISIONS

MINING CLAIM—AMENDED LOCATION

Where, between the dates of the original location of a mining claim and an amended location thereof, the claim was included within an area withdrawn by competent authority from appropriation under the mining laws, no rights attach by virtue of the amended location to such portions of the vein or lode claimed thereunder as were not included in the original location, so long as the withdrawal stands; and as no lawful purpose would therefore be subserved by a survey of the amended location, the Land Department will not direct such survey to be made.

United States Phosphate Co. (Land Department), 43 Land Decisions, 232. April 27, 1914.

MILLSITE IN NATIONAL FOREST

A decision by the Department of the Interior canceling a millsite entry, without passing upon the validity of the millsite claim or location, or the claimant's possessory rights or ownership in the premises, in no wise affects the legal rights, if any, the claimant may have in the millsite claim; and where the land is included within the limits of a national forest, but excepted from the operation of the proclamation creating the same, by reason of the millsite location, the subsequent cancelation of the millsite entry does not have the effect to make the land a part of the national forest, or deprive the Secretary of the Interior of jurisdiction to reinstate the canceled entry with a view to the issuance of patent thereon.

Alaska Copper Co. *et al.* (Land Department), 43 Land Decisions, 257. May 28, 1914.

PLACERS IN STREAM BEDS

The banks and beds of non-navigable, unmeandered streams, on lands belonging to the United States, containing valuable mineral deposits, may be included in locations and entries under the mining laws. The general mining laws are operative with respect to deposits of gold within the limits of national forests or power-site withdrawals the same as with respect to like deposits elsewhere on the public domain. Such lands when containing mineral of such quantity and value as to warrant a prudent man in the expenditure of his time and money, with a reasonable expectation of developing a profitable mine, are disposable only under the mining laws, notwithstanding they may possess a possible or probable value for power-site purposes; but by the Act of August 24, 1912, lands withdrawn under the act of June 25, 1910, are open to location and acquisition under the mining laws, so far as the same apply to metalliferous minerals.

Cataract Gold Mining Co. *et al.* (Land Department), 43 Land Decisions, 248. May 26, 1914.

New Machines and Devices

Sullivan 'DP-33' Rotator

Among new drills recently put on the market is a Sullivan rotating hand hammer drill having several new features. This drill is constructed of steel throughout, with all parts excepting the handle, hardened and ground on all bearing or wearing surfaces to accurate size. The standard chuck bushing with which the machine is equipped, accommodates both solid and hollow drill steel with a $\frac{7}{8}$-in. hexagon shank $3\frac{1}{4}$ in. long, measured from the striking end to the collar. The drill uses the same steel as the Ingersoll 'Jack-hamer' steel. The collar below the shank is $1\frac{3}{8}$ in. diameter and $\frac{1}{2}$ in. long, with square shoulders filleted into the steel body. The machine may be operated with either steam or air, but when a steam drill is required, it must be specified, as the auxiliary exhaust ports in the cylinder adapted for use with steam are not drilled on air machines.

CROSS-SECTION OF 'DP-33' DRILL.

The following table covers general specifications:

Cylinder diameter, $2\frac{1}{4}$ inches.

Length of working stroke, $2\frac{3}{8}$ inches.

Total length of stroke, $2\frac{7}{8}$ inches.

Weight of machine with throttle valve and steel retainer, 38 pounds.

Size of air hose required, $\frac{3}{4}$ inch.

Standard size of drill shanks, $\frac{7}{8}$ in. hexagon by $3\frac{1}{4}$ in. long.

Air consumption in cubic feet free air per minute at 85 lb. pressure, 70 feet.

Boiler horse-power, 5.

Depth to which machine will drill easily, 8 ft. and up, depending on nature of ground.

The following is a list of the characteristic features of the drill: Automatic rotation of drill steel; drill steel retainer; Sullivan differential valve motion; removable valve bushings; valve chest integral with cylinder; automatic lubrication; removable chuck bushing; Sullivan roller ratchet; positive rotation; absence of separate riffle bar; use of exhaust air for cleaning drill hole; minimum vibration; low power consumption; minimum number of parts; and maximum durability.

WITH WATER ATTACHMENT DRILLING HOLES TO A DEPTH OF 30 FEET.

The rotation of the drill steel is accomplished by the use of spiral and straight flukes or grooves milled on the contracted or striking end of the piston. The straight grooves fit correspondingly shaped projections in the opening of the retaining bushing, which is secured in the chuck of the machine, and the spiral grooves fit correspondingly shaped projections in the opening of the oscillating ratchet which is between the chuck and the front end of the cylinder. As the piston reciprocates, a step-by-step rotary movement is transmitted to the piston and chuck of the machine, which in turn receive the drill steel. This principle of rotation dispenses with the separate fluted bar and confines the rotating parts to the front of the machine so that the work of turning the drill steel is accomplished in the most direct manner when the piston moves rearward in the cylinder. The standard

Sullivan solid ring ratchet is employed, having flat springs and roller pawls similar in all respects to the rotating device employed on the reciprocating type rock drill, except that a positive means is provided to prevent the ratchet ring from slipping, instead of depending upon friction.

The drill-steel retainer consists of a U-shaped yoke, adapted, when in the normal position, to engage the drill steel directly below the collar. This U-shaped yoke is suspended by arms from trunnions mounted in suitable sockets upon the side rod springs, in such a manner that the normal compression of the springs acts to keep the yoke of the retainer constantly engaged with the drill steel; but it may readily be disengaged by hand and the drill steel removed when necessary.

The standard Sullivan differential valve motion is employed. The valve chest, however, is forged integrally with the cylinder, and the valve is housed in removable hardened steel bushings by buffer plugs held in position by yoke springs and side rods. The air inlet connection is bushed with a hardened steel inlet nipple, which preserves the threads of the valve chest.

The Sullivan standard automatic lubricator is contained in

TWO METHODS OF MOUNTING.

the base of the handle, differential pressure being employed to cause minute particles of oil to be fed, at every stroke of the piston, into the cylinder, where it commingles with the inlet air and is distributed in the form of a spray over all working parts, thus insuring positive and adequate lubrication when the machine is in operation, and then only. A removable chuck bushing provides a means for keeping the drill shank in alignment with the piston, and by an ingenious arrangement the chuck is housed in such a way as to prevent any possibility of rock cuttings or foreign material finding their way into the bearing of the chuck in its housing.

In common with all types of Sullivan hand-operated hammer drills, exhaust air only is used in connection with hollow drill steel for the purpose of ejecting the rock cuttings from the drill-hole, and the volume of air used for this purpose may be regulated at will by placing a hand over the exhaust opening in the valve chest. When steam is used for operating, it is desirable to keep the drill-hole flooded with water, and on horizontal or up-hole work spiral drill steel is recommended.

Plain pneumatic hose, ¾ in. and 3 ply, is used for supplying air to the machine, and ¾-in., 7-ply cotton-woven jacketed hose is supplied when steam is used, in 25 or 50 ft. lengths as desired. Four types of drill steel are used with this machine, namely: ⅞-in. hexagon hollow drill steel, sharpened with a six cutting-edge rose bit; 1⅛-in. solid spiral drill steel sharpened with 'Z' bit; 1⅛-in. hollow spiral drill steel sharpened with 'Z' bit; and 1¼-in. solid twisted spiral sharpened with fishtail bit.

For the purpose of supporting the machine when holes directed at or above the horizontal are to be drilled, or when the machine is to be operated under conditions which make it impractical for the operator to hold it by hand, the 'telescopic support' and the 'cradle mounting' may be used to advantage. The telescopic support, as the term implies, is a light, portable, telescopic column with the piston ending in a hook. The drill is suspended from the hooked end by a clamp connection engaging the side rod of the machine. In the lower part or cylinder of the support is a spring of sufficient strength to support the weight of the machine. The operator adjusts the support to the required height and collars the drill-hole, after which the hand screw is released and the drill is thus supported upon the spring. Proper alignment of the drill-hole is maintained by pressing the machine down slightly against the spring support. This type of support is recommended for use where the ground is reasonably soft and the time required to drill a hole to the required depth prohibits the use of a more substantial form of support or mounting.

For drilling under the foregoing conditions in hard ground where a rigid form of support is desirable, the cradle mounting is recommended, which consists of a light rock-drill shell with the ordinary feed screw and crank handle, supporting a cradle upon which the drill is secured by bolt and strap connection. For ordinary down-hole work, the machine is guided by hand, the operator merely exerting a slight downward pressure against the drill.

The description of the drill together with the illustrations are published through the courtesy of the Sullivan Machinery Co. of Chicago.

Commercial Paragraphs

The WEBSTER MANUFACTURING CO., Tiffin, Ohio, in the November number of the *Webster Method*, publishes an illustrated article on 'Sand and Gravel Washing in Cleveland.' Conveyor systems are also discussed in two articles on the handling of clay and coal.

STANDARD OIL COMPANY OF CALIFORNIA, in its monthly bulletin, publishes among other articles an interesting discussion on a new method for extinguishing oil fires. Statistics on the world's production of crude petroleum from the year 1857 through 1913 are also presented in detail.

Announcement is made that the partnership formerly known as Hegeler Brothers, which has operated a zinc smelter at Danville, Illinois, for a number of years, has been reorganized into a new corporation called THE HEGELER ZINC CO. This business will be continued under the same management and with the same policies as the old firm. Julius W. Hegeler is president of the new corporation.

The WESTERN ELECTRIC CO., New York City, N. Y., is installing private telephone systems for industrial plants. A recent installation was at the plant of the J. I. Chase company at Racine, Wis. This Company operates a large plant the main buildings of which are as much as a half a mile apart. Two private exchanges with switchboards have been installed and will be connected by trunk lines. Three thousand feet of 25-pair and 12,300 ft. of 50-pair cable will be installed. There will be outside distributing points on the grounds, at which cable terminals will be placed. Loud ringing bells will be placed at various points inside and outside of the buildings to call officials to the nearest telephone. These bells can also be used to sound alarms.

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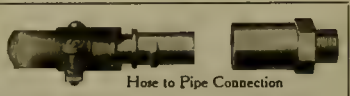

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EDITORIAL

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HAYDEN STONE & COMPANY wire assuring us that the announcement of the purchase of the Butte-Duluth mine by that firm is an error.

SMELTER fume litigation has caused annoyance and loss out of all proportion to its real importance. In the report of the Selby Smelter Commission, which we print this week, it is shown that the real difficulties are easily met when both sides co-operate to determine the exact facts. We congratulate all concerned on the findings of this Commission. It has set standards for others and has solved problems that were leading to endless bitterness and litigation. Incidentally we would call attention to the promptness with which the Selby Smelting & Lead Company adopted every suggestion made by the investigators and to the open-mindedness obtaining on each side.

HYDRAULICKING, once a great industry in California, was stopped by court injunction. Whether it can be revived or other means found for working the mines then closed is a large question discussed by Mr. C. S. Haley in the two articles of which we print the second this week. As a first step the United States Geological Survey and the Bureau of Mines are to undertake a comprehensive investigation of placers and placer mining in the United States. In this work Mr. James M. Hill will represent the Survey and Mr. Charles Janin the Bureau. Mr. Hill will investigate the geological problems involved, and Mr. Janin, those relating to mining. The studies will necessarily extend over two or more years, and will, we are sure, constitute a basis for much constructive work.

COPPER men are making strong efforts to induce the Department of State to assume a more aggressive attitude in the matter of detention by the British of shipments to neutral countries. A number of Western governors have appointed representative men to visit Washington and to impress upon the officials there the fact that this interference is producing conditions of such seriousness as to constitute a public danger in numerous districts in the West. Late in November Mr. Thomas T. Read, associate editor of the *Press*, had a long conference regarding the matter with the acting Secretary of State, Mr. Robert Lansing. It was expected then that negotiations with Great Britain would remove all difficulties within a few days. Steamship and insurance men, however, have not yet received such assurance as would clear the way for unrestricted shipments. On Wednesday last the Secretary of State, Mr. W. J. Bryan wired Mr. Read as follows: *"Department making every effort to relieve copper situation. Exact meaning of articles covering copper now on contraband list is being obtained from Great Britain preparatory to further discussion of the subject."* Our readers will be glad to know that the matter is receiving earnest attention and that the Department of State hopes soon to have cleared away the remaining obstacles.

FOREIGN capital invested in South American mines does not always mean European money. Chileans own or control a surprisingly large number of mines in Bolivia. The Patiño mines, which produce about one-third of the Bolivian tin, are locally owned, but the two next in size, the Llagua and the Oruro, are Chilean owned, though managed in the one case by American engineers, and in the other by a Hollander. Many of the smaller tin mines are also Chilean owned. The Aramayo Francke is British owned, as are many of the nitrate mines in Chile, the remainder being controlled locally, as are the coal mines. At Corocoro, the two principal copper properties are owned by Chileans and Frenchmen respectively. The French also own the Naltagua, Catemú, and other properties in northern Chile. The Braden, Chuquicamata, and Cerro de Pasco, which overshadow all others in size, are controlled in the United States. In Peru the Backus & Johnston interests, the second most important in copper, are under Peruvian control. The Bethlehem Steel Corporation, as is well known, has recently leased from the French, important iron mines in Chile, and, on the whole, the big properties on the west coast are less generally under European control than is usually supposed.

ENGINEERS and metallurgists in the copper country of the Lake Superior region have been notably chary of writing and publishing of recent years. This is all the more a pity since the region is one of much technical interest and the men working there are among the best in the profession. It is said that the general blanket of silence has been due to an unfortunate experience of one of the companies with an Eastern technical journal. That is ancient history of which we do not profess to

have direct knowledge. What is more to the point is the fact that the old spirit is passing. In the excellent address upon the work of the safety department of the Calumet & Hecla, of which we print a part this week, Mr. Bailey not only reveals the cheerful helpful spirit that any visitor to the region feels, but he gives detailed facts of wide value. Other papers are in store. Incidentally, we note with regret that our Chicago contemporary, *Mining and Engineering World*, printed December 12 the report of the Selby Smelter Commission, of which identical copies were sent to all the technical journals with a release date of December 17. It is such things that make trouble.

IN an interesting and valuable article on 'Zinc and British Trade,' published in the November issue of *The Mining Magazine*, Mr. H. M. Ridge makes the statement "The silicate of zinc, which in the trade is included under calamine, although in mineralogy it is known as smithsonite * * *" Many American readers will have regarded this as a slip of the pen, and continued their perusal of his significant remarks. Actually, however, the sentence is not a slip of the pen, but an illustration of the difference between the American and the British languages, which are collectively called English. From the earliest historic times there seems to have existed some confusion as to the ores of zinc, and even after scientific mineralogy was well developed, miners and mineralogists failed to distinguish between the carbonate and the silicate of the metal, which look much alike and often occur together, calling both calamine. It was left to James Smithson, best known to Americans as the founder of the Smithsonian Institution at Washington, to point out that two different minerals were covered by the one name. Through some perversity of chance the name of smithsonite was attached to the silicate by English miners and mineralogists, while it was in America used to designate the carbonate, the name of calamine continuing to be used in both countries to designate, in a vague way, either or both. Thus the confusion still persists, though a British and American engineer may to some degree relieve it by remembering that when his cousin speaks of the one mineral he really means the other.

MAGNESITE

Magnesite is one of the substances on which public attention has been focused by the war in Europe, which for a time interrupted our supply, since the domestic output constituted less than 10 per cent of the $1,500,000 worth of magnesite which is consumed in this country each year. It is used for a variety of purposes, the best known being the making of fire brick and other refractories and for the linings of reverberatory furnaces, chiefly for the making of steel. For this purpose it is first dead-burned, or calcined down to a CO_2 content of less than 1 per cent, in which condition it does not reabsorb CO_2 and moisture from the air. To be satisfactory for this purpose, it must be low in lime, silica, alumina, and iron oxide, though it must be added that it does not seem difficult to find material which is pure enough to be satisfactory for this purpose. Another well known use is for making coverings for steam pipes, so familiar to all. Of less present but apparently much greater future importance are the cement mixtures which are just beginning to attract attention through their use as flooring in bathrooms, hospitals, and other places where a sanitary, waterproof, wear-resisting and warm floor covering is required. In the construction of the buildings for the Panama-Pacific International Exposition a considerable local demand for this purpose has been created, and the output of magnesite in California has largely increased for this reason. Caustic magnesia, the name by which magnesite is known when it has been calcined until its CO_2 content is reduced to 3 or 4 per cent, has also proved recently to be of much value in the bisulphite paper pulp industry, since it seems to be more satisfactory for this purpose than calcium bisulphite and is much cheaper than sodium bisulphite. At one time crude magnesite was used in the soda water industry as a source of CO_2 gas, but in order that its use for this purpose should be more economical than the use of limestone, it is necessary to find a market for the magnesium salts thus produced, and this is increasingly hard to do.

Magnesite deposits occur rather widely, as might be expected, since magnesium is about as abundant in nature as calcium. The massive deposits occurring on the island of Euboea, in Greece, are among the best known and have been worked for many years. It here occurs in thick lenses in serpentine, and as it is not far from the seacoast, in a country where labor costs are low, it can be placed on shipboard at a low cost. Important deposits of crystalline magnesite occur near Salzburg in Austria, and extend across Styria and Hungary to near the Russian border. These deposits are very pure and have been extensively worked for that reason. Practically all the magnesite brought to this country is from one of these places or from Greece.

When the war first broke out, the prospect of a total cutting off of the Austrian supply and a possible interruption in shipments generally, caused the price of magnesite to rise rapidly, but since shipments from Mediterranean ports are now free from interruption the Grecian deposits have risen to the situation, and it is reported that the latest shipload of magnesite received in New York was contracted for at a price only $1 per ton above the prices prevailing in July. The horizon is not entirely clear yet, however, for it is not without the bounds of possibility that Greece will also be drawn into the war, when European supplies will be entirely cut off.

Magnesite occurs at a number of points in California and a growing industry is developing. The principal occurrences are in the Coast range, though in the foothills of the Sierras, in veins in serpentine, magnesite is also found. It is mined in Tulare, Fresno, Kern, Placer,

Riverside, San Benito, Santa Clara, Sonoma, and Napa counties, and the calcined product sells for from $10 to $25 per ton. California operators are hopeful of building up a permanent trade as one result of the war.

SMELTING IN COLORADO

An interesting contribution to the history of the development of smelting operations in Colorado was made by Mr. H. W. Hardinge at the November meeting of the New York section of the American Institute of Mining Engineers. Dr. James Douglas, the chief speaker of the meeting, had recalled the important advances made by the pioneers of smelting in Colorado, at Black Hawk and Argo. Mr. Hardinge then brought out the interesting fact that the development of smelting in Colorado owed a debt to Dr. Douglas of which he was unaware. About the close of 1890, Mr. Hardinge was manager of the smelting plant of the Arkansas Valley Smelting Company at Leadville. The silver content of the charge was so high and the lead content was so low that the slags being made averaged three to four ounces silver per ton, at a time when silver was worth over a dollar an ounce. Dr. Douglas visited the smelter one day and, noting this fact, casually remarked that the addition of a small amount of copper to the charge would clear the slag of silver. The suggestion was at once tried by Mr. Herman Keller, the superintendent, who had previously made some experiments along the same line himself, and one-half per cent of copper in the form of copper ore was added to the smelting charge, with the gratifying result that the slag decreased to 0.93 ounce silver per ton for the monthly average. Later the accumulated slag was re-smelted at a good profit, its silver content being recovered and its good iron content allowing the simultaneous handling of silicious ores at a correspondingly high smelting charge. Within a short time the practice became general throughout the state, and the shipping of lead mattes to eastern refineries for treatment at a high penalty was discontinued. Thus a casual remark was instrumental in fundamentally altering smelting practice in a whole state.

An interesting incident connected with this development is that a fellow metallurgist refused to believe in the results attained, stoutly maintaining that the smelting of copper and lead in the same furnace was a physical impossibility, and was only convinced by being shown the checks received in payment for the products made. Dr. Douglas had earlier in the evening related that when one of the most distinguished metallurgists of the day first heard of the use of water jackets in copper smelting he asserted that the thing was an impossibility, that sulphide ore could not possibly be smelted in contact with iron jackets without bringing about their destruction. The moral drawn by Dr. Douglas was that it is scarcely safe to assert that anything is impossible; and he concluded by asserting his belief that the ideal metallurgical plant of the future will be constructed of scantling, so that it can be easily taken down in making the inevitable changes in practice which careful study never fails to bring about.

INSURANCE RATES TUMBLE

Last January a new workmen's compensation act went into effect in California. In applying the general principle that each industry should carry its own burden of cost of accidents, many new provisions were made and a system was established that rendered inevitable a somewhat higher rate for insurance than that in other states. As we noted January 17, circumstances made it necessary for mine operators to deal with private insurance companies, and these, acting through a single board, established rates that were absurdly high. Specifically, mine operators were asked to accept a basal rate of 7.86 in gold mining and 9.80 in iron and miscellaneous mines. Questioned regarding this the companies maintained that these rates were based upon mining experience in Massachusetts and New Jersey; which carried its own answer to Western mining men. We are sure that the owners of the Davis pyrite mine in the one state, and of the Franklin Furnace zinc mine of the other, if asked, would have disclaimed fixing an insurance rate for California gold mines, but the faith of an insurance man in a few figures is absolute—when they are his figures.

Naturally a vigorous protest was made, and in that we had the pleasure of taking part. With records and data supplied by mining men in and outside the state, we took the matter to the Industrial Accident Commission, meeting there a wholly sympathetic attitude and finding there a cordial spirit of co-operation. Various efforts at amelioration of conditions have been made, as we have noted editorially, particularly in our issue of July 11, there has been some rate cutting, and various proposals have been made and rejected. The final result can now be announced. Negotiations between Mr. Fellows on behalf of the Industrial Accident Commission and the Workmen's Compensation Bureau, which fixes rates for the so-called 'board' companies, have led to establishment of the following rates for 1915: underground men, 5; dredge men, 4.8; mill men, 2.79. Furthermore, the Industrial Accident Commission, acting through the state insurance fund, will accept unlimited mining risks. At a recent conference between the Commission and mine operators, Mr. Albert Burch estimated on the basis of Nevada experience, that the California rate should be 5 per cent, and we are greatly pleased to see that the Commission has found it possible to meet the wishes of mining men fully in this particular. We hope that care and attention may so decrease the number of accidents as to permit a steady reduction in the insurance rate. We do not look upon 5 per cent as low. One large company carrying its own risk from a special fund levied at that rate, and with apparently a normal number of accidents, is building a surplus rapidly. With safer mines, and workmen and superintendents more keenly alert to prevent accidents, it should be possible to operate at a much lower rate.

LOOKING FORWARD

Speaking before the Copper Country Michigan College of Mines Club last week, Mr. O. F. Bailey told of the 'Safety First' work inaugurated in the Calumet & Hecla mines by Mr. James B. McNaughton on the basis that it was "better to reduce the number of accidents than to send flowers after they had happened." Mr. Bailey explained that after a period of careful recording and studying of accidents as they took place, and of interesting the foremen in the work, 'Safety Committees' were just about to be organized when the labor troubles of 1913 delayed the whole matter. A year later these committees were organized, and they are now at work. Mr. Bailey said further:

"We have 37 department committees consisting of 190 members. These are picked from the workmen and they are appointed to serve a period of from two to six months. For example, the Osceola Consolidated company has four department committees, three underground of from five to six men each, and one surface committee consisting of five members. An underground committee is usually composed of a boss, a miner, a timberman, a shaft-man, a trammer or laborer, and in some cases an efficiency engineer. The surface committee is made up as a general thing of a boss, a carpenter, a blacksmith, a machinist, and a laborer. The intention is to have each and every occupation represented. The object in this is to encourage men from all of these occupations to call attention to unsafe conditions or methods, and we figure that it is easier for them to do this with one of their own number.

"Each department safety committee is scheduled to make a trip of inspection twice each month, making a minimum of four trips for each committee. These trips usually consume half a day, the remainder of the day being given over to discussion of what they find and in making a report and recommendations to the general committee. A department committee does not make all of its trips through the same mine; for instance, we try to arrange it so that the underground committee for the South Kearsarge will make two trips through the South Kearsarge mine, one trip through the North Kearsarge or Old Osceola, and still another trip through the Calumet & Hecla or some other. While making these inspection trips each member is expected to talk with the men working underground, especially those of his own occupation, and explain to them the object of the committee and to secure such information and suggestions as he can as to improvements in conditions or methods, which may result in the prevention of accidents. The members of these committees are paid full time and actual expenses while engaged in this work. We have had a few cases where the report was to the effect that they found everything in perfect condition, but most of them have taken the matter seriously.

"I have picked out one report which will give you an idea of what we are receiving.—'The Committee recommends: That the loose ground just below the 48th level be taken down; That the hanging be laced up on the 69th level north and the 70th level north, to make it safe for the trammers, and that stumps be placed in these two levels to keep up the back of the level; That the 71st level north be timbered up before any more ground is taken out and that a large piece of loose ground on the south end of the stope be taken down; Our Committee's attention was called to the fact that Joseph Boggio's timber crowd was without necessary tools for the safe conduct of their work and we recommend that he be furnished with axes, saws, chains, hammers, and snatch-blocks. We further recommend that the timber crowd of John Curto's be supplied with three-quarter inch rope.'

"Altogether we have twelve general committees, consisting of 80 members. These general committees are permanent, that is, the same positions are represented on the committee at all times, and in most cases the chairman of a general committee is also a member of the central safety committee. For example, the superintendent of the Ahmeek mine is chairman of the general committee for that mine and he has associated with him on the committee, the master mechanic, mining captain, and surface foreman. These general committees meet monthly. They read the reports and recommendations from the department committees and take action upon such matters as come within the authority of the members of the committee, and at the same time they make a report and recommendations to the central safety committee, and include in their report matters reported by the department committees.

"When new members are appointed on department committees it has been our custom to get seven or eight committees together at one point and outline the plan to them, giving them assurance that their report on conditions and their recommendations are solicited and disabuse their minds of any feeling that they are sent out to find fault with their boss or for the purpose of getting anyone into trouble. At the time these committees are appointed, every member is furnished with a 'safety button.' Another thing which we are now doing to bring the members of the safety committees, as well as other employees, closer together in this matter is the provision now being made for an assembly room at Calumet which will hold from 75 to 100 men where we can get them together and in addition to talking to them of our plans expect to give them a chance to be heard on this subject.

"I hope some day in the near future that we will be able to publish an Employees' Magazine for the Calumet & Hecla and subsidiaries. In addition to safety matters, it would be my idea to include items of general interest in our business as well as items of local interest, and I look upon it as a means of giving employees, as well as the general public, a better idea of what we hope to accomplish."

A Plan for Reviving Hydraulic Mining—II

By C. S. HALEY

In restraining the operations of hydraulic mining, the need of a training in the principles of the industry would seem to be as necessary as in the actual operation of the mines themselves. The building of satisfactory but economical dams, the recognition of the principles controlling the transportation of débris by running water, and the percentage of sand and clay, as well as light cobbles, in the gravel being worked, should all be taken into account. The natural erosion caused by the flow of streams under ordinary conditions is also a factor whose burden at present rests altogether on the hydraulic miner.

DÉBRIS DAM ON BEAR RIVER, CALIFORNIA.

Furthermore, the work requires all the time that can be given to it by a special body of men, if arbitrary restrictions are to be removed and a proper rate of production maintained. Under present conditions this is impossible. There is absolutely no reason why several times the present number of mines in the counties of Nevada, Sierra, Placer, and Plumas, as well as other counties to the south, should not be in active operation today, as far as the damage done by débris is concerned, except that regulation is not only exceedingly arbitrary, but intermittent. It really is easier, and pays better, in the more out-of-the-way places, to operate without a license than, by seeking to do so in a lawful way, to advertise the fact that you are working. More than one instance can be named of a legitimate operator being forced to bear the blame for the muddying of the rivers when the damage was actually done by another person on the same stream who was working intermittently and illegally. Is it any wonder that, under such conditions, operators who are acting in entire good faith, and in accordance with the law, become disgusted and close down their properties?

The photograph above is that of a dam on Bear river. It was built by two mining companies, one of which was later enjoined, while the other was permitted to work unrestricted. Later, permission was given to a third to hydraulic further up the river at a time when no settling pool remained at this dam. All of which goes to show the necessity of placing the regulation of hydraulic mining in the hands of a body of experienced men whose sole business it is to attend to it.

Another point which has tended to cut down hydraulic

production has been the increasing use of water for power and irrigation purposes, as well as its use for domestic supply in various towns. Recently in Auburn, the very town in which, 23 years ago, the movement to rehabilitate hydraulic mining began, a protest was filed against the muddying of the American river. Such protests, considering the condition of the river during about half the year in flood time, seem rather unnecessary. The use of a modern filter would be far more effective.

On the other hand, there is no question but that the power interests have grown to a position of great importance, as well as have the irrigation systems. Nevertheless, there is here no need for conflict. During from four to six months of the year the streams of the Sierras carry an excess volume of water which all the dams and storage systems yet devised, or that are likely to be devised during the next few centuries, cannot contain. This water, or a small portion of it, is what the miners would use, and during slack water they would be willing to shut down.

Such, then, are the conditions that confront the hydraulic miner today. The remedy for this state of affairs is simple, and should be applied, as it means the increasing of California's gold production from one to two millions of dollars annually, and the restoration of a portion of its former wealth to that portion of the commonwealth which was at one time its mainstay, its pride, and the source of its present prosperity.

Yuba River Discharge

In a recent publication of the United States Geological Survey, entitled 'The Transportation of Débris by Running Water,' the distinguished author, Grove Carl Gilbert, makes some very interesting statements. In speaking of the flow of the Yuba river and its suspended load, in 1879 when that stream was at its flood and hydraulic mining was being carried on, the following results were noted: When the discharge was 26,000 cu. ft. per second, a load of 0.35% by weight was noted: when discharge was 18,000 cu. ft., the load was 0.42%. At low water in the same year, when discharge was 510 sec.-ft., a load of 0.86% was noted. The fact that the river's load is greater in proportion during low water is explained by the fact that the turbid tributaries of the river are less diluted with the clearer water from other tributaries. From these results, it will be noted that a decrease of 97% in volume brought about an increase of virtually 150% in the proportionate load.

On the other hand, in 1906, when most of the hydraulic mining was suspended, with a discharge of 33,000 ft., the load was 0.065%. If the increase in load is at all regular for large volumes (which appears a warrantable assumption), the suspended load for a volume of 18,000 ft., the same as in 1879, would have been about 0.13%, or about one-third of what it was at the time when the hydraulic mines were working at capacity. In other words, the volume of débris carried down by natural erosion is, when the mines are mostly shut down, about one-third as much as when they were working full blast. As conditions of stream bed and other factors were in 1879 more favorable to débris suspension than in 1906, it may be assumed that this factor is low rather than high.

The fact that at low water the percentage of débris transported is so much less than it might be calculated to be is, of course, explained by the deposition of débris by the feebler currents, and consequent shoaling of the river.

Débris Deposited in Streams

Returning again to official statements, I find the following in the report of the Débris Commissioner, from May 1901 to December 1902:

"The débris flow has caused the destruction of thousands of acres of fertile farms and the serious impairment of navigable rivers. Its attempted solution by injunctions by the courts has resulted in the destruction of a profitable industry of the state—that of hydraulic mining. Although many reports have been made on the subject, there are certain features that have not been given due weight, because the various investigators were not in touch with the actual conditions leading to the débris flow. It is this lack of knowledge that has in a great measure retarded its solution in the past. Careful consideration by those most interested will show that there is common ground to stand on, and it is hoped that it will lead to a 'community of interests' that is so necessary to hasten the much-needed work. * *

"The California Débris Commission in 1894, from the result of borings made by Col. W. H. Heuer, placed the amount of débris from Marysville to Daguerre Point, a distance of 9½ miles, at 308,000,000 cu. yd., and estimated 100,000,000 cu. yd. more to the Smartsville dumps, or a total of 408,000,000 cu. yd. I am of the opinion * * * 600,000,000 cu. yd. are deposited within this area. Of this amount there were deposited * * * during the period 1879-1899, * * * a total of 100,550,000 cu. yd. This represents the cleaning of the cañons, the washings of the hydraulic and other mines, and from natural causes.

"During the past eight years, I have endeavored to determine what the relative erosion was on Deer creek. * * * In the years gone by there was, in this watershed, considerable hydraulic mining, which is now practically abandoned. The dumps have been so cut and carried away as not to affect the winter flow. Altogether it can fairly be considered average conditions for natural erosion on the watershed. On January 3 and 4, 1895, there fell 7.08 in. of rain in 23½ hours. The creek was very high and muddy. The percentage of silt was determined and a rough gaging of the flow made. After making liberal deductions for safety, it was found that the creek carried 86,000 cu. yd. of material past the town in 24 hours. Two-thirds of this, by weight, may be counted as sand, being the mean of a number of observations and checked by comparison of the composition of soils. At that time the Excelsior Water & Mining Co. was hydraulicking at Smartsville.

impounding the debris in a worked-out pit. It is one of the largest concerns operating under the California Debris Commission. Yet that storm sent down more material in one day than the Excelsior company mined in six weeks—boulders, cobble, gravel, sand, and 'slickens.'"

Miner Must Restrain Natural Débris

The point that I wish to make and to emphasize is that under the present system of building restraining dams and allowing operation until they are filled up, the gravel miner is forced to take upon himself the burden of restraining the natural erosion of the elements—a burden which, besides being absolutely unfair to him, is too titanic in its proportions to be borne by one class or industry alone.

By a study of the maps of the United States Geological Survey, the principal Tertiary gravels of the state will be found to be in the counties of Nevada, Plumas, Sierra, and Placer. Eldorado, Amador, and Calaveras, as well as Tuolumne and others, contain but small quantities of gravel compared to the immense bodies of the Alta, Gold Run, and Red Dog channels, and others around Dutch Flat and Nevada City.

During the early days of the industry, work was mainly confined to the lighter, surface gravels, and it is from these that most of the débris has come. The gravel which it is desired to work at the present day is as a whole much heavier in character, with the possible exception of isolated bodies such as that at You Bet. Of gravel of this type, where dumping is not done directly in the rivers, but upon bars adjacent to them, it may be safely assumed that from 75 to 80% of the entire material stays on the original dump or within a few hundred feet therefrom. The finer material and the sand, of course, goes down to the river, with the exception of what settles between the boulders of the dump. For this reason, it may be made as a fairly general statement, covering at least three-fourths of the Pliocene channels in California at the present day, that not more than 15% of the washed material will come within the field of the restraining dams.

Financing Reclamation Work

This being the case, it would seem that the matter of restraining this material from the rivers down in the valley should be fairly simple. A gravel tax would be cheerfully borne by the miners if they were allowed to have a fair chance to operate, and the revenue could be applied to the building and maintenance of restraining works in the principal river channels. This tax should in all fairness be regulated according to the relative fineness of the material being worked, thus throwing the burden of maintenance more heavily upon operators who produced the more débris. This tax being a yardage tax, would also not bear too heavily upon the small operators. Further, it would have the effect of eliminating all the operators who, by reason of the poor quality of their gravel, or its excessive fineness, could not afford to pay the tax. In this way a more real restraint would be put upon the quantity of débris than by all the engineering works that could be constructed.

Another point can here be readily made which illustrates again the principle of community of interest. Of late years the destruction of valuable farming land by gold dredging operations has been the subject of a good deal of comment, and most of the larger dredging companies in California at present live in a fear that public sentiment may cause them to close down their operations in the near future. In Australia, the necessity of reclaiming the damaged lands has long been recognized, with the result that in farming communities the gold dredges are forced, at considerable expense, to reclaim their land behind them by pumping the sand and silt back on top of the boulder piles. In the report of the Secretary for Mines, Victoria, series 1907 to 1913, detailed descriptions of the methods adopted, accompanied with photographs, are given. The expense involved in reclaiming is borne by the dredging companies, and, notwithstanding the value of the reclaimed land, cuts into profits enormously. Naturally, the American companies have been loath to follow their example. Nevertheless, the time is not far distant when the alternative of reclaiming the lands or closing down is apt to be forced upon them by some zealous legislature, anxious for re-election.

Reclaiming Dredge Tailing

As everybody who has been in the dredge fields knows, the uneven and irregular gravel heaps can be leveled, though at considerable expense. But getting a top soil upon them is another matter. It requires the use of suction pumps to bring up the sand and silt from the river beds. And just here is where the hydraulic miner could step in, to both his own advantage and that of the dredge companies. A few suction dredges, stationed in such places as on the Yuba river near Hammonton, on the Feather river below Oroville, and other similar localities, could handle all the material that the mines could dislodge from their now coarse gravel, aside from the use of restraining dams. The maintenance of these dredges could be paid out of a fund created by a gravel tax levied as suggested, and the dredge companies could co-operate. The cry of forty years ago was, 'Too much sand and silt'; that of today seems to have been reversed, in the case of the dredgers.

To carry out any readjustments of the problem of débris control, certain radical changes would have to be made. In the first place, the whole problem should come under the direct control of the United States Bureau of Mines, which is now extending its activities into the Western fields. The débris commission should be composed of engineers appointed by the Bureau of Mines, and a man of practical experience should be retained on the job as long as possible, as it is in his experience and length of service that his chief value would lie. One member of the commission should, of course, be an army officer, representing the river and harbor work. The others should be veteran mining engineers; there will be many capable men found retired from the most active

forms of the profession. Under them should be a body of younger engineers, whose chief duty should be to keep records of all work done, survey and engineer dams and restraining works, survey and keep contour maps from year to year of all operating properties, which maps would show from computation of dumps and worked out ground just how great a tax should be borne by individual companies and operators, and how much impounding space has been filled in by actual working, and not by natural erosion. This would not be complex, nor need it require a large corps of engineers, as with stadia and transit work; large areas could be gone over in a very short time, and the maps readily altered from year to year.

The adjustment and regulation of a gravel tax, to distribute the burden of restraining works and dredges, would of course require the judgment and training of a skilled engineer, with long experience in hydraulic mining. At first there would be difficulties and minor dissensions, but as time went on, certain regular criteria would gradually assume definite form, and the tax would be justly administered. The objection may be made that superior opportunities for corruption would be offered, but if the work were carried on by the government, it would be infinitely less open to such practice than when carried on under the auspices of such an organization as the once powerful Anti-Débris Association has come to be.

Advantages of Plan Proposed

The chief advantages of such a readjustment would be: (1) a definite understanding between the government and the hydraulic miners as to just where the latter stand—something which seems at present to be very vague; (2) a distribution of the burden of restraint which would be just and equitable; (3) the elimination of natural erosion from the question and the removal of the prohibitive tax which it now imposes on the industry; (4) a part solution of the waste dredge lands problem, which is now vexing the state more and more; (5) the removal from the shoulders of the officers involved in the river and harbor work, a burden they would thankfully be rid of, and its administration in more experienced and qualified hands, not subject to frequent change.

And the greatest advantage of all would be the immediate resumption of hydraulic mining on a scale which would once more be worthy of the commonwealth which the industry has helped so much to create. There is no question but that the gold production of California could readily be increased from two to three millions a year, if the owners of hydraulic mines could once be assured of their rights under the law, and not under the very dubious judgment of a body of men who have but little time to devote to the subject, and who receive no compensation for the time which they do devote to it. The effect of the change would be astonishing and instantaneous among the mining men of the state.

In conclusion, then, the whole matter resolves itself in this way. An act of Congress will be required to repeal the Caminetti act and to place the whole question under the jurisdiction of the Bureau of Mines. The latter has already, in the course of the few years of its existence, shown itself capable of dealing promptly and efficiently with many problems wider in scope and more involved in detail than is that of the rehabilitation of hydraulic mining in California. This being the case, should it favor such legislation its enactment by Congress should be easy to obtain.

Having assumed control of the situation, a commission somewhat along the lines suggested could take charge of the entire matter and work out the details of a plan which would be at once satisfactory to the miners and not prejudicial to the agricultural interests. There is plenty of common ground to stand on, and the attitude of the miners can hardly be surpassed in liberality by the farmers. The resumption of hydraulic mining on its former scale is, of course, not to be expected; but the half billion to a billion of dollars that is at present absolutely locked up in useless ground of the Sierra Nevada may well be expected to be in time added to the riches of the commonwealth of California in increasing volume as time goes on and the efficiency of a practical working plan of control is demonstrated.

The result of the whole thing would in a very few years mean the building up of a now partly impoverished and retrograded district in the eastern part of the state, the employment of a considerable army of useful men, and an increase of gold circulation which at the present time is very sadly needed. Shall we continue to talk about it, or shall we get some action?

The Transvaal being such a large gold producer, it is highly desirable that the mines be kept in operation during the war. At the quarterly meeting of the Chamber of Mines at Johannesburg, the president, E. A. Wallers, made the following statement: "At the commencement of the war, the matters of the supply of essential stores for the mining industry, and the disposal of our gold naturally claimed the very closest attention of the executive committee. It is with great pleasure that I am able to state that, with the efficient and sympathetic help of the government, both here and in London, every assistance has been given to the industry to enable us to insure the continued working of the mines. The arrangements made in regard to mining supplies are satisfactory, and there is little doubt that sufficient will come forward as required, although there may be a little temporary stringency at certain times, but nothing, as far as we can see, that should prevent us from carrying on operations at full blast. Most of the members of the Chamber have pooled their supplies of cyanide, mercury, and zinc, and have entered into joint contracts for the supply of these articles for an appreciable period. As regards the question of mining supplies in general, I might add that we have at various times met the representatives of the Chambers of Commerce and Trade, and their attitude throughout the whole matter has been extremely helpful."

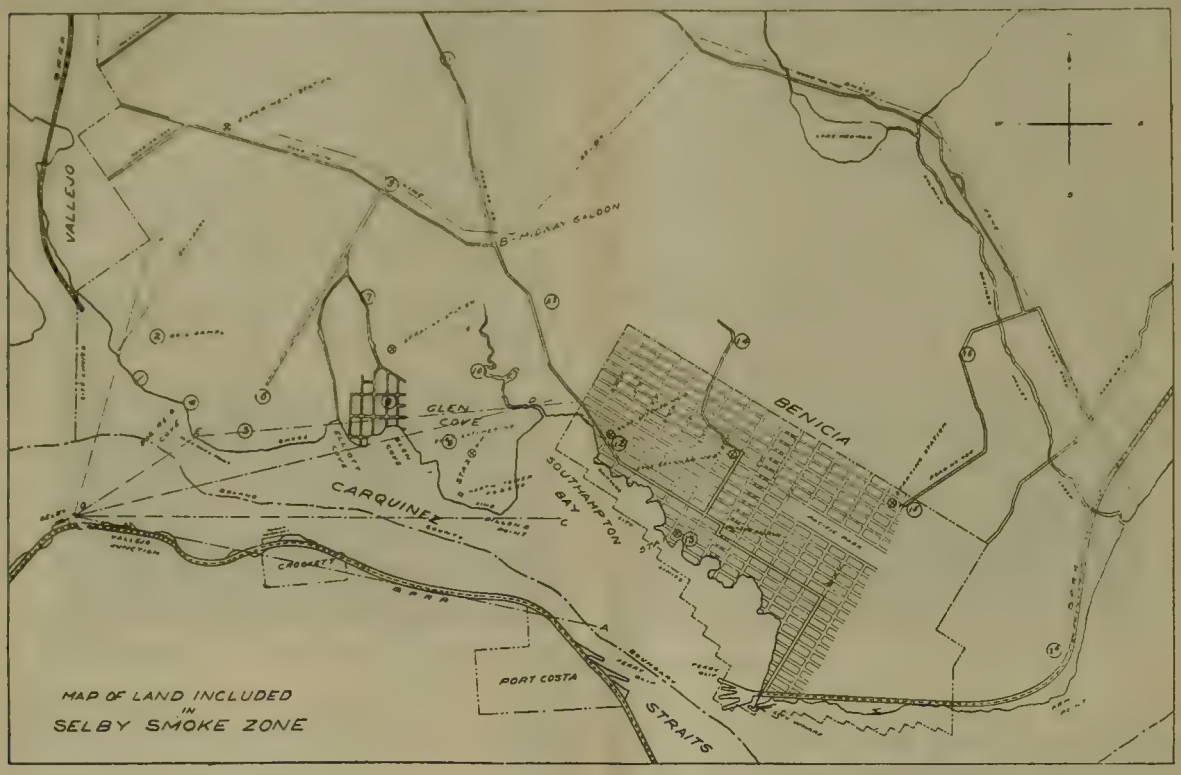
Report of the Selby Smelter Commission

The filing of the report, findings, and recommendations of the Selby Smelter Commission with the Superior Court of Solano county settles finally and conclusively the long-continued controversy between the residents of Benicia and the adjacent agricultural country and the Selby Smelting & Lead Co. concerning the alleged disagreeable and injurious effects produced by the smoke from the Selby smelter.

The smelter operated by the Selby Smelting & Lead Co. is situated near Vallejo Junction in Contra Costa county, California, at the western end of the Carquinez straits. The city of Benicia is situated in Solano county at the eastern end of the straits, about five miles from the smelter. During nine months of the year the prevalent trade winds blow the smoke from the Selby smelter over and into the city of Benicia and the agricultural area lying between Benicia and Vallejo.

On March 14, 1905, action was brought by the district attorney of Solano county, California, in the Superior Court of Solano county, praying for an injunction which would restrain and enjoin the Selby Smelting & Lead Co. from permitting injurious smoke and gas from the Selby smelter to blow over and upon the city of Benicia and the tributary country. The case was brought to trial on August 7, 1906, and judgment of the court in favor of the plaintiff was rendered on July 16, 1908. The decree of the court was to the effect that during eight months of each year between March 15 and November 15, the Selby company was enjoined from discharging noxious gases and fumes into the open air in such a manner that the same would be carried into and upon the city of Benicia and the tributary country in Solano county in such quantities as to be offensive to the senses and to interfere with the comfortable enjoyment of life and property.

After motion for a new trial was made by the defendant and denied by the court, an appeal was thereupon taken to the Supreme Court of the state. On June 12, 1912, the judgment of the trial court was affirmed by the Supreme Court.



During the period covered by this litigation the Selby company had been making efforts toward the elimination of some of the objectionable constituents of the smoke, these efforts having resulted in the removal of the major portion of lead, arsenic, and sulphur trioxide from the smelter smoke. In the spring of 1913, although the Selby company maintained that it had abated the the nuisance, complaints were made by the residents of the area that a nuisance still existed, and that the decree of the court was, therefore, being violated by the smelting company.

Various considerations, among them the prospective heavy expense which would accrue to both parties to the litigation as a result of a trial of the smelter com-

pany for contempt of court, led to conferences of the attorneys representing both sides, which resulted in an agreement to submit the question of fact as to the violation of the decree of injunction to a board of technically trained men, deemed by both sides to be qualified to act in such a capacity, and equal financial responsibility of the parties in the expense of the commission's activities. The result of the agreement was the filing of a stipulation in the record of the cause providing for such a board. On May 22, 1913, this board was organized as the Selby Smelter Commission, with the following personnel: J. A. Holmes, director U. S. Bureau of Mines; E. C. Franklin (at the time of appointment chief of the chemical division of the Hygienic Laboratory of the U. S. Public Health Service), professor of organic chemistry, Leland Stanford, Jr., University; Ralph A. Gould, chemical engineer, San Francisco, secretary of the commission.

Facts to Be Determined

The function of the Selby Smelter Commission was to determine the facts and report its findings on the following:

1. Is the Selby smelter operating in such a manner as to violate the decree of the court dated July 16, 1908?

2. If the defendant company is violating the decree, what is the extent of the violation?

3. If the defendant company is violating the decree, what steps must be taken by the defendant to avoid a violation of the decree?

For the determination of facts, the commission and its staff have carried on careful and complete investigations of all matters which in the opinion of the commission could have any bearing on the questions at issue and to be answered. These investigations were made by the following staff of trained scientists and technical men, no one of whom otherwise than in arriving at the truth was directly or indirectly interested in the findings of the commission: A. E. Wells, metallurgist and chief chemist, in charge of smelter investigations and field work; C. B. Dutton, special legal agent, U. S. Bureau of Mines; Charles F. Shaw, professor of agronomy, College of Agriculture, University of California; E. E. Free, soil expert and agronomist; J. W. Blankinship, plant pathologist; Wyatt W. Jones, plant pathologist; R. W. Doane, professor of entomology, Leland Stanford, Jr., University; C. M. Haring, professor of veterinary science, College of Agriculture, University of California; K. F. Meyer, professor of bacteriology and protozoölogy, University of California.

Through the courtesy of Thomas Forsyth Hunt, dean of the College of Agriculture, and F. T. Gay, of the department of pathology, the commission had the valued co-operation of several of the staff of the University of California. The facilities of the U. S. Bureau of Mines also were placed at the disposal of the commission and much assistance was rendered by its staff of experts, especially F. G. Cottrell and L. H. Duschak.

The results of the investigations of the several experts were presented to the commission in the form of reports, as given below:

Results of Investigations

1. A Detailed Study of Statements of Residents of the Selby 'Smoke Zone' as regards the presence of a Nuisance in the Area, by C. B. Dutton.

2. Conditions in and around the Selby smelter and the Selby 'Smoke Zone,' by A. E. Wells.

3. Investigations to Determine the extent of the Contamination of the Atmosphere in the Selby 'Smoke Zone' by the Smelter Emanations, by A. E. Wells.

4. Investigations to Determine the Sulphur Dioxide present in the Atmosphere in places outside the Selby 'Smoke Zone,' by A. E. Wells.

5. Conditions of Plant Life in the Selby 'Smoke Zone,' by J. W. Blankinship.

6. The Occurrence of Sulphur Dioxide Injury to Plants in the Selby 'Smoke Zone,' by Wyatt W. Jones.

7. Insect Pests in the Selby 'Smoke Zone,' by R. W. Doane.

8. Agronomic and Soil Conditions in the Selby 'Smoke Zone,' by Charles F. Shaw.

9. Investigations of Live Stock Conditions and Losses in the Selby 'Smoke Zone,' by C. M. Haring and K. F. Meyer.

10. Fumigation Experiments to Determine the Effect of Highly Diluted Sulphur Dioxide upon a Growing Grain Crop, by A. E. Wells.

11. Investigations to Determine the Effects of Sulphur Dioxide on Man, by A. E. Wells.

12. The Possibility of Reducing the Sulphur Dioxide Output from the Selby Smelter—(*a*) Investigations on the Gases from the Dwight and Lloyd Sintering Machines of the Selby Smelter; (*b*) Studies in the Commercial Utilization of the Sulphur Dioxide produced by the Selby Smelter; by A. E. Wells.

13. Bibliography, 'The Effect of Sulphur Dioxide on Vegetation and Animal Life.' The Chemists' Club Library, New York.

The field investigations upon which these reports are based were conducted between June 1913 and September 1914.

Is There a Nuisance?

In collecting the data for his report, Mr. Dutton interviewed the residents of the 'smoke zone' in as thorough and as representative a manner as possible, and sought to obtain directly their ideas concerning the existence of a nuisance. The opinion expressed as to the existence of the nuisance and injury from the smelter smoke varied from the extreme of unreasoning radicalism to entire indifference.

A study of Mr. Dutton's report reveals the fact that two classes of odors have been described by the residents of the 'smoke zone' as 'smelter smoke;' one is undoubtedly that due to sulphur dioxide, and the other is that of certain products from the refining of petroleum, the so-called 'oil smell.' Judging from the statements of these residents, there can be no doubt that in the past, un-

til 1910 or 1911, there was present at times in the 'smoke zone' fumes and gases possessing very disagreeable odors, the 'oil smell,' which could not possibly have been due to smelter emanations. Subsequent to 1911, 'oil fumes' have not been so prevalent, but occasionally the odor of sulphur dioxide has been detected.

The conclusions derived from Mr. Dutton's report are that among the greater proportion of the residents there is at the present time only slight, if any, legitimate objection to the presence of 'smelter smoke' in the atmosphere of the 'smoke zone.' Under extremely unfavorable conditions and to supersensitive persons, 'smelter smoke' may occasionally be smelled in the area, but to the fair minded person such occurrences do not prevent the enjoyment of life nor are they detrimental to the health of the community.

GASES FROM BLAST-FURNACE AND ROASTERS WITHOUT AND WITH CURRENT OF COTTRELL APPARATUS ON.

The commission considers that one of the most important phases of its investigations has been the direct determination by chemical analyses of the sulphur dioxide contained in the atmosphere of the 'smoke zone.' This work was conducted under the superintendence of A. E. Wells, with the assistance of eight trained chemists and six helpers, and is believed by the commission to be the most extensive and exhaustive of its kind heretofore.

For the determination of sulphur dioxide, a method has been developed which is believed to be by far the best yet used in work of this character, in that it combines in a most satisfactory manner those characteristics which permit 'instantaneous sampling,' rapidity of execution, easy field manipulation, and a high degree of accuracy. Concentrations of sulphur dioxide as low as 0.2 parts per million of air are rapidly and easily determined by the method as developed and finally adopted by the commission. For the essential features of the method, the commission is indebted to J. R. Marsden, chief chemist of the Selby smelter.

For making observations in the field, two permanent laboratories were established, where sulphur dioxide determinations were made at brief intervals daily, and an automobile was equipped as a portable laboratory, by means of which determinations were made in all parts of the Selby 'smoke zone,' as well as in many places outside the Selby 'smoke zone.' The field investigations to determine the sulphur dioxide content of the atmosphere in the Selby 'smoke zone' extended from September 17 to December 15, 1913, and from March 1 to April 15, 1914, during which time 4862 determinations were made. During the same period about 700 determinations were made in places outside the Selby 'smoke zone.'

During the entire course of the investigations, especial attention was given to the metallurgical processes going on at the smelter and the amount of sulphur dioxide eliminated from the smelter during the tests in the 'smoke zone' has been checked by the staff of the commission. Determinations were made when the wind conditions were the worst possible for the area, and when, at the request of the commission and under its supervision, the output of sulphur dioxide from the smelter was the highest possible. Other tests have been made with the smelter entirely closed down and with the wind conditions favorable and unfavorable to the 'smoke zone.' Every attempt has been made to obtain these data under all possible conditions, in order that maximum, average, and minimum figures might be obtained

as to the sulphur dioxide content of the atmosphere of the 'smoke zone.'

Atmospheric Content of SO_2

Of the total number of 'instantaneous' samples (4862) taken in the Selby 'smoke zone' during the period of field work, 75% contained less than 0.2 parts SO_2 per million of air; 86% contained less than 0.4 parts SO_2 per million; and over 97% contained less than 1 part SO_2 per million parts of air. Only 21 samples, or 0.43% of the total contained more than 2 parts SO_2, and no sample analyzed more than 7.1 parts SO_2 per million. The higher concentrations were found only when puffs of the smoke from the Selby smelter were drifted by a gentle breeze over the most exposed portions of the 'smoke zone,' and at no time did a concentration greater than 2 parts SO_2 per million persist for a continuous period of more than thirty minutes. The total time during the whole period of the commission's investigation that the concentration of sulphur dioxide was more than 2 parts per million at any part of the 'smoke zone' was 220 minutes, or 3 hours and 40 minutes. Only on six occasions was the concentration above 3 parts SO_2 per million, and the total time that the concentration was above that amount was 65 minutes. Within the city limits of Benicia itself, the maximum concentration of sulphur dioxide found was 2.4 parts per million, and only 22 out of the 2840 samples taken in this portion of the 'smoke zone' contained more than 1 part SO_2 per million.

In the business section of San Francisco during calm mornings, the concentration of sulphur dioxide was found to be as high as 1.8 parts SO_2 per million. Under brisk wind conditions as are prevalent during the late morning and early afternoon during the period of trade winds, the sulphur dioxide content was seldom over 0.2 parts SO_2 per million. On the ocean beach no determinable quantity of sulphur dioxide was found. In Oakland and Berkeley, of the 148 determinations made, none showed a concentration of sulphur dioxide higher than 1 part per million. One hundred and three determinations were also made in the vicinity of Richmond, which showed an average value of 1.1 parts SO_2 per million, and a maximum of 4.5 parts SO_2 per million. In Martinez and vicinity, 168 determinations were made. The average of these determinations was 0.23 parts SO_2 per million, and the maximum 1.7 parts SO_2 per million.

The results of these investigations show that, on the one hand, although the atmosphere of other areas investigated shows a higher constant concentration of sulphur dioxide that the Selby 'smoke zone,' the maximum concentrations within that zone, on the other hand, are higher than any of the other areas investigated. These higher concentrations, however, never persist for more than a few minutes.

What Constitutes a Nuisance

In order to determine whether the concentration of sulphur dioxide found in the 'smoke zone' could be considered sufficient cause for a nuisance complaint, or could be injurious to the health of people residing in the zone, it became necessary to study the effects of high dilutions of sulphur dioxide upon man and to determine the sensitiveness of various persons to the gas. The following is a brief summary of the results of these investigations:

Of the 60 subjects experimented upon, 32 of whom were previously acquainted with the gas, no one was able to detect the presence of 1 part SO_2 per million of air. With concentrations of 2 parts SO_2 per million, several of the subjects detected the presence of something foreign in the air, but could not identify it, and two identified the gas by taste. With concentrations of 3 parts SO_2 per million, the greater proportion of the subjects acquainted with the gas were able to identify it, and at 4 parts practically all were able to do so. The greater proportion of the subjects not previously acquainted with sulphur dioxide did not identify the gas until the concentration was greater than 4 parts per million. In the investigations to determine what concentration of sulphur dioxide would be considered a nuisance to all persons, very little agreement was found between the ideas expressed as to what was a nuisance. As a general statement, it may be said that concentrations of 3, 4, and 5 parts SO_2 per million were not considered to be a nuisance even if continued for considerable periods of time; concentrations of from 5 to 10 parts SO_2 per million, if continued for 10 to 15 minutes, would be considered a nuisance; concentrations above 10 parts SO_2 per million, if existing for only a few minutes, would certainly be called a nuisance. It was definitely determined that concentrations below that at which the sulphur dioxide can be smelled, that is, below about 3 parts SO_2 per million, cannot possibly be considered a nuisance or cause for discomfort.

SO_2 in Air at Benicia

It will be recalled that in the atmosphere of the city of Benicia the sulphur dioxide concentration never reached 2.5 parts per million during the whole period of the commission's investigations, and that at one of the most exposed spots in the 'smoke zone' there were but six short periods when it was above 3 parts, reaching a maximum of 7 parts on one occasion only. In view of the established facts therefore, it is quite impossible to maintain that during the period of investigations by the commission the residents of the city of Benicia or of any other part of the 'smoke zone' have been subjected to a nuisance as the result of discharge of sulphur dioxide from the Selby smelter.

Extended experiments were conducted to determine whether such concentrations of sulphur dioxide as are found in the Selby 'smoke zone' are capable of doing any injury to crops or other vegetation growing in the zone. The plan of these experiments was to allow barley plants to grow normally in an open field, and occasionally and for definite periods of time to subject the plants to definite concentrations of sulphur dioxide. These experiments were carried out with the following object in

mind: 1 to determine the visible injury produced by definite concentrations of sulphur dioxide applied for definite periods of time; (2) to determine the economic injury or decrease in yield resulting from the visible injury produced; (3) to determine the possibility of 'invisible injury' to a growing grain crop and the extent to which this may take place.

Crop Experiments

In a field of growing barley, experimental plots 4 ft. by 20 ft. in area were laid out, and covered during periods of fumigation with a cabinet designed so as to interfere as little as possible with the illumination of the plot. The sulphur dioxide air mixture was blown in at one end and allowed to escape at the other, in such a way as to maintain a steady stream of air containing sulphur dioxide through the cabinet during the fumigation periods. The length of time of each fumigation varied between two minutes and one hour. Experiments were carried on simultaneously on a farm near Vallejo and at the University farm at Davis. At Vallejo, 106 plots, and at Davis 35 plots were experimented upon, with results which were concordant in every respect.

A concentration of 5 parts sulphur dioxide applied for an hour under ordinary humidity conditions produced considerable visible injury. Visible injury is produced on growing barley by concentrations of 1 part SO_2 per million of air if the length of time of application is sufficiently great. Thus, three fumigations of seven hours each produced slight visible injury and no reduction in yield, with air containing 1 part sulphur dioxide per million. Sixty-two fumigations of one hour each, with 0.5 parts SO_2 per million, irregularly continued through the growing period, produced very slight visible injury and no reduction in yield.

From a study of the results of these experiments in connection with the information gained from the investigations upon the sulphur dioxide content of the atmosphere of the 'smoke zone,' the commission has found that from time to time conditions may arise under which slight visible injury will be visited upon susceptible plants growing on the more exposed portions of the 'smoke zone.' Since, however, plants will endure a considerable amount of visible injury without any diminution of crop yield, the commission concludes that within the 'smoke zone' no economic damage results from the smoke of the Selby smelter. This conclusion receives convincing confirmation from the observations of the commission's plant pathologists, who have found no indications whatever of economic sulphur dioxide damage within the area of the 'smoke zone.' It was found that when the plants were at one time badly bleached, this fact did not necessarily mean a decrease in the yield. A number of plots badly bleached in the early stages of growth were observed to recover rapidly, and it was found that their yield at maturity averaged within three per cent of the yield from the check plots. Short time fumigations repeated a great many times, and of sufficient intensity to keep the foliage bleached throughout the season, were much more effective in reducing the yield than were one or two very strong fumigations.

No economic damage or loss as expressed in decreased yield of crops or decrease in the fertility of the seed resulted from the treatment of barley plants with quantities of sulphur dioxide insufficient to produce marked visible injury. Thus, there was no indication of an economic 'invisible injury.'

For the determination of the condition existing in the 'smoke zone' as regards the crops of various kinds and the many kinds of plant life found therein, the commission engaged two plant pathologists of a high degree of training and of extensive experience in the study of plants in relation to smelter smoke injury. Each was commissioned to make a complete plant pathological survey of the area, reporting all abnormal conditions which exist and to trace, wherever possible, the actual cause of such conditions. The only conclusions which can be drawn from the work done in the plant pathological survey are that such poor conditions of plant growth as exist in the 'smoke zone' are directly traceable to one or more of the following causes: plant diseases, predatious insects, poor soil, poor cultivation, lack of water, and indifference to all of these conditions by the farmers of the area. None of the conditions existing so far as vegetation is concerned can be attributed to the effects of the smoke from the Selby smelters.

From a consideration of the data collected during the entomological survey, the general conclusion reached is that lack of cultivation, lack of proper pruning, absence of spraying and fumigation with insecticides, are mainly responsible for the unusually bad condition which exists among the trees, vines, and shrubs in the Selby 'smoke zone.' The indifference of certain farmers to these conditions is illustrated by the fact that during his investigations, Mr. Doane volunteered to advise the farmers free of charge as to the proper methods of combating insects and to supervise their attempts, yet none of them accepted his services.

Poor Soil Means Poor Crops

The problems presented to the agronomic soil experts were: (1) Are the agronomic conditions of the 'smoke zone' such as to conduce to high agricultural development? (2) Does there exist in the 'smoke zone' any soil trouble which is responsible for any poor condition of plant growth which may exist? (3) Has the soil of the 'smoke zone' been polluted by materials deposited therein from smelter smoke? (4) If such pollution exists, is it of economic importance? May it influence the growth of crops or plants for good or for ill?

The yield of crops in the area is below the average for areas in other parts of the state having the same climate. The poor quality of the soil and the poor agricultural practices are sufficient to account for the existing bad conditions as to crops and crop yields. No soil trouble exists, other than the poor quality of the soil, to which the existing conditions of plant growth can be traced.

In the matter of soil pollution, an extensive investigation was conducted. Samples of soil were taken from various portions of the area and subjected to examination to determine the presence of lead and arsenic. These metals were found to be natural constituents of the soils of the 'smoke zone' and the country surrounding it. A slight increase in the lead and arsenic present in the soil was found in the area nearest the smelter, but this increase was shown to be of no economic importance. Supplementing this work, the data collected by Mr. Wells on the presence of lead and arsenic in the air before the building of the roaster bag-house proved that although there was lead and arsenic present, the amount was unimportant from the point of view of soil contamination.

Damage to Animals

The veterinary survey included the identification of every horse and the enumeration of all the other important domestic animals within the zone. The listing of the horses developed the fact that 31 horses out of a total of 308 within the 'smoke zone' were suspected as being of the type known as 'roarers.' Twelve of these 31 were diagnosed as 'roarers,' the 'roaring' condition being brought about directly by the paralysis, either part or complete, of certain muscles of the throat and neck, which causes improper functioning of the respiratory system, so that under exercise the animal so affected breathes with a peculiar roaring sound. In the opinion of the experts, the condition of these roarers was due to chronic lead poisoning and that the animals had been injured by smelter smoke.

Soon after beginning its investigations, the commission came to the conclusion that a study of the atmosphere of the 'smoke zone' uncontaminated by the visible element of the smoke of the Selby smelter would be highly desirable. The Selby Smelting & Lead Co. was, thereupon, requested by the commission to take steps to remove all solids from the smoke that was being discharged from the plant. The Selby company, with commendable promptness, began the erection of a bag-house, by means of which the visible smoke from the roaster stack (the only source of visible smoke) could be eliminated. The commission's request was made October 25, 1913, and the installation of the bag-house was completed April 1, 1914, at an expense to the Selby Smelting & Lead Co. of approximately $35,000.

Studies of the Sintering Machines.

In order that full information might be at hand upon which to base recommendations for the subsequent operation of the smelter, in the event that a nuisance was found to exist within the 'smoke zone,' the commission early undertook certain studies to determine the possibility of eliminating the sulphur dioxide from the smoke of the plant before the latter is sent into the atmosphere.

An investigation was conducted to determine the possibility of operating the Dwight & Lloyd sintering machines of the plant in such a manner as would allow the production of a gas with a sulphur dioxide content sufficiently high for its recovery as a by-product. As a result of this investigation, it was found that by a proper preparation of the charge and the re-circulation of a part of the gases, that 80% of the total sulphur dioxide eliminated by the machines can be concentrated in a volume containing 7.5% sulphur dioxide. With this concentration it is possible to apply a commercial scheme for recovery by the production of sulphuric acid, liquid sulphur dioxide, or sulphur.

Findings of the Commission

From the personal investigations by the commission and from a study of the various reports presented, the commission finds that the Selby company violated the injunction up to April 1914, with respect to damage to certain horses in the 'smoke zone,' and that this violation ceased when the roaster stack bag-house was erected; Selby company has not violated the injunction with respect to disagreeable odor maintained in the 'smoke zone,' nor with respect to injury produced on crops or vegetation or on domestic animals through emitting sulphur dioxide into the atmosphere; the Selby company will not violate the injunction if it discharges less than 80 tons of sulphur dioxide per 24 hours into the atmosphere, and cleans the smoke of its visible element; the Selby company will not violate the injunction, if for purpose of cleaning or repairing the bag-house, visible smoke is discharged for periods not to exceed a total of 48 hours in any one month.

The Victorian state coal mine, Australia, produced 510,490 tons of coal during the past financial year. Sales amounted to 495,155 tons, as follows:

	Screened.	Run-of-mine.	Slack.	Total.
Government railways..	297,381	8,941	9,836	316,159
Other departments.....	10,957	1	1,815	12,774
General public	.....	....	166,221	166,221
Total	308,338	8,942	177,872	495,154

The selling price of coal per ton, delivered into cars at the pit mouth, at June 30, was:

	Screened.	Run-of-mine.	Slack.
To railway department	$2.64	$2.04	$1.56
To other public departments	2.76	2.04	1.68

There were 1011 men employed, and 457 miners averaged $3.36 per day. After every expense was paid, including depreciation and sinking fund, the profit was $5800.

Diamond mining in South Africa is at a low ebb on account of the war. In July there were 5018 Europeans and 40,861 natives employed at producing mines, compared with 233 and 101, respectively, in September. Non-producing properties, where no underground work is being done at present, are employing 2807 white men and 1776 colored men.

Butters' Salvador mine, Central America, yielded a profit of $29,000 from 3200 tons of ore in October. The mill recovery was 87.5 per cent.

SMELTING FURNACE AT SEMINOLE MINE.

Gold Mining in Georgia

By CLAUD. HAFER

The illustration shown above is that of what may be called a 'toy' smelter. It is at the Seminole copper-gold mine, 45 miles from Augusta, Georgia. This furnace was built ten years ago, and operated intermittently to smelt second-class concentrate from the mine, which was too low in copper content to ship to smelting works. It is a 24 by 36-in. rectangular brick stack with water jackets on the sides and back, and with three 2-in. tuyeres at the back. Its capacity varied from 10 to 15 tons per day of ore and concentrate, and two carloads of matte and one ton of rich base bullion were produced. Approximately five tons of concentrate was run into one ton of matte. The concentrate was a mixture of iron and copper sulphides, with 20% of silica and a little galena. The material was briquetted by hand, using a mixture of cement and lime for the binder, and was smelted without any additional flux. A matte was made containing 15 to 20% copper, 20 oz. silver, and 2 to 3 oz. gold per ton. The difficulties of operating small furnaces are well known, but this furnace in the hands of the skilled metallurgist who built and operated it, worked remarkably well.

The mine is 12 miles from any railroad and the difficulty of securing transportation and the expense of wagon haul were factors in bringing to an end the operations that were carried on in a small way here for a number of years. As there is now a prospect of the early building of a railway to within easy reach, there is a strong probability that work will be resumed. This property is well known as being one of the most interesting of Southern gold-copper deposits and is described in *Bull.* 455 of the U. S. Geological Survey.

Five different orebodies or veins occur in a mineralized shear zone in mica schist, which is some 300 ft. wide, and has been intruded by basic dikes, and subjected to considerable faulting. The veins were worked by open-cut methods in ante-bellum days for their gold content, and were discovered through the means of placer work along Soap creek, which cuts across the mineral belt. At water-level the ores became refractory to the simple early day metallurgical methods, and work was abandoned to be resumed after the war, when the sulphide ores were exploited. These contain copper and lead as well as gold and silver. A shaft explores the

CONSOLIDATED CHLORINATION PLANT, DAHLONEGA DISTRICT.

formation to a depth of 225 ft., and at the 145-ft. level a long cross-cut exposes the mineralized schists and the different orebodies. The orebodies are as much as 15 ft. in width, and consist of quartz and silicious schist impregnated with chalcopyrite and galena. Adjoining the ore the wall rock is heavy with auriferous iron pyrite, which is, however, not sufficiently rich to be mined and treated under present working conditions. Some of the ore is rich enough to be shipped direct to smelting works.

The mill for this purpose is equipped with a Gates gyratory crusher, Colorado Iron Works rolls, Twentieth Century jig, and two Bartlett tables, with the accessory belt elevators, revolving screen, and classifiers. Its capacity is from 30 to 50 tons per 24 hours. The mill was not altogether satisfactory, and in the event of commencing work again, stamps and Wilfley tables will be used as well as copper plates for amalgamation, as there is free gold in the semi-oxidized ore, and the big waste dump that has accumulated during many years, contains free gold in quantity to warrant re-milling.

The second photograph is that of the Consolidated Chlorination Works in the Dahlonega mining district. This was built in the boom days, early in the past decade, and has long been inactive. The plant's original capacity was 30 tons of sulphides daily, and the tonnage was to have been supplied by the 120-stamp combination amalgamation and concentration mill nearby. Plants of such size were out of place in Dahlonega and the result has been the nearly complete paralysis for years of this old mining district.

The Dahlonega district is today a museum of mining and in its limits one can find equipment of all kinds: dredges, pipe-lines, mining ditches, an abandoned electric tram line, and heavy pumping plants for supplying water for placer operations. There are some 500 stamps, ranging in type from modern heavy heads mounted on concrete blocks, down to primitive mills employing wooden mortars, made of a single hollowed out log lined with iron, and wooden stamps with iron shoes. The Southern miner is not less persistent than his brother of the West and effort is still being made to continue the work that was commenced here near a century ago. One company, whose personnel includes individuals who were victims of the boom, is putting up a small plant that is a modification of the old Dahlonega method of hydraulicking and milling. The soft low-grade ore will be excavated by means of a hydraulic giant working under a pressure of 90 ft. A 1500-ft. flume fitted with riffles to catch any nugget gold will transport the broken material to the mill where a revolving screen will be used for sizing. The coarse rock, after sorting, if feasible, will be milled in a 10-stamp battery, and passed over amalgamated copper plates. The fine material will be ground in a tube-mill without the addition of quicksilver, and passed over plates. If the tailing from either department is of sufficient value to merit secondary treatment, concentration, or cyanide equipment will be added. This installation is largely experimental, but on a sufficiently large scale to be profitable, if it proves to be technically successful when placed in operation.

The concensus of opinion among those who should know, is that the mines of Dahlonega under proper management can furnish plenty of low-grade quartz ore, so its future rejuvenation is possible. In recent years a large pyrite deposit was discovered near Dahlonega. Its outcrop has been traced 2000 ft., and on the dip it has been explored 150 ft. Its thickness proved by cross-cuts, trenches, and drill holes, is from 20 to 30 ft. An average sample of 8 cars taken across the vein gave the following result: S, 43.52%; Fe, 39.70%; Cu, 3.09%. As the deposit is a bedded vein of the Dahlonega type, it undoubtedly contains small amounts of the precious metals, and it is not likely that the average copper content is as high as the assay indicates. At all events this ore is a valuable source of sulphur dioxide for making sulphuric acid, and the residue may be leached to recover the copper, after which the iron oxide can be nodulized and sold to furnaces, as is being practised by the North Carolina Ore corporation at Winston-Salem, North Carolina.

Smelting the residue with the silicious gold ores from other mines, to an auriferous copper-iron matte, would be of the greatest benefit to the district, but all of this depends on cheap transportation to carry out the different products, and to bring in fuel and other supplies (charcoal locally made might be used as fuel), and at present there is no railroad nearer than 15 miles.

A Bottomless Scraper

In various Alaska placer districts a bottomless scraper bucket, known as the Bagley, is used with good results. It is illustrated in the accompanying figure. The bucket is hitched with a bridle as shown and is managed by

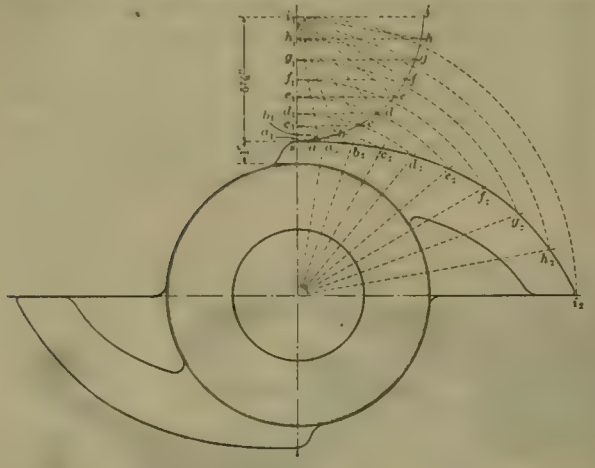
means of tail rope and lead rope. It fills and then rises and rides over the material below. There being no bottom, wear is less and at the same time the presence of a top and arrangement of the ropes assures a full load. This bucket is especially useful in heaping up soft material. The one pictured is in use on Otter creek in the Iditarod district to transport gravel from a winter dump to sluice boxes.

Improved Cam for Stamp-Mills

By ARTHUR B. FOOTE

*The cams at present universally used in stamp-mills lift the tappets with an involute form of curve, to which the surface of the tappet is always tangent; moreover, the line of contact between tappet and cam, if produced, would pass through the centre of the stem. This is no doubt a desirable feature, but the writer has long believed that it would be much more desirable if the cam were to pick up the stamp without shock and gradually increase the upward velocity of the stamp throughout its upward movement. The involute form of cam attempts to impart instantly a considerable upward velocity to the stamp, starting it from a state of rest, and the result is a destructive blow, a great deal of noise, and much wear and vibration.

The writer has developed a form of cam which will lift the stamp with a motion similar to that of the



METHOD OF LAYING OFF CAM.

piston of an engine between the end and middle of its stroke: in other words, harmonic motion, from the point of zero to maximum velocity. The curve will give this ideal motion only when the stamp is set for the exact drop for which it was designed, but the improved cam will not be as bad as the involute cam until the drop is reduced one-half. In other words, if a cam is designed for a 6-in. drop, it will be some improvement over the usual form of cam until the drop is only 3 inches.

Any cam, whatever its form, must of course lift the stamp in the same number of degrees of revolution; therefore, with this new form, since the stamp starts more slowly on its upward course, it must end by going faster, the average speed being the same as with the involute cam. The stamp, after it is no longer in contact with the cam, keeps on going up a certain distance, which is easily calculated. It is, therefore, possible to hang up a stamp without a cam-stick, if the fingers are not more than $\frac{1}{8}$ in. longer than necessary to hold the tappet above the cam.

With this design of cam the surface of the tappet is not tangent to the surface of the cam throughout the lift. The possible consequences of this were studied with a full-size model, and did not seem serious, as the engagement between the surfaces was an easy sliding motion, instead of a blow. If the drop is shortened, the blow becomes more and more pronounced, but the surfaces also become more and more nearly tangent.

Five cams of this new design have been running in one of the mills of the North Star Mines Co. now for over a month, fulfilling every expectation of the writer. Holding the hand on the tappet, it is impossible to feel the cam strike the tappet, although the stamps are dropping 107 times per minute.

The cut shows the method of laying off the curve of the cam, which will give approximately harmonic motion to the stamp. Spaces $s\ a_1$, $a_1\ b_1$, $b_1\ c_1$, etc., represent the distances traversed by the stem in equal intervals of time.

Charles W. Taylor, president of the Taylor Foundry & Engineering Co., of Grass Valley, California, rendered valuable assistance with this new cam.

*Paper presented to Am. Inst. Min. Eng., New York meeting, February 1915.

GOLD AND SILVER PRODUCTION of Honduras in August and September was as follows in ounces:

	Aug. 1914.	Sept. 1914.	Aug. 1913.	Sept. 1913.
Gold	1,260	1,291	878	1,114
Silver	167,995	161,424	121,170	163,968

According to a *Consular Report*, the European war has caused a material increase in the operating expenses of the mines. Cyanide has increased in cost 50%, zinc dust 100%, and tube-mill supplies 35%, all of which represents an added cost of approximately 70%. Zinc dust, classed as an explosive by United States transportation laws, can be shipped only on freight vessels, and boats carrying only freight do not touch at the Honduras Pacific port. *Revista Economica*, of Tegucigalpa, Honduras, has been publishing a series of articles dealing with the mineral resources of the Central American republics, including Honduras. The republic owes its prosperity under Spanish rule, and the greater part of its present progress, to its mineral resources.

GOLD YIELD of eight properties in West Africa in October amounted to 38,879 oz. The total for 1913 will be about 25,000 oz. more than in 1913, when it was 397,679 oz., against 362,940 oz. in 1912. Individual returns were as follows:

Mine.	Ore treated. Tons.	Gold recovered. Value.
Abbontiakoon	12,015	£19,065
Abosso	9,351	19,596
Akoko	233	980
Ashanti Gold Fields	10,064	37,225
Broomassie	4,543	16,652
Cinnamon Bippo	2,628	5,300
Prestea Block A.....	25,900	40,247
Taquah	5,670	16,826

Persistence of Ore at Kolar

By T. A. RICKARD

*In the Kolar goldfield of India the prevailing country rock is the Dharwar schist, which is hornblendic and pre-Cambrian.[1] This is traversed by lodes that in their strike (8° west of north) and in their dip (40 to 70° west) conform to the foliation of the schist, so that these ore deposits may be regarded as veins formed along planes of fracture coinciding with the foliation.[2] The coincidence is not perfect everywhere, for, as might be expected, the later fractures in places found an easier way by diverging slightly from the earlier structural lines of weakness.[3]

All the noteworthy mines are on one lode—the Champion Reef—but several subordinate veins have been exploited profitably. The orebodies represent the richly gold-bearing portions of the quartz veins; even where a vein becomes too poor to be mined the quartz may persist. From Plummer's shaft in the Mysore mine to Kennedy's shaft in the Nundydroog, a distance of three miles, the main lode is continuous except where intersected by dikes and cross-courses. At some levels this lode has been persistently profitable for 7000 ft. on the strike. The folds in the country rock do not interrupt this continuity; on the contrary, the orebodies are most generous in width where the schist has undergone a sharp fold, making a pleat, the axis of which marks the pitch of the shoot. The longitudinal sections of the four principal mines indicate that the various orebodies are comparatively uniform in their pitch, at an angle of 45° north. This fact has had an important bearing on the history of individual mines, for it has caused sundry ore-shoots to pass from one property into another. The width of ore averages about 4 ft., but stopes as wide as 35 ft. are recorded.

Of the seven properties linked along the main lode, four have become great mines; the other three need not be discussed in connection with the persistence of ore in depth. The length of the four productive properties

*From 'Persistence of Ore in Depth,' a paper presented to the Inst. M. & M., London, November 19.

[1]J. Malcolm Maclaren, 'Gold,' p. 15.

[2]F. H. Hatch, 'The Kolar Goldfield,' *Memoirs* of the Geological Survey of India, Vol. XXXIII, Part 1 (1901).

[3]For this note I am indebted to Arthur Llewellyn, formerly in charge of the Survey and Geological Department of the Kolar group of mines.

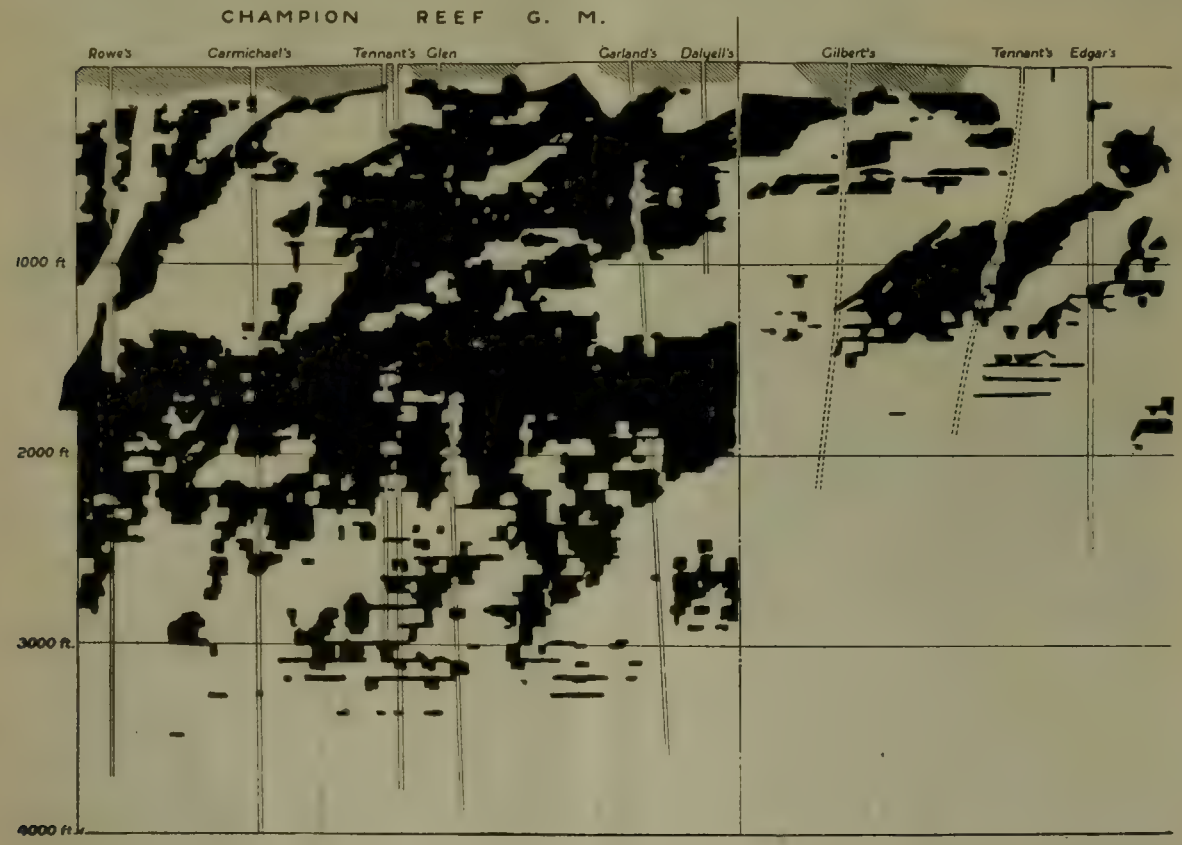


FIG. 1. LONGITUDINAL SECTION OF MYSORE OREBODY.

and the depth of their workings are given herewith, in feet:

	Extent of property on lode.	Depth on the dip.	Vertical depth.
Mysore	7847	5000	3165
Champion Reef	3506	4700	1340
Ooregum	3355	5100	1670
Nundydroog	6198	3200	2756

For many years the yield from these deep mines was so steady that the Kolar goldfield became a stock example of persistence, if not enrichment, in depth. This hasty inference was as fallacious as the suggestion, made in 1904, that a flattening of the lode presaged a speedy end to a highly productive industry.[4] Leaving geological inferences of doubtful value, I find that the statistical record indicates impoverishment in depth, but sagacious management has decreased the cost of exploitation to such an extent that the economic result has continued to be most satisfactory.

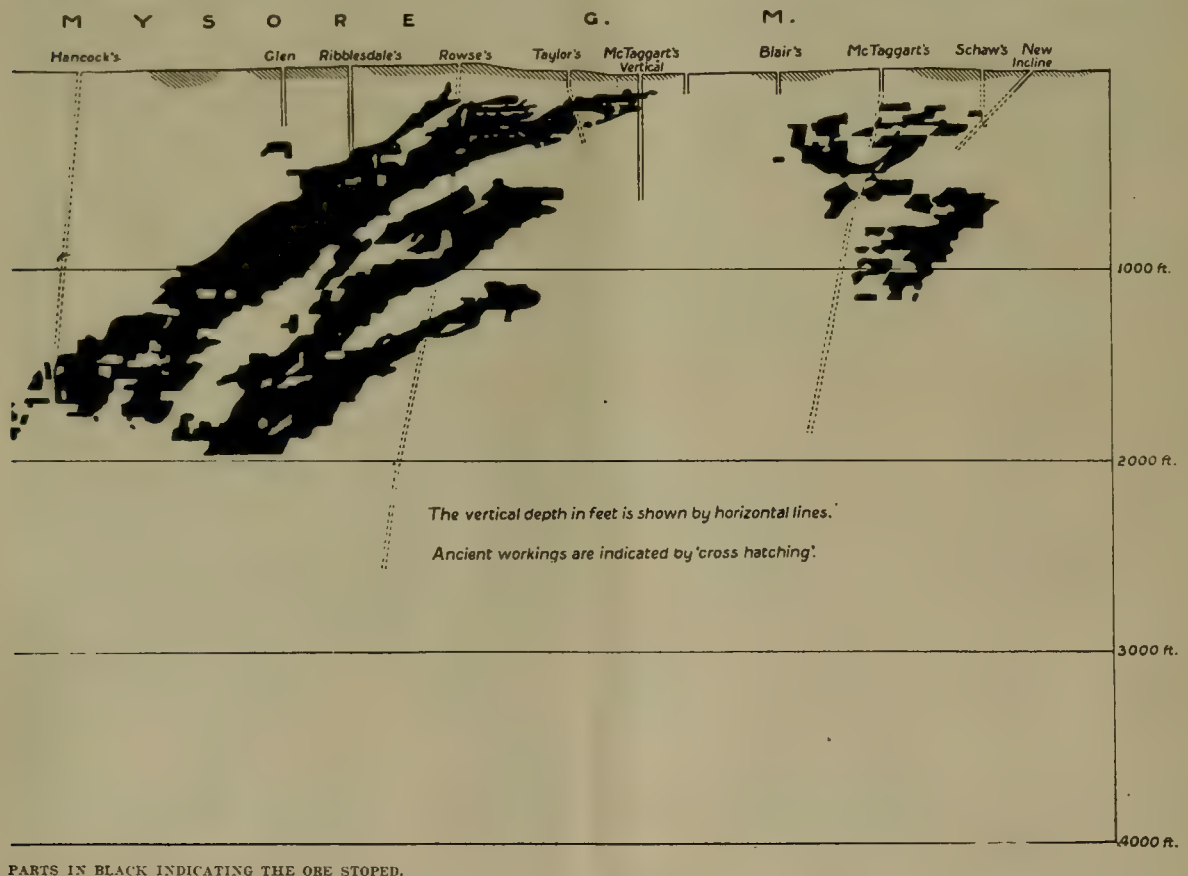
Of the four principal mines, the most northerly, the Nundydroog, has two ore-shoots, 1800 ft. apart. The lower levels became decidedly poor in 1908 at a depth of 1200 ft. Subsequently the mine gave good results, and the output of ore was gradually increased. Eighteen months ago, however, the bottom workings appear to have passed through the principal ore-shoot at 2500 ft., the output becoming curtailed pending further developments.

On the Ooregum, which comes next southward, the ancients followed the richest spots down to 250 ft.,[5] and dug into the vein along the entire length of outcrop within the limits of the property. The first orebody exploited was traced from these old workings to 750 ft. in depth, where it diminished in length and richness; but an ore-shoot pitching north from the Champion Reef crossed the southern boundary, and enriched the lode from 1260 to 2000 ft. Under this came a third shoot, which was broken by a dike near the south boundary, but made again 1000 ft. north on the 3000-ft. level, from which it has been traced to the bottom of the mine at 5100 ft. on the dip.

In the Champion Reef the old workings reached to 275 ft. This mine did handsomely until about six years ago, when it was 3700 ft. deep. Since then the length of stoping ground has contracted. An examination of the qualitative stope-section shows that impoverishment began at the south end and on the 9th level. Down to the 16th the mine was 'sick.' Then the upper Tennant's shoot from the Mysore crossed the boundary, and for five levels ore was almost continuous from boundary to boundary—3500 ft. Again for 12 levels the lode was

[4]'Geology of the Kolar Goldfield,' by A. M. Smith, *Trans.* Inst. M. & M., Vol. XIII, pp. 152-180.

[5]Unless otherwise stated, all the mine measurements are taken on the dip of the lode.

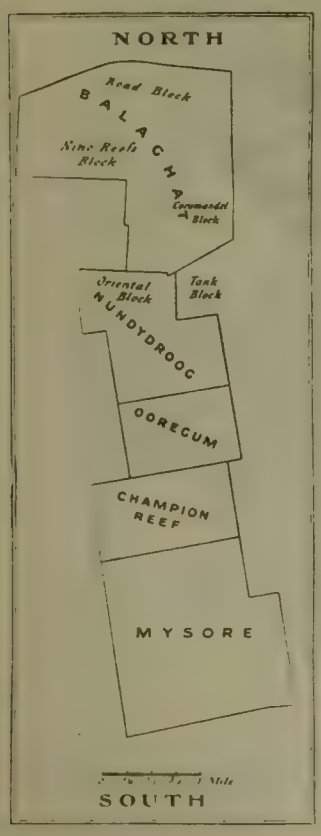


PARTS IN BLACK INDICATING THE ORE STOPED.

poor and patchy. Then an improvement became apparent, on the 33rd level, where, at the south end, the lower portion of Tennant's shoot crossed the south boundary and gave renewed encouragement.

The Mysore is the great mine of the Kolar district. It extends for 1½ miles along the lode, and includes ten distinct ore-shoots. In places three or four orebodies are found overlapping. The ancients worked to a depth of 300 ft. at the north end of the mine, where Gilbert's shaft was sunk, but this orebody proved disappointing. Below it, however, came Tennant's shoot, which did not outcrop, but ended at about 450 ft. from surface. Under Tennant's, and close to it, comes another. Indeed, in this mine the three principal runs of ore have the form in each case of twin ore-shoots. Crocker's shoot is the most regular and persistent in the goldfield; it has had a length of 1500 ft. of continuous high-grade ore. Impoverishment appeared at 1600 ft., followed in depth by alternations of yield, the latest stage being impoverishment for 700 ft. McTaggart's shoot, also in two divisions, one pitching under the other, reaches to within 200 ft. of the surface, but does not outcrop. It is enriched at 1660 ft., and for 1000 ft. in depth, becoming poor at 2800 feet.

In this gold-mining district the existence of ancient workings proved as much an obstacle as a guide in the first operations, because the unknown former workers had removed all the rich and easily accessible ore to a depth reaching nearly to 300 ft. under the surface.



The present industry owes its origin to an Irish soldier named Lavelle, who began prospecting in 1871 and obtained a concession two years later. In 1876 he transferred his rights to a syndicate—the Kolar Concessionnaires—formed by the late General de la Poer Beresford. The first working capital was furnished by Arbuthnot & Co., of Madras, but this famous mercantile house retired from the venture at an early stage. In 1880 the firm of John Taylor & Sons was invited to assist the enterprise. This was done after the late Bell Davies had reported favorably. But for three years the results were most disappointing, and it was due to the pertinacity of the engineers, more particularly John Taylor, that the work was pushed to eventual success, aided by the financial support of the late Sir Charles Tennant. How complete that success has been is proved eloquently by the statistical record:

	Ore, short tons.	Gold, fine oz.	Dividends.
Mysore	3,917,109	3,603,112	£7,414,344
Champion Reef	3,179,185	2,502,292	4,018,966
Nundydroog	1,526,554	1,241,808	2,002,768
Ooregum	2,402,346	1,562,829	2,214,320

In his earlier paper, F. H. Hatch gives the yield of gold per ton in 1899; this can be compared with that in 1913, by converting the standard gold as recorded in the annual reports into the fine gold quoted in the geological memoir. Another correction must be made for the use of the short ton (2000 lb. avoirdupois) in some of the later reports as compared with the long ton (2240 lb.) of the earlier statistics. Making these corrections, I find that the yield of the four big mines compares as follows in pennyweights of fine gold per short ton:

	1899.	1913.
Mysore	27.68	14.29
Champion Reef	26.41	10.92
Nundydroog	19.60	15.95
Ooregum	14.04	13.92

The decrease in yield is apparent; whether it is due to the treatment of a larger tonnage or whether, conversely, the necessity for treating a larger tonnage arises from the lower grade of the ore, is not obvious. Other evidence suggests that there is a real impoverishment, which has been largely compensated by a cheapening of the processes of exploitation. This is indicated by a comparison of the cost incurred at the two periods, in shillings per short ton, as follows:

	1899.	1913.
Mysore	33.36	24.24
Champion Reef	42.34	26.55
Nundydroog	39.28	30.33
Ooregum	40.53	22.68

These figures do not give the total cost. Among the items omitted are: (1) the royalty paid to the Mysore government, at the rate of 5% of the gross value of the gold, *plus* 2½% on dividends distributed since March 1910[6]; (2) the English income tax; and (3) the depreciation of, or expenditure on, shaft-sinking, plant, and machinery, this item being differently treated at the two periods under comparison. The actual total cost is about 50% more than the 'working' cost or revenue expenditure. However, that does not affect the comparison, for it applied as much in 1899 as in 1913. On the other hand, while the cost has not decreased as much as the yield, the dividends have increased considerably in some cases, as the following comparison indicates:

	1899.	1913.
Mysore	£350,000	£381,250
Champion Reef	275,000	130,000
Nundydroog	72,600	99,050
Ooregum	65,000	129,250

[6]The extra impost has been paid to the government since the renewal of the leases.

This favorable result is due mainly to the increased tonnage:

	1899	1913.
Mysore ..	103,424	302,662
Champion Reef	104,296	220,511
Nundydroog	39,424	90,650
Ooregum .	71,800	153,636

Obviously these statistics do not bear directly on the geological problem before us, simply because mineral exploration is not conducted with a view to elucidating scientific questions.

In Fig. 1 are shown the portions of lode area that have actually been stoped. This does not show all the ground that is ore bearing, of course; but it serves to indicate the shape, size, and trend of the orebodies.

Structure Controlling Ore-Shoots

The question of continuity of ore in depth is also complicated by the flat pitch of the successive ore-shoots. This feature need not, of course, perplex any intelligent observer now, but in the early days of the mines, before the geological distribution of the ore had been ascertained, it was, undoubtedly, a hindrance to confident exploration. The Mysore, for instance, passed through several periods of depression. In the Company's office a transfer of 200 shares at 9d. is still preserved as a memento of the dark days of 1883. The ore under the old workings near Gilbert's shaft appeared to 'peter out,' although it really sloped flatly across the adjoining boundary into the Champion Reef property. A long exploratory level at 1100 ft. had been extended for 3000 ft. without finding anything of particular promise, for the rich part of Tennant's shoot was underfoot and Crocker's orebody was farther south. Such eras of depression have been repeated not only in the history of the Mysore mine, but in that of the Kolar goldfield as a whole. It is the barest justice to state that the persistence of intelligent effort on the part of the management cannot be discounted even by one who finds it necessary to question the persistence of the ore. Two outstanding facts in the history of this group of mines are: (1) the uninterrupted technical control of operations by the oldest mining firm in London, and (2) the complete detachment of those operations from share-gambling. The lode has been exploited for the gold to be extracted, not as a counter in Stock Exchange manipulation. To these two facts is owing, largely, the ability of the mining companies to obtain financial support, whenever necessary, from a large body of absolutely loyal shareholders. The history of Kolar constitutes one of the best pages of the mining record.

Returning to more technical considerations: A careful examination of the longitudinal sections of the four principal mines will show how the successive ore-shoots slope one under the other, often in pairs, at an angle of 45° with the horizon, tending, however, to spread apart in depth northward. This spreading is due to a flattening of the fold, the structure of which was a determining factor in the deposition of the ore. The shoots are not always continuous bodies of ore, but represent favorable structural conditions, having a fairly regular pitch, which, as I have said, coincides with the axes of the folds in the schist. The decreasing pitch of the ore-shoots and the apparent spreading or fanning of their axial lines points to a diminution in the acuteness of folding or intensity of plication. This is an unfavorable change in the geological structure.

This structure explains many of the vicissitudes recorded in local history. Vertically the distance between ore-shoots is considerably greater than the interval separating them at right angles to their pitch. When an ore-shoot, like that at Gilbert's shaft, was lost in depth, it was not until long afterward that the stope-section showed that it had passed flatly across the boundary into the adjoining mine. At least two ore-shoots in the Mysore did not outcrop, and therefore were not easily found. The general effect was to accentuate unduly the alternations of depression and prosperity, and to exaggerate the intervals of poverty and richness. On the other hand, as the mines have become healthily enlarged, the managers have provided against fluctuation of output by allowing large reserves of ore to accumulate, whereby to help the lean years and obviate anxiety to their shareholders. Thus, at the present time, the Mysore has 1,377,000 tons of ore in reserve, this being equal to over four years' supply. As regards the immediate subject of this paper, the output for successive years does not correspond with increasing depth because the ore milled in 1914 may come from stopes two thousand feet higher than the bottom level; in other words, the depth of the mine in any year bears no direct relation to the quality of the output. Of this, of course, the economic geologist must be aware, lest he fall into inferences of a most misleading character.

Gold output of Rhodesia in October was £337,241, against £309,398 in September. Ten months of this year show an increase of more than £50,000 over that for the whole of 1913. There were 219 producers during the month. Some individual returns were as under:

Mine.	Ore treated. Tons.	Gold recovered. Value.
Antelope	3,377	£ 7,551
Bell Reef	3,200	7,491
Cam & Motor	12,435	17,109
Eldorado	5,228	11,123
Gaika	3,000	7,476
Giant	6,000	412*
Globe & Phoenix	....	27,000*
Lonely Reef	4,030	11,127
Rezende	10,500	3,786
Shamva	48,489	31,348
Thistle-Etna	2,132	3,359
Transvaal and Rhodesia Estates	2,050	6,100
Wanderer	12,160	1,903*

*Profit.

Gold output of the Indian mines in October was 50,818 oz. This year's total will be about 8000 oz. more than in 1913. Eight mines are producing.

Concentrate Treatment Costs at the Treadwell Cyanide Plant

By W. P. LASS

The Treadwell cyanide plant treats concentrate recovered by Frue vanners from ore crushed by 900 stamps in the mills of the Alaska Mexican, Treadwell, and United companies on Douglas island, near Juneau. The following table, made up from the records, shows detailed costs at the plant during June 1914, when 3023.30 tons of material was treated:

COSTS PER TON

	Grinding.	Dissolving.	Filtering.	Precipitation.	Refining.	Total.
Direct labor:						
Operating	$0.140	$0.245	$0.163	$0.085	$0.213	$0.846
Repair	0.043	0.028	0.032	0.019	0.055	0.177
Supervision	0.020	0.020	0.020	0.020	0.020	0.100
Clerical	0.009	0.008	0.009	0.008	0.008	0.042
Total	$0.212	$0.301	$0.224	$0.132	$0.296	$1.165
Direct supplies:						
Cyanide	....	$0.549	....	....	....	$0.549
Lime	....	0.058	....	....	....	0.058
Pebbles	$0.050	....	....	....	....	0.050
Zinc dust	....	....	....	$0.141	....	0.141
Peptn. paper	....	....	....	0.011	....	0.011
Filter-cloth	....	....	$0.009	0.003	$0.006	0.018
Lead acetate	....	....	....	0.034	....	0.034
Fluxes	....	....	....	....	0.022	0.022
Misc. Supplies.	....	....	....	....	0.008	0.008
Sulphuric acid.	....	....	....	....	0.010	0.010
Total	$0.050	$0.607	$0.009	$0.189	$0.046	$0.901
Subsidiary accounts of mixed labor and supplies:						
Build'g repairs	....	$0.017	....	....	$0.005	$0.022
Elec. repairs.	....	....	....	....	....	....
Mech. repairs.	$0.024	0.035	$0.017	$0.011	0.057	0.144
Electric power	0.060	0.002	0.002	0.004	0.002	0.070
Steam heat	0.006	0.007	0.004	0.002	0.001	0.020
Comp. air	0.006	0.005	0.007	0.005	0.007	0.030
Water	....	....	0.001	....	....	0.001
Train service.	....	0.002	....	0.001	0.002	0.005
Assaying	....	0.027	....	0.018	0.052	0.097
Insurance	0.006	0.005	0.006	0.006	0.005	0.028
Fuel oil	....	....	....	....	0.005	0.005
Gen. expense.	0.004	0.004	0.004	0.004	0.009	0.025
Total	$0.106	$0.104	$0.041	$0.051	$0.145	$0.447
Total cost.	$0.368	$1.012	$0.274	$0.372	$0.487	$2.513

Comparative costs are as follows:

Items.	June.	May.	Jan. 1 to June 30, 1914.	Same period of 1913.
Concentrate treated, tons	3,023.30	2,800.80	16,048.81	15,642.37
Average per day, tons	100.78	90.35	.....	.....
Cost per ton:				
Labor	$1.165	$1.224	$1.369	$1.435
Supplies	0.901	1.003	1.008	1.177
Subsidiary accounts	0.447	0.539	0.564	0.681
Total	$2.513	$2.766	$2.941	$3.293

Supplies consumed are as follows:

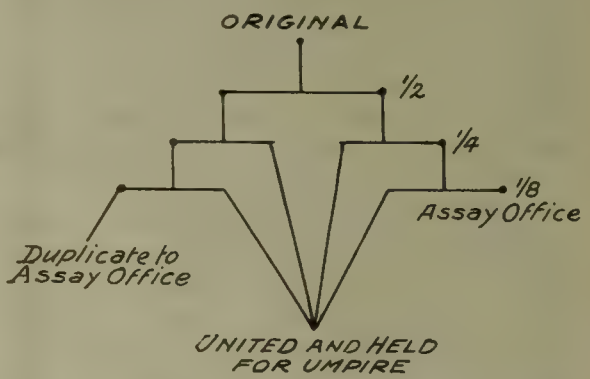
Material.	Amount, pounds.	Cost per ton.
Cyanide	2.38	$0.549
Lime	6.74	0.058
Pebbles	7.28	0.050
Zinc dust	2.00	0.141
Precipitating paper	....	0.011
Precipitating cloth	....	0.003
Filter-cloths	....	0.009
Electric power, kilowatt-hours	28.72	0.070

During June the concentrate averaged $52.6074 per ton before, and $1.8177 after treatment, showing an extraction of 96.5 per cent.

The cyanide plant began treating the Douglas Island concentrates in September 1910, and for the first three months the estimated extraction was 97%, while the actual gold extraction as represented by the assay value of the heads and the actual bullion shipped plus the plant's gold inventory was but 90%. Since then the actual extraction has at all times exceeded the estimated extraction.

The estimated extraction is based on the assay value of the head and the assay value of the dry sands plus the value of the sluicing-out solution.

The assay value of the heads is determined from the daily samples as taken by a ship's auger from each of the cars. This sample, after drying and moisture determination, undergoes two cut-outs. Assays are made from the extremes of the quartering as shown by the diagram below:



Thus all samples have duplicate cut-outs, to which separate numbers are given for assay purposes, though

they may not be sent in for assay on the same day. In this manner an individual check is obtained upon each assay and the value calculated upon the average of the two. In case the two assays vary by more than 5%, two new cut-outs are made from the original sample and the accepted value calculated from the three nearest values. At the end of the month the assayer is acquainted with the accuracy of his results.

The work is checked by making a composite sample from each of the daily rejects or umpire samples by taking an amount in ounces from each sample equal to the tons in the lot from which the day's sample was taken. Thus the monthly composite sample contains the same number of ounces as tons of the original ore from which sample was taken. This composite sample is cut down and assayed in the same manner as the daily samples were assayed. If the value of this sample does not check with the value as calculated from the daily assays, all the work may be checked over until the erratic assays are eliminated.

The following cost-sheet shows the detail cost per assay for the year 1913. This sheet is based upon an inventory of the stock on hand at the end of each month, and aids the assayer in keeping stock.

ASSAY OFFICE REPORT, YEAR ENDED DECEMBER 31, 1913

Item.	Used during year. Quantity.	Amt.	Cost per assay.
Litharge, pounds	3038	$ 363.10	$0.0111
Borax glass, pounds	1800	202.41	0.0062
Sodium bicarbonate, pounds	1650	35.53	0.0011
Potassium carbonate, pounds	1263	102.52	0.0031
Powdered silica, pounds	290	4.52	0.0001
Potassium nitrate, pounds	30	3.60	0.0001
Granulated lead, pounds	100	6.00	0.0002
Lead foil, pounds	50	3.00	0.0001
Proof silver, ounces	14	13.17	0.0004
Proof gold, ounces	1.5	38.58	0.0012
Bone ash, pounds	2348	158.62	0.0049
Nitric acid, c.p., 7-lb. bottles	19	23.44	0.0007
Hydrochloric acid, com'l 6-lb. bottles	24	18.55	0.0006
Clay crucibles, 20 gm., each	4077	122.33	0.0038
Clay crucibles, 30 gm., each	707	36.39	0.0011
Clay scorifiers, 2½ in., each	515	10.30	0.0003
Clay scorifiers, 3 in., each	42	1.05	.....
Clay muffles, S246, each	48	116.83	0.0036
Clay muffle arches, QQ, each	6	18.74	0.0006
Clay tile, 5 by 7 by 12 in., each	23	21.45	0.0007
Bone ash cupels, 1¼ in., M	....	.....	.....
Bone ash cupels, 2 in., M	....	.....	.....
Pulverizer discs, each	12	55.50	0.0017
C. I. jaw plates, etc., pounds	314	22.02	0.0007
Jute ore bags, 17 by 28 in., each	150	15.88	0.0005
Sieves, 8-in., 10-mesh, each	....	.....	.....
Sieves, 8-in., 20-mesh, each	1	1.10	.....
Sieves, 8-in., 30-mesh, each	1	1.20	.....
Sieves, 8-in., 40-mesh, each	2	2.06	0.0001
Sieves, 8-in., 50-mesh, each	1	1.35	.....
Sieves, 8-in., 60-mesh, each	1	1.27	.....
Sieves, 8-in., 70-mesh, each	....	.....	.....
Sieves, 8-in., 80-mesh, each	3	4.29	0.0001
Sieves, 8-in., 90-mesh, each	....	.....	.....
Sieves, 8-in., 100-mesh, each	12	24.67	0.0008
Sieves, 8-in., 120-mesh, each	2	3.51	0.0001
Sieves, 8-in., 150-mesh, each	1	2.64	0.0001
Sieves, 8-in., 200-mesh, each	1	3.85	0.0001
Sieves, 10-in., 10-mesh, each			.....
Sieves, 10-in., 20-mesh, each			.....
Sieves, 10-in., 100-mesh, each			.....
Sieves, 12-in., 10-mesh, each			.....
Sieves, 12-in., 20-mesh, each			.....
Renewing furnaces and balances		109.15	0.0033
San Francisco office charge		139.76	0.0043
Miscellaneous		108.09	0.0033
Total		$1796.47	$0.0550
Labor		5834.65	0.1787
Building repairs		43.84	0.0013
Electrical repairs		27.12	0.0008
Machinery repairs		65.63	0.0020
Fuel oil		328.50	0.0101
Steam heat		473.09	0.0145
Electric power		31.81	0.0010
Train service		11.42	0.0004
Electric light		20.08	0.0006
Total		$8632.61	$0.2644

ASSAYS MADE DURING YEAR

Treadwell, mining	3,784
Treadwell, milling, 240	2,113
Treadwell, milling, 300	2,114
Treadwell, sulphides	1,701
Cyanide department	4,145
Alaska Mexican G. M. Co.	5,170
Alaska United G. M. Co., 700	5,000
Alaska United G. M. Co., R. B.	4,730
Alaska Juneau G. M. Co.	890
Bullion expense	736
Experimental	2,091
Outside	174
Total	32,648

METAL PRODUCTION of Queensland has been considerably affected by the war. The output for the September quarter is as follows:

Product.	Sept. quarter 1913 (tons).	Sept. quarter 1914 (tons).
Copper	6,033	3,410
Silver (ounces)	156,954	30,709
Tin	952	362
Lead	923	105
Wolfram	93	34
Bismuth	0.5	0.2
Molybdenite	11.5	1.75
Manganese	25	.....
Ironstone flux	1,061	8,359
Limestone flux	41,979	27,046
Bismuth-wolfram	45.75	0.75
Total value	$2,785,000	$1,200,000

Production for the nine months ended September was $2,260,000 less than for the corresponding period of 1913. The gold yield in October was 22,713 oz. fine, an increase of 3078 oz., and 199,342 oz., or 20,711 oz. less than the same period of 10 months of last year. Molybdenite is $22.80 per unit.

ORE RESERVES in the New Modderfontein mine, on the Rand, total 6,300,000 tons averaging $8.40 per ton. Operating costs total $3.58 per ton.

DISCUSSION

Readers of the Mining and Scientific Press *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

Valuation of Dredging Ground

The Editor:

Sir—The various methods of calculating the average value of dredging ground, as shown by the letters in recent issues of the *Press* are interesting because they illustrate that mistakes can readily be made in a comparatively simple matter, and although Mr. Herzig has forestalled me by sending the correct solution, I am submitting mine, which is, I am sure, based on first principles.

In the accompanying sketch, Fig. 1, it is required to

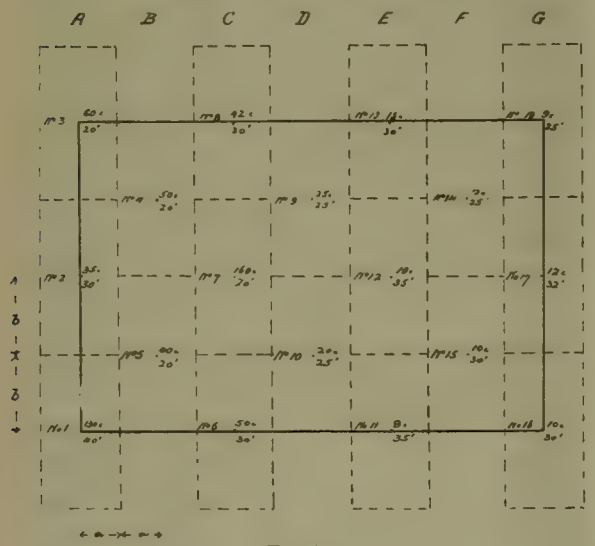


Fig. 1.

find the average value and depth of the portion within the full lines, and the dotted lines represent the ground prospected, a value and a depth being shown in the centre of each dotted rectangle. Incidentally it may be mentioned that Mr. Decoto's average (37.69c.), published in your issue of May 9, is correct for the ground enclosed in the dotted lines.

The average value is the total value divided by the cubical contents of the ground in question, and in order to arrive at the latter, let us assume that the distance between the lines of holes is $2a$ and that between the holes is $2b$. By this assumption, fractions will be avoided.

Referring now to hole No. 1, we see that the area to be included in our calculation is $a \times b$, the volume is $40ab$ and the value contained therein is $5200ab$.

By similar calculations the following results may be obtained:

1.	$a \times b \times 40 \times 130$	$= 5{,}200ab$
2.	$a \times 2b \times 30 \times 35$	$= 2{,}100ab$
3.	$a \times b \times 20 \times 60$	$= 1{,}200ab$
4.	$2a \times 2b \times 20 \times 50$	$= 4{,}000ab$
5.	$2a \times 2b \times 20 \times 40$	$= 3{,}200ab$
6.	$2a \times b \times 30 \times 50$	$= 3{,}000ab$
7.	$2a \times 2b \times 20 \times 160$	$= 12{,}800ab$
8.	$2a \times b \times 30 \times 42$	$= 2{,}520ab$
9.	$2a \times 2b \times 25 \times 25$	$= 2{,}500ab$
10.	$2a \times 2b \times 25 \times 20$	$= 2{,}000ab$
11.	$2a \times b \times 35 \times 8$	$= 560ab$
12.	$2a \times 2b \times 35 \times 10$	$= 1{,}400ab$
13.	$2a \times b \times 30 \times 15$	$= 900ab$
14.	$2a \times 2b \times 25 \times 12$	$= 1{,}200ab$
15.	$2a \times 2b \times 30 \times 10$	$= 1{,}200ab$
16.	$a \times b \times 30 \times 10$	$= 300ab$
17.	$a \times 2b \times 32 \times 12$	$= 768ab$
18.	$a \times b \times 25 \times 9$	$= 225ab$
	Total	$= 45{,}073ab$

Thus the gold content is represented by $45{,}073ab$ and dividing this by $48ab$, the area of the ground in question, gives 939.02 as the product of the average value and the average depth.

To find the average depth, let us represent line A graphically, thus, Fig. 2:

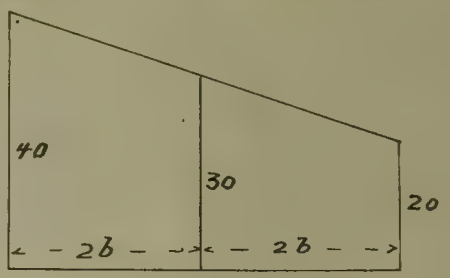


Fig. 2.

This shows the depths of the bore holes and the distances between them and the area of this figure is:

$$\frac{2b(40+30)}{2} + \frac{2b(30+20)}{2} = 120b$$

And since the base has a total length of $4b$, the average depth is $120b$ divided by $4b$ or 30. By similar calculations, the average depth of each line will be found to be: line A, 30; line B, 20; line C, 25; line D, 25; line E, 33.75; line F, 27.5; and line G, 29.75.

These results may be graphically represented as in Fig. 3 on the following page.

Since this line is at right angles to the previous ones,

the distance between the lines, namely $2a$, is shown, and proceeding as before, we find the total area to be $322.25\ a$, which, divided by $12a$, gives 26.854 as the average depth.

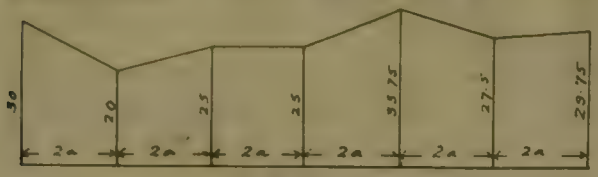


FIG. 3.

Previously we found that the product of the average depth and the average value was 939.02, and this divided by 26.854, the average depth, gives 34.96 as the average value.

No units are designated in this calculation, as they make no difference provided that the same units are maintained throughout. The method employed herein is applicable to all cases whether the lines or bore holes are spaced evenly or unevenly, and the rules used by Mr. Herzig may be easily deduced from it. For practice, let some of your correspondents calculate the averages by taking the lines of bore holes horizontally or diagonally instead of vertically as in this calculation. The results will be found to be the same.

JAMES T. DIXON.

London, October 27, 1914.

The Pan as a Regrinder

The Editor:

Sir—In view of occasional contributions in regard to the inefficiency of the grinding pan as a regrinder, the following notes may be of interest to millmen:

I am treating an accumulated dump of concentrate, some of which dates back to the eighties, using an old silver-grinding pan from a scrap heap as a regrinder. The foundry which made the pan recommended a pulp ratio of 1 to 3, and a speed of 75 r.p.m. to get the best results. Under these conditions, the best that I could get was one ton of concentrate in 72 hours, ground through 150 mesh. I have varied the pulp ratio and speed, and with 12% moisture and 30 r.p.m. I get a result of one ton in six hours. With the thin pulp and high speed, it would seem probable that the centrifugal force would tend to throw the pulp away from the die. This principle would apply to continuous as well as intermittent grinding.

WILLIAM S. MANN.

Cisco, Placer county, California, November 20.

[Our correspondent does not give the mesh of the concentrate before treatment or the diameter of the pan. Assuming that it was from a 20-mesh screen, and the pan is 5 ft. diameter, with shoes and dies in order, his pan should do better work than one ton in six hours. It is hard to imagine a pulp with 12% moisture, in fact, this would be simply damp sand. A berdan pan would grind more than this quantity, but the pulp should have a ratio of at least one of concentrate to one or two of water, perhaps a little more. With a speed up to 50 r.p.m. the output ought to be increased. Thin pulp and a high speed do not result in pan efficiency. If carefully operated, the feed to a pan may be continuous, as grinding in charges is a slow process, unless the material is very rich. Intelligently worked, the pan is an efficient regrinder.—EDITOR.]

Steam Stamps From a Gold Miner's Point of View

The Editor:

Sir—It is with pleasure I answer Mr. Hardinge's argument in support of the conical tube-mill; not that I wish to minimize the usefulness of his mill, but I do wish to emphasize what may be the future practice with cylindrical tube-mills of large diameter, and to show that the shape of particle most suitable for concentration is open to discussion.

We will assume that the conical mill wherever used in competition with a cylindrical tube-mill will show less oversize, but this is no indication of efficiency unless the cost of classifying and grinding with the cylindrical tube-mill is greater than grinding in the conical tube-mill alone. Until such tests are made with mills of the same major diameters and all other conditions of operating identical, so far as practical, the relative merits of the two classes of tube-mills must remain in doubt. For example, it is hardly fair to compare a belt-driven mill with one geared direct with the most approved gears, when the saving alone due to the difference in the method of transmitting power is more than that probable from the substitution of one machine for another. So far as I know, the tests at the Calumet & Hecla were not made with the cylindrical tube-mill and classifier in a closed circuit. If Mr. Hardinge can quote the figures showing the cylindrical tube-mill working this way, say with a Dorr classifier and the power applied in the same way as applied to his conical mill, his argument will be overpowering. It is altogether beside the argument that the Company has paid so many millions in dividends.

Mr. Hardinge's argument, that the flattened particles are more easily concentrated than the more granular product from the Chilean mill, ignores the fact that my statement was that both the Chilean mill and conical tube-mills tended to flatten the particles of copper which were floated off, and the proof of this contention is the poor extraction from either mill on the concentrators. I mentioned the fact that the Lovett machine, which rolls the copper into balls and spirals, produces a product from which 20% more copper can be extracted on the concentrators than from the conical tube-mill discharge. As Mr. Hardinge says, "economic efficiency * * * certainly must be considered as being superior to mere supposition based on theory."

ALGERNON DEL MAR.

Los Angeles, December 10.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

CARGO through the Panama canal from August 15 to November 15 totaled 1,079,521 tons, carried in 185 vessels.

NATIVES EMPLOYED in Rand gold mines at the end of October numbered 170,438, against 150,012 at the end of December 1913.

CRUDE OIL EXPORTS from Peru from January to September, inclusive, amounted to 96,000 metric tons, or about 672,000 barrels.

COAL MINERS at the Point Elizabeth government colliery, New Zealand, averaged $4.46 per day in 1913. The output was 124,804 tons.

ORE HOISTED by Rand mines during the first half of the current year averaged 2,269,365 tons per month, against 2,547,082 tons in the same months of the previous year.

FUEL OIL used by railroads in the United States in 1913 amounted to 33,004,815 bbl. There was 29,145 miles of line operated by this fuel, the oil-burning engines covering 118,672,162 miles. An average of 3.60 miles was made per barrel of oil consumed. The navy used over 21,000,000 gal. of fuel oil in the fiscal year ended June 30, 1913.

AN EARTH TREMOR at the Village Main Reef mine, Johannesburg, on November 12, resulted in the death of one native and probably two others, while shaft pillars about 150 ft. vertical below No. 6 level of No. 2 shaft were crushed, and No. 9 and 10 stations fell in. The sand-filled stopes saved workings from serious damage. Earthquakes on the Rand were described in the *Press* of July 25, 1914.

CURRENTS are set up during the filling of locks at Panama, having a tendency to move a vessel to one side. A mixture of fresh and salt water affects the vessel more. In filling a chamber there is considerable surface disturbance; but in emptying, the surface is placid, and there is scarcely any tendency to move a vessel, according to R. H. Whitehead, who has studied the phenomena of water pressures and currents in the locks.

AN AERIAL TRAMWAY, 37 miles long, is to be constructed between Valencia and Nirgua in Venezuela by an English concern. It will be in sections of 10 kilometres, making six in all. Each is to be driven by its own motive power, electricity for the first section near Valencia, and either oil, gas, or steam power for the others. The contract states that the line must be completed within two years of starting erection, and will run for 99 years under certain conditions.

IN REFINING PETROLEUM, sulphuric acid is used mainly to remove the resinous matters and certain hyrocarbons such as olefines. These constituents are separated out in the form of residual sludge, of little value. The acid process has certain disadvantages. The new Edeleanu process uses liquefied sulphur dioxide, which is a comparatively simple system, and besides doing away with the acid troubles, the compound may be readily recovered from the solution and used again with little loss.

CONSIDERABLE LOSS of life and damage to property has been occasioned by explosions of dust in grain mills in the United States. An investigation was made recently by the millers and the U. S. Bureau of Mines. During the inquiry it developed that the following causes have been assigned to many of the explosions in milling plants in this country and abroad: (1) use of open lights, or naked flames, such as lamps, torches, gas jets, lanterns, candles, matches, etc.; (2) property fires; (3) introduction of foreign material in grinding machines; (4) electric sparks from motors, fuses, switches, lighting systems; and (5) static electricity produced by friction of pulleys and belts, grinding machines, etc.

THE EFFICIENCY of the average steam plant of the United States is less than 5%: that is, there is only about 5% of the heat energy in the fuel fed to a boiler furnace delivered to the bus bars of an electric plant, according to R. H. Fernald in the *Journal* of the Cleveland Engineering Society. Assuming 13,500 heat units are in a pound of coal used, the relative heat losses in a steam plant, compared with a suction gas plant, are as follows:

	Plant	
Heat losses.	Steam, %.	Gas, %.
In ash	2.00	1.10
Radiation and cooling	4.60	18.60
Stack gases	24.60	....
Total boiler or producer losses	31.20	19.70
Radiation and friction	3.30	4.30
Exhaust	53.50	23.70
Jacket water	....	33.50
Auxiliaries	7.30	....
Total heat losses in entire plant	95.30	81.20
Net efficiency of plant	4.70	18.80

In one of the most efficient steam plants in the country only a little over 10% of the energy in the fuel is converted into energy.

MINING IN THE FAR NORTH*

Placer Mining in the Fairbanks District

By EMIL EDWARD HURJA

Early Russian traders who penetrated to the Tanana river found the first gold in interior Alaska in the sixties and seventies. Alfred H. Brooks, of the United States Geological Survey, in making a reconnaissance of the Tanana river in 1898, suggested in a printed report that attention had better be paid to the streams entering the Tanana on the right limit as probable sources of placer gold. Following the discovery of the Fortymile placers in 1886 came the Rampart and Birch creek, or Circle, excitements, one in 1893 and the other in 1894. Prospectors from the Birch Creek district wandered across the hills into the Chatanika watershed, but their prospecting did not reveal anything to justify remaining in the district. In 1898 a party of prospectors came up the Tanana and passed the present site of Fairbanks on the Chena slough. They were not equipped with machinery for prospecting deep ground, reports Mr. Brooks, and their stay in the district yielded no appreciable results, other than to verify the presence of gold in the alluvium.

In 1901, a trading expedition from St. Michael, under E. L. Barnette, came up the Tanana, entered Chena slough and, encountering a bar, built a camp on the south side of the slough. They wintered there, and the town of Fairbanks took shape. The trading station was 275 miles from the Tanana river. In 1902, a prospector known as Felix Pedro found gold on what became known as Pedro creek in July 1902. His friends were notified, and Pedro creek and some of the outlying streams were staked. Cleary creek and Fairbanks creek became the producers of the new camp. When the news of the discoveries reached Dawson, Yukon Territory, a great rush started. Everyone stampeded. Every boat was jammed to the guards. The inevitable event in Alaskan mining camp history took place. There was no immediate bonanza and hundreds left the place, discouraged and penniless. The gravels found in the district were of low grade generally, although rich ground has since been worked on different creeks of the district. The production during the summer of 1903 was about $40,000. Conditions in the Fairbanks district—deep ground, frozen overburden, water supply, fuel abundance—led to the development of deep placer mining machinery. Powerful hoists were brought in, the 'carrier' was developed to its greatest efficiency, and systematic methods supplanted haphazard ones. Roads were built by the Alaska Road Commission from Fairbanks to the creeks, a distance of from 10 to 40 miles.

Fairbanks, though on a small slough of the Tanana river, can be reached by steamers during the season of navigation. Occasionally the water is so low that supplies have to be left at Chena, situated at the mouth of the slough, to be brought from there to Fairbanks by the Tanana Valley railroad, a development of the first five years of Fairbanks. The railroad is 45 miles long and connects Fairbanks and Chena with the numerous creek settlements on Goldstream, Engineer, Pedro, Gilmore, Dome, Vault, and Cleary. It was built by Falcon Joslin, and is considered one of the most daring projects of interior Alaska.

*[Previous articles in this series by Mr. Hurja on mining in Alaska and the Yukon have been 'Mining Revival in the Ketchikan District, Alaska,' July 4; 'Wrangell, Alaska,' special correspondence, July 11; 'Developments of the Alaska Gold Mines Co.,' July 18; 'Juneau, Alaska,' special correspondence, July 25; 'Cordova, Alaska,' special correspondence, August 8; 'Valdez and Prince William Sound,' August 15; 'Seward and the Kenai Peninsula,' August 29; 'The Koyukuk Mining District,' September 12; 'Operations of the Yukon Gold Co.,' October 10; 'Skagway-White Horse Mining District,' October 17; 'Operations of the Canadian-Klondyke G. M. Co.,' November 14; 'The Klondike, the Treadgold Placers, and Outlying Districts,' November 28; 'The Upper Yukon: Circle City, Eagle, and Woodchopper,' December 5.—EDITOR.]

LOOKING UP GOLDSTREAM, FAIRBANKS DISTRICT.

SCRAPER HANDLING GRAVEL FROM OPEN-CUT TO SLUICE-BOXES AT No. 8 BELOW, PEDRO.

The output of Fairbanks went ahead steadily. In 1904 the production was $600,000; in 1905, $6,000,000; in 1906, $9,050,300; in 1907, $8,010,000; in 1908, $9,203,000; in 1909, $9,650,000; in 1910, $6,100,000; in 1911, $5,000,000; in 1912, $4,150,000; in 1913, $4,000,000; in 1914, $3,500,000. The decrease in the output after 1909 is due to the exhaustion of the higher grade placer deposits. Some of the decrease has been made up by the lode gold production, but that industry is still in its infancy. The output of the past year is estimated at $3,500,000. The decrease is greater each year, as the ground being mined approaches the limit of workable value. Where ground averaging $1 per square foot was not touched in the earlier days, pay-dirt going 60c. per square foot is being mined today.

The chief production now is from Cleary and Pedro creeks, with Goldstream, Dome, Little Eldorado, Ester, and Vault creeks each contributing. Water was abundant this summer in Fairbanks; so much so that the bridge spanning Chena slough was washed away and several dams on different creeks were unable to withstand the floods. Not a little damage was done in and about Fairbanks during August by water. Because of the decreased production, business conditions in Fairbanks were not the best during the summer, particularly as many of the merchants stocked up with goods the year previous when a transportation rate war reduced the freight rates to a minimum.

Gust Peterson and George H. Gibbs, owners of No. 2 Below, Chatanika, are planning to do considerable work on their claim during the winter. The depth to bedrock is 140 ft.—— On the Hope claim, opposite No. 1 Below, Chatanika, Jack Brevig, Andy Brewick, and John Chater are operating a lay from the owners, Fred Schaupp and Rube Keeler. The depth to bedrock is 78 ft., of which 30 ft. is 'muck.' About five feet of dirt is taken out, including from two to four feet bedrock. The gold is coarse and assays $17.50 per ounce, as does most of the Chatanika and Cleary gold. A 40-hp. Erie boiler furnishes power for a 6¼ by 9 double-drum Lidgerwood hoist. The work from one shaft has just been finished and the other is being opened up. The pay-streak is being taken out for a distance up and downstream of 350 ft. and across the valley a distance of 150 ft. The ground averages $1 per square foot of bedrock. Sluicing started May 10. The season's output will be 60,000 sq. ft. of bedrock. Twenty-four men are employed.

The Hardscrabble claim, on the first tier, left limit, adjoining the Hope claim, is being operated by A. D. Thompson and four partners. The claim is owned by Al. Hilty, A. D. Thompson, and John Smith The depth to bedrock is 100 ft. A new streak which parallels the one worked before along Cleary has been found. Ground 200 ft. wide and having an average value of 75c. per sq. ft. is being worked. Most of the gold is above bedrock. The summer work was fairly profitable, although the cost of working was high because of the necessity of pumping. Present plans provide for the working of a big block of ground during the winter, when the ground is frozen. The plant includes a 40-hp. boiler and a Samson hoist.

C. H. Watson operated during the summer on a big scale on the Asset fraction and Asset claim, owned by Schaupp Brothers, and situated on the left limit, opposite Discovery claim, Chatanika, and on the Hazard claim, owned by Schaupp & Keeler, as well as on the Independence claim, owned by Schaupp Brothers and Ward. Two plants are working a distance of 500 ft. apart. The depth to bedrock is 147 ft. Three feet of gravel is taken out, and from 1 to 2½ ft. of bedrock. The summer's work embraced a block 80,000 sq. ft. of bedrock. Two boilers of 25 hp. capacity operated the two double-cylinder 5½ by 8 American hoists used in hoisting. There is sufficient ground proved on the holdings to permit work to be carried on for three years more. Water is obtained from the Chatanika ditch, with a 33-ft. fall. Pole riffles in the dump-box are followed by perforated metal riffles underlain by cocoa matting to catch the fine gold. Thirty-five men are employed.

On the Hazard claim, on the left limit opposite No. 16 Below Discovery on Cleary creek, Charles Nelson, Ben Johnson, and Ole Brewick are working as laymen. The claim is owned by Fred Schaupp and Rube Keeler. A two-year lease was secured in the spring of 1914. The depth to bedrock is 100 ft.; the width of the 'pay' being worked is from 100 to 150 ft. Ten thousand square feet was worked during the summer, and plans provided for mining a much greater amount during the coming year. An 18-hp. boiler and hoisting plant are used. Gold saving is effected with pole riffles, followed by perforated metal and cocoa matting. Water is obtained from the Chatanika ditch.

John Flygar and Andrew Holmlund are operating a lay on the left limit bench claim opposite Discovery, Chatanika flats, owned by Mattson & Ward. The depth to bedrock is 50 ft. Ten thousand square feet of bedrock was cleaned during the summer, at an average value of $1 per square foot. The pay is in gravel a distance three feet above bedrock. It is 30 ft. wide. A 10-hp. boiler is used.

Probably the most scientific placer mining in the Fairbanks district is conducted by Keyes & Rettig on No. 15 Below, first tier, right limit, of Cleary creek, and the adjoining Diamond fraction. The ground was recently acquired from Hans Hess. The depth to bedrock is from 50 to 60 ft. The depth of the shaft is 62 ft. The season's work contemplated cleaning 100,000 sq. ft. of bedrock, having an average value of from 60 to 80c. per square foot. The cost of mining the ground is 50c. per square foot, according to figures kept by Mr. Keyes. Steam points are used in thawing, as is the custom generally in all

placer mines of the district, but in opening up the drifts and blocking out the ground, a novel and entirely new method was adopted. More in the nature of an experiment than anything else, an Ingersoll-Rand Jackhamer was purchased and has been used in driving holes for the sweaters. The Jackhamer drives an eight-foot hole in bedrock in 30 minutes and an eight-foot point is driven into gravel in from 15 to 20 minutes. The operation of the machine has been altered somewhat, and steam to aid in the thawing is run into the hollow point independently from a side aperture. The original plans of the machine sent the exhaust steam through the head of the point. The driving of points has formed the chief cost of opening up placer gravels, and the work of the Jackhamer has reduced this.

THREE-DRUM AMERICAN HOIST ON AL. HINTY'S CLAIM, CLEARY CREEK.

Two boilers, having a combined horse-power of 70, supply power to a 30-hp. Krogh pumping engine, an electric light plant and a 10-hp. Samson hoist. The pump is necessary to lift water into the sluice-boxes. An electric lighting plant provides lights for the underground workings and eight mine buildings. The gold lies partly in gravel and partly in bedrock. Five feet of dirt is taken out, of which 1½ ft. is bedrock. Thirty-eight men are employed. During the summer, a hoisting record was established. R. H. Keyes hoisted 287 buckets to the surface in five hours. The ten-hour day showed 526 buckets hoisted from the bottom of the shaft and dumped into the sluice-boxes. The dump-box has a length of 50 ft. In the dump-box and 50 ft. of the sluice-boxes iron-shod pole riffles are used, followed by an undercurrent of two box lengths to catch fine gold. The gold averages $17.38 per ounce.

On No. 14 Below, second tier, right limit, of Cleary creek, Kelly Brothers & Hickey are operating ground owned by W. J. Nolan and G. A. Vedin. The ground is 125 ft. deep; the 'pay' is 130 ft. wide and averages from $1.80 to $2 per square foot. The season's output is placed at 30,000 sq. ft. Water for sluicing must be raised a height of 30 ft. Two 40-hp. boilers supply power for the hoisting plant and thawing equipment. Fourteen men were employed. The lower part of the claim, 750 ft. of pay-streak, remains to be worked next season.

Alex Niemi & Co. are operating on 15 Below, third tier, right limit bench claim on Cleary, owned by G. A. Vedin. The depth to bedrock is 95 ft. The season's work embraced mining 30,000 sq. ft. of bedrock. The pay averages 70c. per sq. ft., all in gravel, with the exception of from six inches to one foot, which is in bedrock. Iron-shod riffles in the dump-boxes and sluice-boxes catch all the coarser gold, with one box of undercurrent. A 60-hp. boiler was used to operate a double-drum Lidgerwood hoist. On No. 18 Below, left limit, first tier, Hoover & Co. operated a 40-hp. plant, with a few men during the summer. Their work was said to be profitable.

Frank Johnson and John Anderson are working a lay on No. 14 Below, first tier, right limit, bench claim on Cleary. The claim is owned by Noyes & Underwood. The ground is 24 ft. deep and is frozen so that drift mining is done. The 'pay' is 100 ft. wide. Twenty thousand square feet of bedrock was cleaned during the summer. Most of the gold is in bedrock. In 1913, to take out $60,000 in gold on the claim, it cost $54,000, so closely were the expenses figured. Eighteen men are employed. A 40-hp. boiler operates a vertical Samson hoist.

Thirty thousand square feet of bedrock was cleaned up during the summer on the Snowflake bench claim, owned and operated by Peter Malone. The claim is opposite No. 13 Below, creek claim, on Cleary. Two plants are working. The 'pay' is from 90 to 130 ft. wide and averages from 60 to 65c. per sq. ft. The depth at the upper plant is 120 ft., at the lower, 134. Six feet of gravel is taken out, as no gold occurs in bedrock. An American and an O. & S. hoist are used. Two years more of operation is in sight.

O. P. Gaustad and A. C. Troseth own and operate on No. 9 and No. 10 Below, creek claims, and No. 10, right limit bench, as well as the Olnes fraction. The ground is 45 ft. deep, 11 ft. of which is 'muck.' From six to ten feet of gravel is taken out, as the gold is widely scattered above bedrock. The pay averages 50c. per square foot. The summer's work comprised 15,000 sq. ft. A No. 6 Pulsometer pump keeps the drifts free of water which seeps in from the worked out claims farther upstream. A 50-hp. Economic boiler and a 10-hp. Little Giant hoist comprise the hoisting mechanism. Fifteen men are employed. Gravity water is obtained from a ditch 1½ miles long and 400 ft. of flume-way. The dirt is dumped into a 40-ft. dump-box, with pole riffles. The sluice-boxes have perforated iron riffles underlaid with cocoa matting, which catch the fine gold. Gaustad & Troseth also own No. 2 Above, bench claim, left limit of Cleary, and the fraction between the bench and creek claim, but no work is being carried on there at this time.

H. J. Patterson is operating as layman on No. 8 Below, first tier, left limit, bench claim. The ground is owned by H. C. Hamilton. The depth to bedrock is 40 ft. Twelve thousand square feet of bedrock was to be the season's output. The 'pay' averages 75c. per square foot, and is 100 ft. wide.

KEYSTONE DRILLS USED IN PROSPECTING AT FAIRBANKS.

Gravity water is obtained from a ditch. A 30-hp. boiler operates a 6 by 8 Lidgerwood hoist. Fifteen men are employed. On No. 8 Below, first tier, right limit, owned by H. C. Hamilton and T. Treefeld, Otto Nars, Elert Hanson, and Martin Jorgenson are working a lay. The ground is 65 ft. deep. The season's work takes in an area of 24,000 sq. ft. of bedrock. A 20-hp. boiler and a 6 by 6 Little Giant hoist comprise the equipment. Eight men were employed during the summer.

Keyes & Rettig also are opening up on No. 7 Below, creek claim, Cleary. The claim has been taken under lease and option from Quinn, Gaustad, Troseth & Kern. The ground is 50 ft. deep. The pay-streak is 150 ft. wide and has been blocked out up and downstream a distance of 250 ft. The plans are to hoist all winter.

Harry Pearson and Andrew Johnson own and operate on No. 6 Below, first tier, right limit, bench and the adjacent fraction between the bench and the creek claim. The ground is 60 ft. deep. Twenty men are employed. A 50-hp. Oil City boiler and a 7 by 10 Samson upright hoist are used. Twenty thousand square feet of bedrock is given as the output for the season. Iron-sheathed wooden riffles and pipe riffles are supplemented by two boxes of undercurrent with plates and cocoa matting.

On No. 4 Below, right limit, bench claim, first tier, Wood & Piper operate a lay. The ground is owned by John Durand. Ten men worked during the summer, and 20,000 sq. ft. of bedrock was cleaned. The 'pay' averages 80c. per square foot. It is 40 ft. to bedrock. A 40-hp. Erie boiler and a 20-hp. Harris hoist comprise the equipment. The ground is frozen. Gravity water is obtainable.

The first open-cut work on Cleary is being carried on by Al. Hilty on No. 1 Below, creek limit, Cleary. The upper half of the claim is owned by Hilty; the lower half by Charles Dittmer. The work of preparing the ground for open-cutting has been going on for two years. In 1912, the work of cutting a bedrock drain to keep bedrock free from water in the proposed works was started. The drain has a length of 1900 ft. It is 5 by 2½ ft. in size and is timbered and lagged for its entire length. The work of opening the ground was started on the lower end. First, a number of old tailing piles, remnants of early operations, were sluiced. The gold derived from the waste paid more than one-half the expenses of opening the cut. Then the 'muck' was ground-sluiced off where possible and scraped where necessary. An American triple-drum 3 by 10 hoisting engine, one of two of its size in interior Alaska, is operated by an 80-hp. Scotch marine high-pressure boiler. Wood used for fuel costs $14 per cord and the consumption amounts to three cords per day. A Benton electric light plant has been erected, so that work may go on continuously during the sluicing season. Most of the ground is thawed, although there are some frozen spots which have to be thawed with steam points driven from the surface. The ground has a depth of from 16 to 22 ft., of which from 4 to 12 ft. is 'muck.'

The first cut prepared is 250 by 250 ft., which was worked out during the 1914 season. Three more cuts would work out the claim. After the first cut, the waste 'muck' and gravel from successive cuts will be ground-sluiced into the worked-out cut, eliminating the necessity for expensive scraping and enabling better time to be made. Preparations have been made to obtain gravity water, with 2000 ft. of ditch and flume supplying two and one-half sluice-heads. A No. 6 Morrison centrifugal pump has been installed to return the water during the dry season. Two Bagley scrapers are in use, one with dimensions 4 by 5 by 2½ and the other measuring 3½ by 5 by 2½ ft. Each scraper is controlled from the hoist by cables, a one-inch lead line having a length of 850 ft., and a ¾-in. haulback line having a length of 1750 ft. The cable is Roebling plow-steel and has been found entirely satisfactory. One Stevens, one home-made, and two Columbia blocks are used with the 3-ft. scraper. Six Stewart blocks are used with the 4-ft. scraper. The dirt is dumped into a hopper at one side of the cut, which empties into a dump-car having a capacity of 40 cu. ft. The dump-car is hauled up a 200-ft. incline by a 6¼ by 8 Lidgerwood hoist and emptied into the dump-box which has a length of 82 ft. and a width of 4 ft. In the dump-box are iron-shod wooden riffles, followed by similar gold-saving equipment in the sluice-boxes, with the exception of two boxes of undercurrents. The sluice-boxes are 2 ft. wide. The cost of preparing the first cut was 50c. per square foot. Successive cuts will cost from 30 to 35c. per square foot because of the opportunity of simplifying the scraping operations.

The Hilty fraction, which lies between the Freeman bench claim and No. 1 Below, creek claim, is being worked as a drift mine because of its greater depth. On No. 7 Above, Cleary creek, just beyond the rich bonanza claims of the early days, Gust Honk, I. B. Wickstrom, and Gust Bostrom are operating on the left limit bench claim of the first tier. The ground is 56 ft. deep. Ten thousand square feet of bedrock was cleaned up during the summer and plans provide for a similar area to be worked next summer. A 30-hp. boiler and a 14-hp. American hoist comprise the equipment. The men also own No. 8 bench claim, but are doing no work on it now. Ringdahl & Co. are working on eight creek claims with a crew of four men. They have a 20-hp. plant. Westenvick Brothers are open-cutting on a small scale on No. 11 Above. David Thompson is working with two partners on 10 Above, Cleary.

The only Cleary tributaries on which placer mining is being carried on are Chatham and Wolf creeks. On Willow and Bedrock there is no placer mining. Parker & Cunningham have a small plant on No. 1 Chatham and had a few men working during the season, taking out probably $2500. A few 'snipers' worked on several of the claims farther upstream. Several discoveries were made during the summer on Wolf creek, so that there was more life there than has been evident for some years. Nelson & Sampson worked with a windlass outfit on No. 1. Schon & Larson, on the lower end of No. 1 Above, had five men working. The ground was 60 ft. deep, the 'pay' 70 ft. wide, and the season's work covered 30,000 sq. ft. A 25-hp. boiler and Little Giant hoist made up the equipment. The ground averaged from 75c. to $1 per square foot. Work will continue on this claim next year.

On upper No. 1, Bloom & Erickson took out a little gold with a windlass outfit. On the upper half of No. 2, Thynes & Co. had three men working during the summer, taking out 'pay' from a depth of 35 ft. Holk & Pierson, on No. 3, had a small prospecting plant at work hunting for a continuation of the new streak. Rasmussen & Beam had two men working on the upper end of No. 3 and took out 'pay' averaging from $4 to $5 per sq. ft., according to reliable reports. They had a 10-hp. plant. Larson & Anderson, on No. 4, had three men working with a small plant. Johnson & Co., working on No. 5 Above, found good 'pay' in shallow ground. Demos & Co., working on the Nipsic association, installed a boiler late in the season and started prospecting. Liebe & Co., on the upper part of the Nipsic association, built a plant and were prepared to work on a fair scale during the latter part of the season.

Ludwig Johnson is working on No. 15 Below, with a crew of 30 men. He has a 60-hp. plant and hoists 'pay' from a depth of 120 ft. He has lays on neighboring claims and expects to continue work for three years more. On No. 8 Below, Stewart & Co. are driving with a crew of eight men. They used a 40-hp. plant. J. H. Page is operating on No. 7 Below, with a small crew. The ground has a depth of 30 ft. Freeman & Larson, working on No. 3 Below, are opening up ground having a depth of 24 ft. They have a 30-hp. plant, employ 10 men, and expected to take out 25,000 sq. ft. of bedrock during the summer. The ground is frozen. Martin Sather & Co. operated a plant on the same claim for two months at the beginning of the sluicing season.

(To be Continued)

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

NEW YORK

COPPER. DIVIDENDS DECLARED, AND RAY CONSOLIDATED, ANACONDA, OLD DOMINION AFFAIRS; AND THE EXPORT SITUATION LEAD.

Concrete evidence of improvement in the copper situation is seen in the dividends recently declared by several of the more important companies. Utah Copper has declared its regular quarterly dividend of 75c., and Chino will pay 50c. per share on December 31. The Tennessee Copper Co. has also declared its regular quarterly dividend of 75c., payable January 2. The Old Dominion will distribute 50c. on December 31. Ray Consolidated has deferred action on its quarterly dividend. The Calumet & Hecla does not consider that the improvement in the copper situation is yet sufficiently great to justify any dividends.

There was a report in circulation that the Ray Consolidated would close on the first of January because of the Arizona law requiring 80% of mine employees to be American citizens. This has been denied by the management, which has no intention of discharging its American staff through a general shut-down. In addition, there is a good deal of doubt whether the Arizona law would be held constitutional by the courts, and also the State Department has been making representations to the Arizona state officials, since some foreign nations have already protested against a law which discriminates against their nationals.——John D. Ryan and B. B. Thayer have been in Anaconda and Great Falls recently, making plans for the future operations of the mines.——Old Dominion has been making a good recovery lately and has been showing unusually low costs, partly because the grade of the ore now being mined is higher than usual, partly because the new concentrating plant has increased recovery as well as decreased operating costs, and also because there has been a marked increase in efficiency of employees in operations generally. The November output was 1,924,000 lb. copper. Net earnings for the nine months of the year were $1,085,000, and dividends for the year will reach $1,172,000. Litigation between the Company and Mr. Hyams continues to be as involved as ever. The decision handed down by the Court of Errors and Appeals in New Jersey, which is the supreme court of that state, turns out not to be a decision, but merely a memorandum to correct an error, and further complications are still in order. For long-distance, senseless litigation, this case certainly holds the record.

The copper export problem has not much improved. It now appears that Norway and Sweden have not given guarantees satisfactory to England, as reported, and five more vessels, carrying some 6,000,000 lb. copper, consigned to Scandinavian ports, have been detained by British cruisers. The British government has made no reply as yet to the inquiry of the State Department as to whether the guarantee given by Italy is satisfactory or not. The customs officials in New York have devised a plan which they think will help the export situation, and they propose to have a customs inspector present at all times during the loading of a vessel, and when the ship clears they will issue a certificate that it has nothing on board except what is shown in its papers, this doing away with any excuse for taking the vessel into a British port to search it. But since copper is considered by England as contraband of war, this will hardly help the shippers of that metal. Exports from this country during October were 64,932,261 lb., of which over one-third was consigned to Italy. During the first 28 days of November, exports were 55,000,000 lb., only 5,000,000 lb. of which was for Italy. There is much speculation here as to whether the Copper Producers' reports will ever be resumed. Many of the producers seem to think they are productive of more harm than good, and are quite willing to let them go by the board.

The vice-president of the National Lead Co. is quoted as saying there is at present an unusual demand for lead because of the demands of neutral and warring countries, and that it is hoped to hold some of this business after the war is over. In the face of this declaration, the recent reduction in the price of lead assumes an air of mystery, even greater than usually attaches to the fluctuations of that peculiar metal.

The statement in last week's notes that Hayden, Stone & Co. had purchased the Butte-Duluth mine is denied by that firm. [The information came to us so direct that it seemed unnecessary in this case to confirm it by appeal to Hayden-Stone. Correction is made elsewhere.—EDITOR.]

TORONTO, ONTARIO

CANADIAN NICKEL, THE UNITED STATES, ENGLAND, AND GERMANY. —GOLD MINING AND SHARES.—RESUMPTION OF ANTIMONY MINING.

The agitation connected with the export of nickel to the United States, with the possibility of the refined metal reaching Germany, has subsided, as a result of recent action by the Canadian government, which has for some time been in communication with the British authorities on the subject. The International Nickel Co., of New Jersey, to which the nickel matte is shipped for refining, claims that it has em-

AN AVERAGE SILVER SHIPMENT FROM THE BUFFALO MINE, COBALT; 141 BARS, 140,544 OZ., 999 FINE, VALUED AT $84,325.

ployed effective measures to prevent any of the output being sent to Germany by an indirect route, and invited investigation. Accordingly, an accountant was sent to New York by the Dominion authorities, who made a careful investigation. His report, which is said to be satisfactory, has been sent to the British government, and its decision will, of course, determine whether the Canadian people should take any further action or not. Meantime, it is not considered at all likely that the export to the United States will be interfered with, as it would be a very serious blow to the mining in-

dustry. Production at the mines of the Canadian Copper Co. has been steadily increasing of late, and is now stated to be about normal. The Mond Nickel Co., the output of which all goes to England, is preparing to make important extensions to its plant, the funds for which will be raised by an issue of $500,000 6% redeemable debenture stock.

Since the resumption of trading in mining stocks, the market has been quite active, especially in Porcupine issues, owing to a confident feeling that the gold mining industry is about to enter on a period of prosperity. The re-entry into the field of the Bewick, Moreing & Co. interests of London, whose Canadian company, the Northern Ontario Exploration Co., is preparing to resume active development work on its holdings, is regarded as a significant indication of the greater interest likely to be taken in the district by British financiers. The great demand for gold created by the war naturally directs attention to the goldfields, and further investments are looked for. The main drawback, however, is the exorbitant prices at which improved prospects are held by the owners, which have all along acted as a deterrent to the more rapid development of the country. Trading in the Teck-Hughes, in particular, has been active, owing to the recent opening of an ore-shoot said to assay $28 per ton over a good width.

The demand for antimony, which is used in the manufacture of shrapnel, and the cutting off of the supply from Germany, has resulted in the reopening of the antimony mines at Lake George, York county, New Brunswick. These were worked many years ago by the Lake George Mining & Smelting Co., with an output of about one ton per week, and afterward by the Canadian Antimony Co., but operations ceased owing to the low price of the metal and the distance from railway facilities. The price has now risen to 14c. per pound, and the transportation difficulty has been solved by the completion of the St. John Valley Railroad to within three miles of the plant, so that there seems to be a fair opportunity for putting this industry on a permanent basis.

PLATTEVILLE, WISCONSIN

Blende, Galena, Iron Pyrite, Carbonate of Zinc during November.—Ochre Mining.—Production by Districts.

November brought to light no unusual developments in the way of production and ore deliveries in the zinc-lead districts. The metal markets at the beginning of the month offered little encouragement to an increased output, spelter being quoted at $4.75 to $4.85 per cwt., St. Louis. Gradual and substantial gains were recorded, forcing the price above $5, the month closing at $5.35. With this advance in the price of metal came also a more marked advance in the price of blende, and the base was raised from $39 to $43, to $43 to $47 per ton, 60% grade, which prevailed in the closing days of the month. With low prices, however, marked increases in production of raw concentrates were noticeable, with corresponding gains in deliveries. This situation was entirely reversed at the end of the month, the production of raw zinc concentrates the last week being just half that recorded in the first two weeks. The only reasonable conclusion that could be arrived at seems to be that producers, scenting still higher advances in both the price of metal and ore, had concluded that a waiting game might prove the more profitable. All the active producers are in better shape than ever to make a heavy recovery, weather and road conditions could not possibly have been better, and labor was in good demand, so that a curtailed production could in no wise be charged to any of these ulterior causes. The reserve in the field at the close of the month was conservatively estimated at less than 3000 tons. Buyers were active in all the districts, and competition was more accentuated than at any time previously during the year. Leading buyers representing Eastern mining syndicates freely predicted $5.75 to $6 for spelter at the beginning of the coming year, and $50 per ton for blende.

Lead ore ruled weak the first half of the month. Prices were slightly in advance of $40 per ton; then a radical change became effective. A better demand was in evidence and prices advanced sharply until bids recorded $48 per ton, in the last days on 80% ore. Miners regarded the gains askance and held their ore closely, shipments for the entire month being exceedingly light.

Producers of iron pyrite met with poor demand, and sagging quotations, and production was greatly curtailed. Deliveries were light and confined principally to the Benton district.

Producers of carbonate zinc ore, operating in the northern districts of the field, met with a sporadic demand in the beginning of the month, which was totally absent at the end. The price based on calamine ores for the Missouri product is good, giving the Wisconsin miner about $12 to $16 per ton for his product, most of which is taken in the dry and economically mined. Shipments were light, and a heavy tonnage was carried over. Production has not been diminished, as the small concerns are all operating underground again for the winter.

What promises to develop into a new industry in this field is found in the shipment of a car of ochre from the Highland district which brought $5 per ton. This mineral is to be used in the manufacture of paint, and on experiments now being conducted by a large paint-manufacturing concern depends the mining of the ochre in large quantities. Deposits 15 ft. thick and of large tonnage are found in the northern districts of the field. An experiment of this character was tried once before, many years ago, but the great development of the Middle West makes the carrying out of a project of this kind more feasible at this time.

Zinc ore deliveries were made from the districts of the field during November as shown in the table herewith:

Districts.	Zinc, pounds.	Lead, pounds.	Pyrite, pounds.
Benton	6,542,000	262,400	1,814,020
Galena	5,268,000	.....	.....
Cuba	4,114,000	.....	.....
Hazel Green	3,520,000	220,000	.....
Livingston	3,508,000	.....	.....
Shullsburg	1,968,000	.....	.....
Platteville	1,256,000	.....	.....
Harker	960,000	.....	.....
Highland	630,000	60,150	.....
Dodgeville	468,000	.....	.....
Mineral Point	50,000	.....	.....
Linden	902,000	60,150	.....
Total	29,186,000	602,700	1,814,020

SYDNEY, NOVA SCOTIA

Timber for English Mines.—Coal Production.—Gold, Tungsten, Gypsum, and Oil Development.

There is unusual activity in procuring 'pit props' for the mines of Great Britain throughout the maritime provinces of Canada and Newfoundland. England's supply of mining timber formerly came from Norway and Sweden and other contiguous countries which are now partly or wholly cut off from transportation. New Brunswick, which has extensive forests, is especially profiting by the business; but ships are picking up the timber from piles all along the east coast of Canada, where men thrown out of employment from other lines are cutting the props on contract or for wages.

There is reason to believe that the war will benefit the coal mines of Nova Scotia, on account of the demand for bunker coal for warships, which are taking increasing amounts of Welsh and Continental coal, so that Nova Scotia

may get some of the export trade that these countries formerly took care of. In spite of dull times in many manufacturing lines in eastern Canada. The coal mines of Nova Scotia particularly of the Sydney district, are more extensive and important than is generally appreciated. The production of coal in Nova Scotia has grown from about 3,000,000 tons per year in 1900, to 7,000,000 tons for the year 1913, and gives employment to over 12,000 men, an output of over 500 tons per man per year. Most of the mines are within a few miles of an Atlantic port with which they are connected by railroads. The industry is in the hands of a few large companies such as the Dominion Coal Co. and Nova Scotia Steel & Coal Co. Vertical shafts as well as incline slopes are used. About one-third of the province's coal output is consumed within itself, where the Dominion and Nova Scotia companies have iron furnaces and steel works. These in 1913 used 900,000 tons of imported iron ore, mostly from Newfoundland. Another third of the coal goes to the province of Quebec, while the remainder is shipped to other maritime provinces and to the United States, the last-mentioned taking 500,000 tons of Nova Scotia coal yearly.

Other mining industries in Nova Scotia include gold, tungsten, and gypsum. The gold mines have dwindled in production of late years, although several hopeful operators are endeavoring to apply modern close methods of gold saving, by improved cyanide treatment, to ore from the rather narrow quartz veins. Nova Scotia has been producing gold for over 50 years. In several periods the production has risen to over 25,000 oz. per year, the last time from 1896 to 1903, but in 1913 the output was only 2364 oz. There are no large deposits, at least so far discovered, but there are a number of small mines and prospects scattered throughout the province. Tungsten mining in Nova Scotia, which attracted some attention recently, has been disappointing, although an amount of shaft-sinking and driving was done in the hope of establishing a new industry. Gypsum mining, or quarrying, is represented by several companies, which in 1913 produced 270,000 tons, much of which was shipped to New York, to be used for plaster.

In New Brunswick some little excitement was aroused in the past two years by extensive drilling for oil along a belt not far from the ocean. A little was found, but more gas. Iron mining during recent years has not been successful. However, ore of fair quality is known to occur in the district back of Bathurst, and will some day become important.

PETROGRAD, RUSSIA

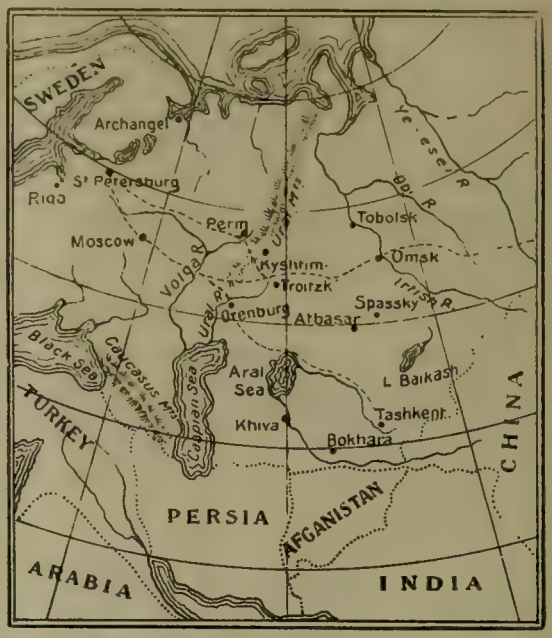
RÉSUMÉ OF THE RUSSIAN GOLD-MINING INDUSTRY: LABOR SHORTAGE, WAGES, DREDGING PROSPECTS, AND COMPANY OPERATION IN PLACE OF SMALL CONCERNS.

The position of gold mining in Russia this year, never particularly promising, is naturally less so now owing to interference with the labor market by the opening of hostilities, and consequent mobilization of military forces. A semi-official report on the prospects of this year's gold-mining returns observes that it has not promised to be very active, and that quite independent of the military question, the most serious obstacles to its further development lies in the shortage of labor. This factor in the industry is growing increasingly difficult on account of its cost. Labor in Russia grows persistently dearer, and to add to this difficulty there is the recognized impoverishment of the gold deposits that have hitherto been worked and which has resulted in the shutting down in many cases, particularly in those of the smaller industrialists, of their operations altogether, though in others they have only curtailed their work.

Taking Western Siberia under particular observation, and the Orenburg mining district, there is no doubt that the activity of the operators has considerably declined simply because of the scarcity of labor. This is directly attributed to the construction of railways, which attracts nearly all the workers, and consequently makes the cost of such as are willing to remain in the goldfields almost prohibitively high.

This incubus, so to speak, on the gold industry was not naturally foreseen when, in response to the demands of the operators themselves, the government started out on an active railway construction campaign, which has the temporary effect referred to, but will no doubt in the future have its recompense in the form of easier access to the consumers' markets for the products of the mines.

It is in the Amur district, however, that the weight of this consideration is being most seriously felt, because of the prohibition by the government against the employment of yellow labor in the gold mines; and it is feared that the direct result of this policy being put into effective force will be to bring about a disaster to the gold industry in the Amur territories. While the daily wages of the Chinese and the



----------RAILWAYS. ..... BOUNDARIES.

PART OF THE RUSSIAN EMPIRE.

Koreans can be reckoned at 70 *kopeks* (35c.), the daily wage of the Russian workman varies between 2 *rubles* and 2 *rubles* 75 *kopeks* ($1 to $1.38). Even on such terms, the demand for the Russian workmen is heavy, and the gold producers are taking all measures in order to keep such in their mines for some special work such as investigation of areas, carpentry, and metal work, etc. At the same time, it must be remembered that many deposits recently exploited have not paid even with cheap yellow labor.

Generally in the Russian gold industry there is observed the rise of strong concerns, and a gradual disappearance of the smaller ones. This is explained chiefly by the low-grade nature of the gold-bearing deposits. The richer gravels, as has so frequently been noted, have been worked out, while the poorer ones require the application of newer and more expensive machines, to obtain which the smaller producers have not the means.

One of the most improved methods for operating in the goldfields is the dredge, which makes it possible to exploit low-grade ground. The application of the dredge in the Yenesei jungle has resuscitated altogether the recovery of gold

from this old district. Unfortunately, the development of the dredge business in Russia is seriously hindered by the absence of works for their construction. The Putiloff factory, which has a special dredge department, scarcely handles them at all; it being chiefly occupied in filling orders for the war department. The Neviansky factory, which constructed boats consisting to the extent of about half, of imported parts, has also completely ceased building them of late. As to the foreign manufactures, the cessation of the duty-free importation of machine parts in 1909 has made their use entirely too expensive for the exploitation of Russian gravel. But notwithstanding these obstacles, the dredge business in Russia continues to develop. Among others, there is the Orsk company, which has converted the old stacker scow into an electrically operated boat.

Attention must be called to the growing interest of foreign capitalists in the Russian gold-mining industry. Several large English companies, with a capital of several millions, have, as is known, leased considerable tracts of land from the Imperial Cabinet. These areas, in spite of their considerable richness, have hitherto remained unexploited because they require the application of complicated and expensive equipment. Many other English companies that have taken an interest in such lands have been sending commissions this year into the district referred to, for the purpose of becoming acquainted with the industrial and mercantile value of deposits therein.

Respecting new gold regions, attention is directed to the northeastern portion of Siberia, and to the coast of the Okotsk sea, where gravel has been discovered which contains a fair percentage of gold. One company that has only been partly formed has sent an engineer to these areas for a closer examination of their value.

An encouraging note in the semi-official report deals with the discovery of gold deposits on the lands of the Lena company in the River Bodaibo district. This is considered to be of much importance. There is intensive prospecting being done throughout the Lena basin. The Olekminsk Gold Co. is sending an expedition to the Charu river, and another away to investigate the zone of the River Tartygi. The chief object of these expeditions is to find out whether it is possible to use dredges. Naturally, these reports are awaited with considerable interest, because if the answer is affirmative it opens a new future for this Lena basin in which the dredging hitherto has not been applied. At the same time, these expeditions will inquire into the navigation possibilities of the rivers that serve the district.

KALGOORLIE, WESTERN AUSTRALIA

LABOR IN POLITICS AND THE MINING INDUSTRY.—THE NEW MINE, THE EDNA MAY.—NEW GAS PRODUCER.—SONS OF GWALIA MINE.

The result of the state elections has been a distinct setback to the Labor party, and should put an end to its extreme and socialistic legislation for the time being. The premier, John Scaddan, when stumping the country before the elections, stated that when returned to power, he would reintroduce his 'war' tax, imposing a duty ranging from 1 to 15% on all incomes, apart from the current tax of 5% on dividends. He also threatened the re-imposition of the new Mines Regulation bill, to abolish night shift, contract and bonus work, to reduce a working week to 44 hours, to reduce the number of foreigners to 1 in 10, to give preference to unionists, to double wages for Sunday work, and to inflict numberless other disabilities on the mining industry. As Mr. Scaddan's majority in the Legislative assembly will be two, at the most, and his party is in a hopeless minority in the Legislative Council, his power for mischief is reduced to zero. In fact, neither party will be in a position to pass any legislation of a controversial nature, and it will be a case of mark time for the next three years.

The lode in the Edna May at Westonia, 42 miles west of Southern Cross, and only 195 miles east of Perth, has straightened up from 1 in 1 down to 75 ft., to 1 in 3 between 150 ft. at 225 ft., and the outlook has considerably improved. The second granite bar, 8 ft. thick, was cut in the shaft at a depth of 201 ft., and was passed through in the cross-cut at 68 ft., and until the next level is opened its effect on the lode will not be known. At the 225-ft. level the lode is 25 ft. wide, and assays $40.80 per ton. The drift, at 225 ft., for the first 50 ft. driven on the hanging wall side, assays $33.80, for a width of 12 ft., with ore still on the foot-wall. Up to the end of September the output has been 30,715 tons for $658,650, and dividends aggregating $299,900 have been paid on a nominal capital of $107,100, of which only $41,250 was cash. Owing to the influx of water, an 8-in. Cornish lift is now being installed, and when it is completed, sinking will be resumed. A large number of adjoining leases is being worked, but so far as tested, none of them is any good. The Edna May lode, like the Great Fingall, Golden Pole, and Bullfinch, is confined to a break in the country, outside of which nothing of any value can be located.

A new down-draught wood-gas generator has been invented by G. H. Allen of Fremantle, which, according to I. C. Davies, manager of the State Implement Works, is better than any generator now in use. In fact, Mr. Davies asserts that the Allen generator is driving a 200-hp. gas engine, fully loaded, on half a ton of firewood, against 2 tons consumed by a generator installed only last year. Until the invention is further tested, and fuller particulars are available, it is premature to speculate as to its effect on the mining industry. Mr. Davies states "that the gas produced is absolutely free from all impurities," a rather large statement to make.

The attempt to find a profitable ore-shoot to the north of the main shaft in the Sons of Gwalia mine has so far proved unsuccessful. Owing to the intrusion of epidiorite having cut out the gold in the south end of the mine at No. 17 and 18 levels, Malcolm Maclaren advised prospecting for a new shoot to the north. A shaft was accordingly sunk 1000 ft. north and, at a depth of 80 ft., a good deal of cross-cutting and driving has been done, unfortunately with negative results. Since alterations and extensions to the treatment plant were started two years ago, $297,600 have been spent on equipment. The result has been that costs have been reduced from $5.56 to $5.16 per ton, and profits increased from $2 to $2.30 per ton. Now that the plant is in full swing, and the large expenditure on capital account completed, the dividend which, for last quarter, was cut down to 12c. per share will probably be raised again to 24c. The ore-shoot at No. 20 level, so far as tested, averages $21 per ton.

The state's gold yield in September was worth $2,232,500, and dividends paid amounted to $512,600. There were few changes in the monthly returns. In October the output was $2,153,460, and dividends $299,600. Of this the Edna May yielded $70,700 from 2907 tons, worth $49,100 profit, paying $32,100 in dividends.

The present position of the gold-mining industry is adversely affected owing to the increase in price of stores due to the war, and to the difficulty of obtaining fresh capital while the war lasts.

A scheme for ameliorating the lot of miners who have been injured by accidents or disease caused during their work, has just been formulated, and should be beneficial. The annual amount of money at the disposal of the executive is estimated at $125,000, of which the workmen and mine-owners subscribe 25% each, and a government subsidy makes up the balance.

At 2900 ft. in the Horse-Shoe, the north drift at 122 ft. averaged $59.92 per ton over 8 ft.—The Ivanhoe main shaft is down over 3200 feet.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

Since systematic work was begun by the U. S. Geological Survey in exploring and mapping the mineral resources of Alaska, in 1898, the Survey has covered by exploratory geologic surveys 72,000 square miles, by reconnaissance geologic surveys, 96,000 square miles, and by detailed geologic surveys, 4071 square miles. During the same period topographic exploratory surveys have covered 51,000 square miles, topographic reconnaissance surveys 116,000 square miles, and detailed topographic surveys 3642 square miles, according to the thirty-fifth annual report of the director of the Survey.

Cordova

Tests of the Matanuska coal on the cruiser *Maryland* are reported to have been quite satisfactory.

Juneau

The Alaska Treadwell company is cutting out a new shaft in the Ready Bullion mine by rising from the 2200-ft. level, and will also sink it 200 ft. below that level. From 70 ft. to the surface has been holed through, and rising is to be started next at 450 ft. The shaft is 7 ft. 8 in. by 20 ft. outside, with four compartments, and inclined at 70°. The collar will be of concrete, and the hoist driven by electric power.

At the Alaska Gold Mines' property all of the underground driving that has been planned for some time to come is practically finished. Work is now chiefly confined to the details

ALASKA GASTINEAU SHOPS AND YARDS, FROM THE COARSE-CRUSHING PLANT.

of cutting out stopes, putting in manways, ore rises, etc., with a view to having the mine fully prepared to furnish the large tonnage that the mill will call for. Electrifying of the Sheep Creek tunnel is under way, electricians being engaged in stringing both trolleys and feeders all the way from the coarse-crushing plant through the tunnel to the main ore way. At the power supply division the work is entirely operative, and the two power houses are now supplying the power necessary for all the requirements at both the mine and the mill. At the reservoir, the water his risen to a height of 132 ft., equivalent to 12,600 acre-feet. The average gain of the reservoir over what is used is a little over 600 acre-feet per week. The water-power being developed here is in excess of the estimate. At the reduction division, the coarse-crushing plant is completed, with the exception of the tipple, and parts for this have arrived. The power cables from the substation to the coarse-crushing plant will be completed within a few days. The ore-pocket is finished. At the main concentrating plant the steel erectors have finished their work, and setting of the rolls has been commenced. Both upper and lower floors for the Wilfley and Garfield tables have been cast. This completes all the floor work in the west sections of the mill with some slight exceptions. The mills and tables are either en route or have arrived.

An Ingersoll-Rand 40-drill compressor is being installed at the Alaska Juneau mine. It will be electrically driven.

ARIZONA

Gila County

The Old Dominion mine produced 1,924,000 lb. of copper in November, against 1,616,000 in October, and 2,962,000 lb. in July.

The Superior & Boston Copper Co. reports as follows for the year ended September 30, 1914: Ore shipments were stopped in August, owing to the copper situation; but development, which amounted to 4424 ft., and 563 ft. of diamond-drilling, shows a promising future. This was especially so at 800 and 1000 ft. east from the Quo Vadis fault. Rocks of the contact near the vein are diabase hanging and lime footwall. Work at present is at 800 ft., expenditure being limited to about $2000 per month. The great flow of water in the mine interferes with work, but water-level has been lowered to below 800 ft. Ore shipped was 25,625 tons, realizing $291,515, against $153,436 in 1913. All expenses totaled $309,218, and the deficit was $15,982. The cash balance is $59,286.

Graham County

For the third quarter of 1914 the Shannon Copper Co. reports that its output was 2,064,767 lb., and net earnings $26,562, compared with 3,118,156 lb. and $40,951 in the previous quarter. The cost of producing copper was 11.36c. per pound.

CALIFORNIA

Amador County

The preliminary report of the superintendent, James F. Parks, of the Plymouth Consolidated, shows the following results for November:

Ore crushed, tons	9900
Gross value of output	$42,982
Average per ton	$4.34
Working expenses	$23,884
Cost per ton	$2.41
Development charges	$4013
Cost per ton	$0.405
Surplus over working and development	$15,085
Other capital expenditure	$10,180

Butte County

In the suit of the Leland Stanford University trustees *v.* the Butte Creek Consolidated Gold Dredging Co., Judge McDaniel, at Oroville, has granted a preliminary injunction against the Company. This will prevent the boat from working in Butte creek. The Company testified that it was being moved and was not digging within 50 ft. of the present channel.

A 42-oz. gold nugget was found on Butte creek, near Nimshew, by E. J. Deneen, on December 11.

SAN BERNARDINO COUNTY

At the annual meeting of the Consolidated Gold Fields of South Africa, held in London recently, the chairman of directors said that in one respect it is particularly disappointing that he was not able, as had been anticipated, to tell shareholders that potash was being supplied to the market by the Trona Corporation, operating at Searles lake, California. He had fully expected from the reports and statements of the engineers that he would be able to do so at this meeting, and as, owing to the war, the United States has been deprived to a considerable extent, possibly entirely, of its supply of potash from German sources, it would, of course, have been a distinct advantage if the Company could have been in the market under such favorable circumstances. That potash, borax, and soda ash can be produced on a large scale has been demonstrated by actual figures, but the accuracy of the estimates as to the working costs and yield can only be definitely tested by operating on a commercial basis the fully equipped unit of the plant, which the directors are assured will be during next January. The margin of profit under normal circumstances has always been a good one, but since estimates were made this margin has largely increased owing, it may be, to the cessation of imports into America, which may not be resumed for many years.

SHASTA COUNTY

Forty members of the Shasta County Farmers' Protective Association have sworn that they do not suffer from smelter smoke, and 15 others state that they are plaintiffs in the Mammoth suit without their consent.

SIERRA COUNTY

An 180 gal. per minute centrifugal pump is being installed at the Telegraph mine, and sinking is to be resumed later. H. V. Hughes is superintendent.——Twenty stamps are crushing ore at the Monarch Consolidated, and developments are good.——The Oakland quartz mine has been sold by F. B. Voyle to F. A. Gowing of Oakland.

TUOLUMNE COUNTY

(Special Correspondence.)—The Eleanor Mining Co., Inc., is finishing development work on the Blue Eagle and Little Jawbone claims, which are situated on the north bank of the Tuolumne river, about 800 ft. from the same, and 1200 ft. east of Jawbone creek, in what is known as the Jawbone mining district. The outcrops on the Blue Eagle indicate a large orebody. The vein is exposed to a height of 80 ft. before it dips into the mountain, over 50 ft. across the top, and it is approximately 18 ft. wide. The ore is rather unusual for this locality and contains about 10% of sulphides, pyrite, pyrrhotite, and chalcopyrite. A large number of tests proved that the ore is amenable to concentration and cyanidation, with a high extraction. Up to the present time, four adits have been started to open the mine. The orebody developed is estimated to contain 12,000 tons averaging about $10 gold per ton. Ore of the Little Jawbone is of a similar nature and average value. The vein is 4 ft. wide. The Company has now installed a gasoline engine and air-compressor and drills, and is pushing development as fast as possible. A 50-ton mill will be built next spring.

As there are a number of other good claims in close proximity which this Company is now negotiating to secure, this locality will make a large field for mining operations. The mill will be operated by water-power, of which there is an ample supply from Jawbone creek. M. L. Crafts, formerly general manager of the General Custer mine of Custer, Idaho, and assistant superintendent of the Anaconda mine under Marcus Daly, is in charge of the mines.

Oakland, December 7.

The gravel deposit near Sonora owned by the Peoria Flat Mining Co. has been drained. A steam-shovel is being installed to dig the material and deliver it to a Querner reduction machine.

COLORADO

CLEAR CREEK COUNTY

The Waldorf mine, near Georgetown, is producing a good tonnage of smelting ore, and concentrate from its mill. The Herber lease is yielding high-grade ore from the Commonwealth vein at 900 ft. A cyanide plant is proposed for next spring.——The Josephine, in West Argentine, has suspended on account of the low price of lead.

GUNNISON COUNTY

The Quartz Creek district, near Pitkin, is more active lately on account of recent developments. A fine body of copper ore has been cut by the James Harbaugh Co. at the base of Siegel mountain. Rich gold ore was opened in the Buffalo Head, five miles from Pitkin. A 3-in. streak containing some bismuth occurs next to the vein. The new Camp Bird shaft is down 50 ft., and an electric hoist is being installed.

LAKE COUNTY (LEADVILLE)

The new Davis shaft in the Fryer Hill district is through the overburden at 115 ft., and is in mineralized porphyry.——After several years' idleness the Little Bob mine is being reopened. Men are cutting ice from the shaft and doing preliminary work.——Sinking of the Monarch shaft, and driving an adit into Prospect mountain, in the South Evans district, in which is the Little Bob and others, will help considerably to develop this territory.——The Big Four new tramway is in operation.——Some rich silver ore has been opened in the Double Decker on Yankee hill.

SUMMIT COUNTY

The Wellington Mines Co. at Breckenridge is operating both its mills full time and is shipping 7 to 8 cars of zinc concentrate per week to Bartlesville, Oklahoma.——The French Gulch company's dredge is producing from $25,000 to $31,000 per month. Steam is being used for heating purposes. A carload of iron-lead sand accumulated from the sluices, and this has been sent to a smelter. Herman J. Reiling is manager.——The Tonopah Placers boats are still working, and No. 3 may continue through the winter.

TELLER COUNTY (CRIPPLE CREEK)

Three large transformers are being installed at the Vindicator. The mill is working full time. No. 2 shaft has been retimbered.——The 12-ft. orebody recently found in the Mary McKinney is giving high assays. Lessees in the Howard shaft are mining 3 ft. of $40 ore.——Four or five feet of $30 ore is being shipped from the Monument claim, near the Ajax, by Ross and Cammenish.——Fish and Harris in the Portland have opened 100 ft. of ore averaging $25 per ton over 3 ft. width.——Fifteen lessees are now shipping a good tonnage of three grades of ore from the Granite mine on Bull hill.——A very rich shoot has been opened at 1200-ft. in the Cresson mine, and a carload of ore variously estimated to be worth $400,000 to $1,000,000, has been sent to Denver.

IDAHO

SHOSHONE COUNTY (COEUR D'ALENE)

The Federal company has given up its bond on the Star claims, adjoining the Morning mine. Ore was not found in quantities expected, and the low price of lead influenced the decision also. Spokane people, the Finch & Campbell syndicate and others, and E. H. Moffitt of Wallace own the Star property, and will drive a new lower adit from 2500 to 3000 ft. to cut the veins. These mining men also have an interest in other properties in this district.——The Independence claims have been sold to J. P. Mahoney, of Wallace, by the receiver for $20,475. The New Independence Mining Co. has been formed to work the property. H. L. Day, of the Federal, is largely interested in the deal.——Good progress is being made in extending the transmission wires of the Montana Power Co. The line is 32 miles long, and men are string-

line wires into Burke and Mullan. A lively power war is expected between this Company and the Washington Water Power Co. now supplying current. The orebody in the Nabob on Pine creek has widened to five feet, part of which is clean shipping galena. A new Nordberg hoist has arrived at Burke for the Marsh mine. The new three-compartment shaft is finished and connects the orebody at 800 ft. with the adit. The shaft will be sunk a further 275 ft. A large underground station has been cut, and the new hoist, driven by a 300hp. motor, is to work there. It will raise 2½ tons per trip from a depth of 2700 feet.

MICHIGAN

Houghton County (The Copper Country)

The report of the Old Colony Copper Co. for the year ended October 1, 1914, shows that the revenue from assessments, etc., was $105,875, of which $34,810 was spent in diamond-drilling, and $14,063 in taxes and general expenses. The balance on hand is $56,971. The superintendent, George S. Goodale, reported that the drills did 12,774 ft. of work in eight holes. No. 26 hole developed the Mayflower lode between 1749 and 1826 ft., No. 27 proved it from 1796 to 1828 ft., No. 28 from 1675 to 1705 ft., No. 29 from 1681 to 1692 ft., No. 30 from 1764 to 1863 ft., No. 31 from 1810 to 1844 ft., and No. 32 from 1780 to 1826 ft., while No. 33 has not yet cut the lode. Progress was satisfactory.

A large piece of 'mass' copper has been exposed in the Trimountain. It extends from above No. 25 to No. 27 level. Miners call it a fissure instead of a mass.

(Special Correspondence.)—Total shipments of iron ore from Duluth for the season closing December 1 amounted to 32,020,487 tons. This is the smallest movement since 1908, when the total was 25,427,094 tons.——The agreement between

DRILLING WITH SPIRAL STEEL AND A SULLIVAN DRILL IN ONE OF THE SOFT IRON ORE MINES OF THE LAKE SUPERIOR REGION.

the Great Northern and the United States Steel Corporation will end January 1. The former will operate its own ore properties which have estimated deposits of 200,000,000 to 300,000,000 tons, and M. A. Hanna & Co., of Cleveland, Ohio, will act as selling agents.

Houghton, December 12.

MISSOURI

Jasper County

Fourteen districts contributed toward making the past week an unusual one in point of the great number of companies represented, the total having been 118, Joplin being the leading district with 30 companies, Webb city next with 27, while a few of the other large areas showed the following: Alba-Neck City, 6; Duenweg, 7; Miami, 10; Galena, 14; Spring City, 8; Carl Junction, 4; and Belville, 3. As a number of large tracts of land are included in the total number of companies, the actual number of producing mines would be materially in excess of the 118 given. Cold weather is causing the closing of a number of small mines in the district.

A 300-ton mill is under construction for the Jasper County Land & Mining Co. on the Connor land, south of Carterville. Three mills are now working in this sheet-ground area, and within a few months there will be five. Ore is found at from 190 to 210 feet.

MONTANA

Fergus County

Gold yield of the Barnes-King Development Co. in November was $41,000, from 5035 tons of ore, compared with $31,900 and 3955 tons in October.

Silverbow County

The Anaconda company is to extend its operations in Montana by the expenditure of several million dollars.——It is expected that the Butte & Superior mine and mill will resume operations during the last week of December.

NEVADA

Clark County

The Boss mine in the Goodsprings district has been sold to a syndicate headed by W. C. Price, of Los Angeles, Mr. Pelchier of Sacramento, and H. Fleischaker of San Francisco. A deposit of $50,000 has been made at Las Vegas, and on further payment of $100,000 the property will pass to the Gold-Platinum Mining Co., now being organized under the laws of Arizona, with a capital of $1,000,000.

Elko County

Lessees in the Nevada-Anaconda property, 12 miles north of Carlin, have completed about $10,000 worth of development. Adits have proved a vein of 2% copper ore, and a well defined vein of lead carbonate ore. Several carloads have been sent to smelters. The Company will drive a deeper adit to cut these lodes. Henry Lewis is in charge.

Esmeralda County

At 1750 ft. in the Union Jack claim of the Atlanta property, near the latite-shale contact, 5½ ft. of ore has been opened for over 20 ft. It contains up to $40 per ton in gold and copper. The Company has $30,000 in its treasury.——To further open its new shoot in the Velvet claim, the Jumbo Extension is extending the east cross-cut at 1017 ft. a distance of 60 ft. A third rise will be driven to the latite-shale contact.——After a suspension of several years, work has been resumed at the Commonwealth. The shaft is to be sunk from 300 ft. to 700 ft., to cut the latite-shale area.

Eureka County

The Cortez Mining & Reduction Co. is operating in the Cortez district. The ore mainly contains silver and lead, with some gold, zinc, and iron. Up to the early part of August the mill was treating from 1500 to 1800 tons of ore, producing a silver-lead concentrate. A large body of lower-grade silver-lead ore, but higher in gold, has been developed, and the Company is investigating processes to treat the concentrate produced.

Humboldt County

The Antelope Springs Mining Co. is operating in the An-

telope Springs district, John W. Geiger being general manager. The mine has been developed by adits, No. 4 being in 1300 ft. At 844 ft. vein formation was cut, and driven on for 300 ft., when No. 1 ore-shoot was found. This has been opened 40 ft., and is from 4 to 20 ft. wide, containing silver, lead, and zinc. The mine contains 4000 ft. of workings. The nearest shipping point is 20 miles away. It is now proposed to build a mill to treat the ore, and the manager and other officials are in Park City, Utah, investigating the Daly-Judge mill, which is dealing with similar ore. The proposed plant will cost about $100,000.

NYE COUNTY

Tonopah mines produced 9381 tons of ore, worth $194,818, last week.——The Jim Butler-West End suit is reported to be making good progress.——The Tonopah Mining Co. has secured a lease, and option to purchase within two years, of the Mizpah Extension property. The latter owners get 50% of the net profits of ore mined during the period. If the option is exercised, a new company is to be formed with a capital of $5,000,000, of which the Mizpah Extension gets $2,000,000 and representation on the directorship. The Extension will pay three dividends of 2½c. per share each on January 1, an ordinary, an extra, and a special, totaling $70,750.——Development in the Montana continues encouraging.

The Eureka Johnnie Gold Mining Co. is operating at Johnnie, in charge of Charles Labbe. Several thousand tons of fair grade ore has been developed. A new vein was cut last week, showing 4 ft. of $25 ore. The quartz veins occur in sedimentary formation. The property is fully equipped, and a small mill is contemplated.

Traces of platinum have been reported from this district, which is a promising one, and needs a custom mill.

STOREY COUNTY

The old International hotel at Virginia City, built in 1876, and with many associations of the life of the Comstock Lode, was destroyed by fire on December 12.

WHITE PINE COUNTY

The Nevada Consolidated company's *Safety First* for November shows that there were 12 minor accidents at the property. There was one fatality at the smelter, when a switchman was riding in the cab of a dinkey locomotive which was running backward with an empty slag pot. He was sitting facing forward, and somehow fell face foremost on the track, and was run over. He apparently had not hold of anything, hand-holds being provided.

It is expected in Ely that work will be resumed at the Copper Mines company's property, and drilling at the Giroux.

NEW MEXICO

DONA ANA COUNTY

(Special Correspondence.)—Reports from Rincon state that the discovery of high-grade gold ore in the Caballo mountains was a 'gold brick' scheme, the samples being salted. The Riverview Mining & Development Co. was organized and incorporated for $10,000 to work the properties, claimholders near the 'strike' pooling their holdings and putting in $5000 each toward development. Clyde M. Becker, living at Rincon, states that the gold found in the assay pulp was placer gold, and the copper had been injected from a small high-grade copper vein near the mine, and corrects previous reports given out as to the Caballo mountain 'high grade.'

Rincon, December 1.

GRANT COUNTY

(Special Correspondence.)—The White Signal mining district, south of the Burro mountains, is coming into prominence, and activity in the region is greater than it has been for some time. The lower transportation costs made possible by the advent of the El Paso & Southwestern railroad, affords an outlet for Phelps, Dodge & Co., operating at Tyrone, and has made mining at White Signal more attractive. Ore is now being hauled but a few miles to a siding. Ores contain gold, silver, and copper.

Silver City, November 24.

SOCORRO COUNTY

In the case of Thomas E. Waters, trustee, *v.* the Treasure Mining & Reduction Co. of Mogollon, Judge M. C. Mechem, at Socorro, granted a decree of foreclosure. The property involved is valued at $287,395, and includes the Confidence group of mines, mill, millsite, and water rights.——Cleaveland and Weatherhead, operators of the Sunburst and Deadwood mines, and the Deadwood custom mill at Mogollon, have closed down temporarily in order to make needed improvements in both mines and mill, and after installation of machinery is made will operate on a larger scale. They have not yet fully decided as to what the changes will be. Operators expect to be in the market at an early date for a 50-hp. internal-combustion hoist, cages, and also a machine-drill sharpener.

OREGON

JOSEPHINE COUNTY

Two mining deals were completed at Medford on December 2, whereby the Old Channel mine, on Galice creek, has been sold to H. K. Owens, C. L. Creelman, and John C. Eaton, of Seattle, for $65,000; and a 75% interest in the R. A. Rowley mine, on Drew creek, to DeWitt Van Ostrand, of Wisconsin, for $30,000. The former mine has been tied up by litigation for five years. It was owned by the Old Channel Hydraulic Mining Co., of Chicago. The Rowley is a copper mine, and has three short adits.

A 30-ton cyanide plant is in full operation at the Queen mine near Leland, in charge of W. A. Burr.

MALHEUR COUNTY

The discovery of a large deposit of potash salts is reported 30 miles south of Vale. Los Angeles people are said to be negotiating for six sections of the ground.

UTAH

JUAB COUNTY

One of the U. S. Bureau of Mines rescue cars is at Eureka until December 22, and instruction is to be given to miners of the Tintic district.

Ore shipments from Tintic in November amounted to 348 carloads, or about 17,400 tons, valued at $435,000.

SALT LAKE COUNTY

Sales on the Salt Lake City Stock Exchange for the year were 3,329,943 shares (December, estimated), valued at $683,817, against 6,390,804, worth $1,234,628 in 1913. January totaled 326,951, and October 133,145 shares. This Exchange did not close on account of the war.

SUMMIT COUNTY

The Snake Creek tunnel is in 10,152 ft., 388 ft. being driven in November. Water flowing from the entrance is 8.3 second feet. A new Bury air-compressor of 9000-cu. ft. capacity has been installed, and better progress is expected. The ground at present is a hard mineralized limestone.

WASHINGTON

FERRY COUNTY

The Western Union Mines Co., at Republic, has secured a lease and bond on the Insurgent 'V' fraction and Ireland mines for $125,000. This deal completes arrangements for the development of the entire Republic group by J. L. Harper and associates.

STEVENS COUNTY

The Hecla Mining Co., of Chewelah, controlled by J. C. Argall and Fred J. Foster, of Spokane, has purchased machinery worth $2000. The orebody is to be opened by a 200-ft. shaft.

CANADA

British Columbia

The Granby company's plant at Anyox treated 47,000 tons of ore in October, yielding 1,800,000 lb. of blister copper. The cost was 8c per pound. Two furnaces were in blast. There was also recovered 790 oz. gold and 25,000 oz. silver, the total value of the return being $262,300. The smelter at Grand Forks is now in part operation.

Ontario

At Cobalt the Cobalt Reduction Co. has started constructing a cyanide plant, to treat slime produced in the mill. The latter is now handling 300 tons of ore per day.——The McKinley-Darragh company will pay $67,431, or 3%, on January 1. Total to date is $4,404,709, or 196%.——The Buffalo property is now being operated at full capacity, and 250 men are employed.

Prospecting by hydraulicking at the Nipissing was stopped in November, owing to the cold weather. A total of 95.6 acres was sluiced during the summer. In October the water uncovered five veins near Peterson lake, and drilling on three of these has shown that one is 2 in. wide, assaying 2000 oz. per ton. Three open-cuts produced 10,385 oz. The high and low-grade mills treated 6709 and 154 tons, respectively, yielding $189,029 net value.

Underground work was resumed at the Alexo nickel mine on November 23, after a suspension of 3½ months. The daily output is 40 tons of about 4 to 5% ore.

KOREA

The Oriental Consolidated company reports as follows for September: 240 stamps crushed 25,533 tons of ore, and the cyanide plants yielded $129,096. Operating charges were $74,209, and development, etc., $8217, leaving a net profit of $46,671. The East Candlestick 10-stamp and Kuk San Dong 40-stamp mill were hung up for 13 and 33 days, respectively, through shortage of ore.

The October output was $135,657 from 21,504 tons of ore. The Kuk San Dong mill resumed work on November 1, and it should run for two months. New concrete mortar blocks have been placed under 30 of the 40 stamps at the Tabowie mill. The rainfall was 7 in., making 90 in. for the year to date, an abnormally high quantity.

The Seoul Mining Co., operating the Suan concession in Whang Hai province, reports the following results for November:

Stamps working	40
Time, days	28.5
Ore crushed, tons	6,241
Total recovery	$73,000
Operating expenses	26,000
Net earnings	47,000

PHILIPPINE ISLANDS

A report on the Mambulao Placer Co.'s property includes the following data: The total area is about 830 acres, situated in the valley of the Mambulao river, in the Bay of Mambulao, and on the river Binutas, in the north part of the province of Ambos Camarines, Luzon. One claim is covered with a dense mangrove forest, the wood called *bacauan* being useful for boilers. The alluvial deposit varies from 25 to 65 ft. deep, averaging 36 ft., the first 5 ft. being clay and soil, 15 to 50 ft. of black soil made up of clay and decomposed vegetation, then a layer of 1 to 10 ft. of sand and quartz gravel, with a little clay, on a bedrock of soft, decomposed gneiss. Of 500 acres tested, 300 have averaged 72 *centavos* per cubic yard. Coarse gold exists, and is easily amalgamated. An 8-ft. dredge is proposed, and Joaquin Casanovas is now in San Francisco to place an order for one. Good profits are expected from this property.

PERSONAL

E. P. Kennedy is in San Francisco.

Bradley Stoughton has gone to Chicago.

E. Gybbon Spilsbury has gone to Arizona.

C. H. Wray has returned to London from Nicaragua.

E. H. Nutter is at the Engles copper mine this week.

F. Lynwood Garrison has returned to New York City from Santo Domingo.

W. del. Benedict is expected in San Francisco by the 21st or 22nd of December.

J. Magazumi, a mining engineer of Japan, is visiting the mines of the Lake Superior copper district.

Information is wanted as to the present whereabouts of W. W. Alexander, who was interested in mines in Mexico some twenty years ago.

Cutler B. Whitwell has returned to Nevada City after an absence of three months while examining the Gold Bank mine at Forbestown, California.

J. F. Thorn, who has been at Hot Springs, Arkansas, for some weeks, has fully recovered his health and will leave for Salvador December 22.

H. W. Hardinge is in Arizona, where he went to attend the American Mining Congress and for a three weeks' tour of the mining camps of that state.

The Le Conte Geological Club met at the department of geology, Stanford University, on December 19. The program was: 'Stratigraphy of the Tesla, Pleasanton, and San Jose Quadrangles,' by E. B. Hall; and 'Oligocene in Contra Costa County,' by B. L. Clark.

C. B. Lakenan, general manager for the Nevada Consolidated company at Ely, Nevada, and Jules Labarthe, general manager of the Thompson smelter at Thompson, were appointed by the governor, T. L. Oddie, to represent the state of Nevada at a hearing on the public lands question before the State Department at Washington on December 17.

The John Fritz Medal for notable scientific or industrial achievement was conferred, on December 2, upon Professor John Edson Sweet, of Syracuse, for his achievements in machine design and for pioneer work in applying sound engineering principles to the construction and development of the high-speed steam-engine.

Obituary

Augustus Waterman, long connected with numerous Comstock companies as secretary, and father of Douglas Waterman, died December 1.

John Pym Neville, who died at Oakland, California, December 8, as the result, probably, of internal injuries received a year ago in an automobile accident, was at the time of his death, president of the Selby Smelting & Lead Co. He was an Englishman, born in 1854. He came to the United States when 21 years old, going to St. Louis, where he joined the staff of the Collier White Lead Co. From the presidency of that concern, he came to the Selby company nine years ago, and he has been active in its affairs since. He was a genial, likeable man who in the Bohemian, Athenium, and Claremont Country Clubs was a familiar and welcome figure.

Old Freibergers will hold the annual meeting at Hofbrau Haus, New York, on December 19. It has been suggested that the society have a meeting in San Francisco in 1915; and the Old Academy wants as many as possible to return to Freiberg in 1916 to celebrate the 150th anniversary.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

San Francisco, December 17.

Antimony	15 —15¾
Electrolytic copper	11 —11¼
Pig lead	4.05—5.00
Quicksilver (flask)	$52.50
Spelter	6½— 6¾
Tin	34½—36
Zinc dust, 100-kg. zinc-lined cases	9

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, December 17.—Copper is firm at 12.70, lead quiet at 3.80, and spelter firm at 5.50c per pound. Dividends declared by the Butte & Superior, Chino, Homestake, Nevada Consolidated, Tonopah Mining, and Utah Copper companies total $3,292,414. Unfilled orders of the U. S. Steel Corporation on November 30 totaled 3,324,592 tons, against 3,461,097 on October 31, 4,396,347 tons on November 30, 1913, and 7,852,883 on November 30, 1912. The iron market is quiet and unchanged.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver

Date.		Average week ending	
Dec. 10	49.87	Dec. 2	49.33
" 11	50.00	" 9	49.91
" 12	49.87	" 16	49.83
" 13 Sunday			
" 14	49.87		
" 15	49.75		
" 16	49.62		

Monthly averages.

	1913	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59 32	54.35
Mch.	57.87	58.01	Sept.	60.53	53.75
Apr.	59.26	58 52	Oct.	60.88	51.12
May	60.21	58.21	Nov.	58.76	49.12
June	59.03	56.13	Dec.	57.73	....

The market has been firm, but shows a tendency to weaken. Insurance rates to India have fallen 25% since the cruiser 'Emden' was destroyed. Prices recede quickly whenever the Indian support is withdrawn, yet the undertone seems better. The steamer 'Manchuria' took silver valued at $75,498, say 155,000 oz., from San Francisco to the Orient on December 12. No silver was shipped from the Nipissing mine in November, the product being stored; but 269 bars, weighing 312,231 oz., were sent to England last week. The Tonopah Belmont shipped 178,851 oz. last week also.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Dec. 10	3.80	Nov. 4	3.50
" 11	3.80	" 11	3.50
" 12	3.80	" 18	3.70
" 13 Sunday		" 25	3.90
" 14	3.80	Dec. 2	3.80
" 15	3.80	" 9	3.80
" 16	3.80	" 16	3.80

Monthly averages.

	1913.	1914		1913.	1914
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4.60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr.	4.36	3.86	Oct.	4.37	3.60
May	4.34	3.90	Nov.	4.16	3.68
June	4.33	3.90	Dec.	4.02	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slighly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
Nov. 19	55.00	Dec. 3	55.00
" 25	55.00	" 10	52.50
		" 17	52.50

Monthly averages.

	1913.	1914		1913.	1914
Jan.	39.37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug	40.50	80.00
Mar.	40.20	39.00	Sept.	39.70	76.25
Apr.	41.00	38.90	Oct.	39.37	53.00
May	40.25	39.00	Nov.	39.40	55.00
June	41.00	38.60	Dec.	40.00	....

In London the price is £11 5s., or $54, per flask.

COPPER

Prices of electrolytic in New York, in cents per pound

Date.		Average week ending	
Dec. 10	12.70	Nov. 19	11.75
" 11	12.70	" 25	12 25 to 12.50
" 12	12.70	Dec. 2	12.62
" 13 Sunday		" 9	12.75
" 14	12.70	" 16	12.70
" 15	12.70		
" 16	12.70		

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16 54	14.21	July	14.21	13 26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14 19	Oct.	16.31	11.10
May	15.42	13.97	Nov.	15.08	11.75
June	14.71	13.60	Dec.	14.25	....

A review of the copper situation appears in the New York letter of this issue. Exports of copper from the United States in 28 days of November totaled 45,182,000 lb., valued at $4,959,000. October exports were 64,932,261 lb., worth $7,873,928. During the past two months the principal movements were as follows, in pounds:

Destination.	October.	November.
England	21,156,144	17,025,000
Italy	22,166,413	4,852,000
France	5,874,394	14,361,000
Norway	7,453,411	1,590,000
Sweden	5,342,340	6,119,000

Lake copper has been sold up to 13.12c. for January delivery. It is computed that only nine of the principal American copper companies are paying dividends at present. These are the Anaconda, Calumet & Arizona, Chino, Old Dominion, Phelps, Dodge & Co., Quincy, Tennessee, Utah Copper, and Wolverine.

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
Dec. 10	5.50	Nov. 4	4.90
" 11	5.50	" 11	4.85
" 12	5.50	" 18	5.00
" 13 Sunday		" 25	5.10
" 14	5.50	Dec. 2	5.20
" 15	5.50	" 9	5.50
" 16	5.50	" 16	5.50

Monthly averages.

	1913.	1914.		1913	1914.
Jan.	6.88	5.14	July	5 11	4.75
Feb	6.13	5 22	Aug.	5 51	5.45
Mch.	5 94	5.12	Sept.	5 55	5.16
Apr.	5.52	4.98	Oct.	5.22	4.75
May	5 23	4.91	Nov.	5 09	5.01
June	5.00	4.84	Dec.	5.07	....

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913	1914.
Jan.	50.45	37 85	July	40.70	31.60
Feb.	49.07	39.76	Aug.	41.75	30.20
Mch.	46.95	38.10	Sept.	42.45	33.10
Apr.	49.00	36.10	Oct	40.61	30.40
May	49 10	33.29	Nov.	39.77	33.51
June	45.10	30.72	Dec.	37.57	....

Tin is steady at 34.35 to 35.45c, according to quantity. In London the metal is £149 5s. per ton for spot, and £148 for future.

BOOK REVIEWS

ROBERTS-AUSTEN, A RECORD OF HIS WORK, being a selection of the addresses and metallurgical papers together with an account of the researches of Sir W. C. Roberts-Austen. By Sidney W. Smith. P. x and 382. Ill., Index. Charles Griffin & Co., Ltd., London, 1914. For sale by the *Mining and Scientific Press*. Price $6.

In preparing this attractive volume Mr. Smith has put metallurgists under a debt of gratitude by giving them in accessible form not only many reports on special investigations of permanent importance and interest, but also some of the greatest masterpieces of metallurgical teaching, and thereby continuing and multiplying the influence of a very beautiful and inspiring life.

The outline of Roberts-Austen's life with which the work begins, and the record of his work at the Royal Mint and at the Royal School of Mines, should both interest and stimulate young metallurgists, indeed those occupied in a wide range of allied subjects; while his addresses and the reports on his investigations serve as admirable models to those who are called on to address their fellows, to write professional papers, or to report to their employers.

The abstract of the first five reports of the Alloys Research Committee should be of great convenience to metallographists, in enabling them to run down in these admirable documents any specified information which they seek.

The theories with which Roberts-Austen dealt may be superseded, as nearly all theories must be when, in the fullness of time, they have done their necessarily temporary duty of assembling the existing pertinent facts in a form convenient for assimilation and discussion. The data which he recorded may be replaced by still more accurate and fuller ones. But his methods of presentation will retain their value unlessened, because they are adapted to the unchanging human mind. And herein lies the great value and justification of the present volume, that it teaches us things of persistent value, how to think, to examine, to report, and to address.

Roberts-Austen was a very great teacher primarily because he had the teacher's true spirit, because he considered not his own mind, but the minds of those whom he addressed, looking not in but out. The reason why, on returning to London, we went first to the Mint rather than to the National Gallery or to Westminster Abbey, was that we met there one who welcomed us not for his own sake but for ours; who was truly glad to put his researches off till night in order that he might quicken us. You felt instinctively that you drew inspiration from his look and presence, and became better fitted for receiving whatever is uplifting and broadening in the world's metropolis.

As the work of the physician is not so much to direct as to be followed, not to give good advice but to heal; as it is the work of each of us to do not only what is right from our point of view but more particularly what is effective, what will accomplish the good aimed at; so it is the work of the teacher not so much to utter what is true as to cause his hearers to accept the truth. It was through no vanity or pedantry that Roberts-Austen's language was beautiful and his outlook and his presentation studiedly interesting. It was not so much that this beauty and this interest served to give him readers and hearers, as that it made them read and hear with interest and hence to their profit. The beauty and the interest feathered his shafts that, holding true to line, they might pierce. What profits it to speak truths so disagreeably that nobody will listen, or so obscurely that the busy world refuses to do the duty which the speaker shirks, of shaping those truths so that they may enter? The first duty of the writer or the speaker is to fit his words to the task which they have to do, of entering busy minds and lodging there. On taking up many of our professional papers one is almost tempted to say "I would rather this had been interesting and intelligible than accurate."

It would not be amiss if the secretary of each of our engineering societies should urge each new writer, at least among those young enough to be plastic, to read this book with care. Indeed one may ask whether these secretaries have any duty more important than to guide young writers into readableness, and to impress on them the transparent snobbishness and egoism of writing primarily with the aim of barely recording thought or observation rather than of putting thought and observation into assimilable form, which almost necessarily means simple and pleasant form.—H. M. H.

FOURTH ANNUAL REPORT OF THE DIRECTOR (Joseph A. Holmes) OF THE U. S. BUREAU OF MINES. P. 101, index. Washington, D. C., 1914. This report covers the fiscal year ended June 30, 1914. The personnel of the Bureau totaled 426 at the end of the period, of whom 118 were in the field. There were 19 bulletins, 30 technical papers, and 4 miners' circulars published on various subjects, also the text of 26 other works was edited. A total of 1,039,603 publications was distributed, against 835,556 in 1912-13, 507,536 in 1911-12, and 110,504 in 1910-11. Appropriations by Congress for the year totaled $662,294. A summary of the more important work done last year shows the thorough study of coal mine and other explosions, mine-rescue training (29,975 men taught since 1910), timber in coal mines, use of electricity, mine ventilation, smelter fume, utilization of low-grade minerals, carnotite ores, saving in cost of fuels used by the government, coal studies, and petroleum and natural gas.

RECENT PUBLICATIONS

A SUMMARY OF THE OROGENIC EPOCHS IN THE GEOLOGIC HISTORY OF NORTH AMERICA. By Eliot Blackwelder. Reprint from *The Journal of Geology*.

OIL AND MINING BULLETIN. Official monthly organ of the Chamber of Mines and Oil, Los Angeles, California. Vol. 1, No. 1. P. 31. This was described in the *Press* of December 12.

University of California publications, Berkeley, 1914:

THE AGASANA-LIKE GASTROPODS OF THE CALIFORNIA TERTIARY. by Walter A. English. P. 14. Illustrated.

SKULL AND DENTITION OF THE MYLODONT SLOTHS OF RANCHO LA BREA. By Chester Stock. P. 16. Illustrated.

U. S. Geological Survey publications, Washington, D. C., 1914:

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEVADA IN 1913. Mines report. By V. C. Heikes. P. 42. The total value was $37,097,710 from 5,367,211 tons of ore.

GOLD AND SILVER IN 1913. General report. By H. D. McCaskey. P. 41. The gold output of the United States was worth $88,884,000, and quantity of silver 66,801,500 oz. worth $40,348,100.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN IDAHO AND WASHINGTON IN 1913. Mines report. By C. N. Gerry. P. 47. The output in Idaho was $24,149,049 from 2,451,592 tons of ore; and Washington $1,053,135 from 115,685 tons.

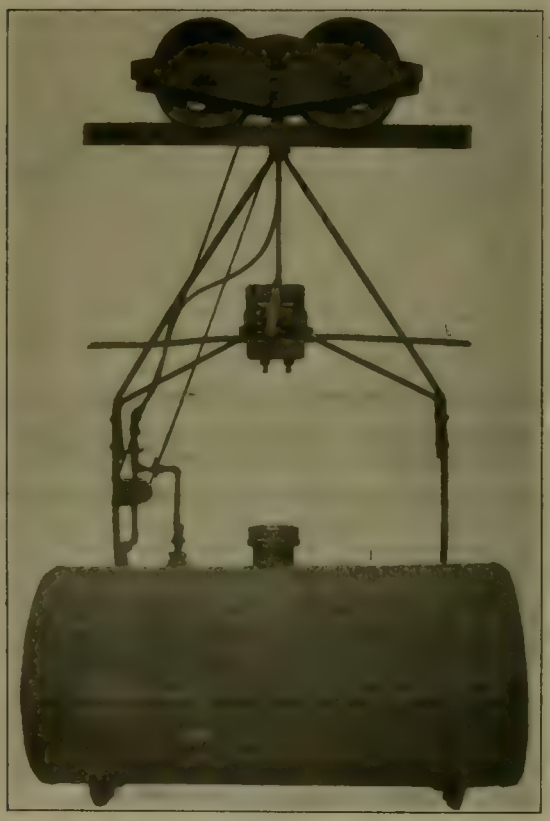
PRODUCTION OF NATURAL GAS IN 1913. Prepared under the supervision of David T. Day by B. Hill. P. 97. The yield of wells was 581,898,239,000 cu. ft., worth 15.10c. per 1000 feet.

THE STONE INDUSTRY IN THE UNITED STATES IN 1913. By Ernest F. Burchard. P. 126. Maps, charts. The value of all classes of rock extracted was $83,732,995.

New Machines and Devices

Automatic Rope Lubricator

The accompanying halftone is that of an automatic lubricator as supplied by the Painter Tramway Co. of San Francisco. Lubricating the rope of an aerial tramway, if done by hand, is slow and tedious work, but a simple matter if the automatic lubricator is used. As shown in the illustration, the lubricator consists of a 50 to 60 gal. tank suspended in



AUTOMATIC OILING APPARATUS FOR AERIAL TRAMWAYS.

an iron frame and hung from a specially designed pulley from the track rope. As illustrated, the device consists of (1) tank, (2) chain drive for the oil pump, (3) small gear pump consisting of two gear wheels which acting on the principal of a rotary pump raise the oil from the tank to the rope, (4) flexible tubing used to conduct the oil from the tank to the track rope, (5) track rope, and (6) the power rope for moving the lubricator over the track rope.

Commercial Paragraphs

STEPHENS-ADAMSON MFG. CO., Aurora, Ill., in Bulletin No. 66, entitled 'The Labor Saver,' discusses several installations of conveying and storage methods as used at gravel deposits and quarries. The handling of large tonnages of material affords many interesting problems and those discussed are presented in detail with illustrations.

The DEISTER MACHINE CO., Fort Wayne, Indiana, has been awarded the contract for the installation of all concentrating tables in the mill at the Inspiration Consolidated Copper Co. The order was for 112 double-deck tables which will be delivered with all possible haste, but the actual installation will not be completed for several months.

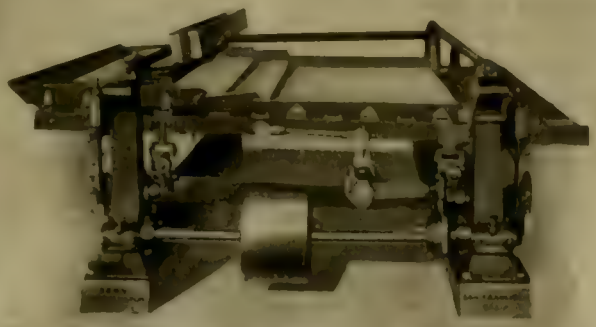
DAVIS INSTRUMENT MANUFACTURING CO., Baltimore, Maryland, has issued a number of bulletins devoted to the various products of this Company. Among these may be mentioned the 'Sighting Compass,' 'Simplified Mine U-Draft Water Gages,' 'Blasting Magneto,' and 'Pitot Tube and Manometer.' These bulletins are single-page leaflets, illustrated and containing a short description of the instrument treated.

BUSCH-SULZER BROS.-DIESEL ENGINE CO. is to install two Diesel engines at the plant of the Needles Ice Co., Needles, Cal. The purchase of these engines was after a thorough investigation of various types of prime movers, and it is hoped to have the engines installed and running by early summer. There will be two engines, one 500-b-hp. driving a 125-ton Ball ammonia compressor and one 120-b-hp. which will be direct connected with an alternating current generator. The engines are four-cyle, four-cylinder type with enclosed crank case, having large doors to give the greatest possible accessibility. Water cooling is used on the cylinders, cylinder heads, exhaust valves, piping, and piston as well as in the cooler for the lubricating oil.

The B. F. GOODRICH CO., Akron, Ohio, has recently received a report from the general manager of the French and English auxiliaries of the Company, in which it is stated that practically the entire stock of tires at the French factory and at the Paris stores has been requisitioned by the government. The tires were left in the Company's hands, but could not be sold to the public, the army having the right to call for them at a moment's notice and pay for them according to a preestablished tariff. There is no interruption in the production of band tires for trucks, but practically all that the Company could produce were used by the army. Recently the Company has been able to resume the manufacture of pneumatic tires on a small scale and also to offer some of the stock to the public. No difficulties have been experienced with regard to the supply of raw rubber and fabric.

CHICAGO PNEUMATIC TOOL CO., Chicago, Illinois, has issued a new publication entitled 'Small Power Driven Compressors,' which is Bulletin No. 34-S. These compressors have been designed to meet the demand for a small compressor which will be a simple, compact, substantially constructed machine requiring a minimum amount of attention. Quite a variety of small compressors are described in this bulletin, among these being the Junior No. 1 and No. 2, which has a 3-hp. engine with a hopper water-cooler on engine and a shaft pulley. This machine differs from other machines of this kind from the fact that the air piston is connected direct and in absolute line with the engine piston and the construction is such that the power is carried direct from the engine piston to the air compressor piston by means of a yoke, consequently the bearings do not receive any of the labor except as a machine which would be running empty. The machine is dust-proof and self oiling, which is one of the most essential points to be considered.

PAN AMALGAMATION



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PERSISTENCE OF ORE AT THE ST. JOHN DEL REY.

By T. A. Rickard 985

The persistence of ore at the Morro Velho mine of the St. John del Rey company has led to interesting developments. History of the mine would show that the lode cannot be said to have become either richer or poorer as it has been deepened, and that the St. John del Rey is an example of persistence to great depth. The experience of other mines, however, warrants the cautious policy of the management, which does not assume the continuity of the orebody for more than a few hundred feet as measured at any time from the bottom level.

ORIGIN OF THE ROCKY MOUNTAIN PHOSPHATE DEPOSITS.

By Eliot Blackwelder 987

One of the chief problems relating to the origin of these deposits is the nature of the environment capable of supplying the inferred successive layers of animal carcasses. This requires more data than are now available, although plausible suggestions may be presented.

NEW PLANT AT MT. MORGAN, QUEENSLAND 988

Many alterations have been made in the plant of this Company during the past two years, and the equipment as a result has been greatly improved. These improvements include changes in the smelter, concentrating mill, power plant, and shops. A report on the work which has been done is supplied by B. Magnus, the general manager for the Company.

CYANIDING TAILING IN THE WILLOW CREEK DISTRICT, ALASKA.

By J. T. Terry, Jr. 989

The Gold Bullion mine was the scene of the first sand-leaching cyanide plant in the territory, and as the best equipped property in the Willow Creek district, is representative of the practice. Details are given as to the operation of this plant where tailing composed of from 40 to 50-mesh sand, fairly free from slime, is being treated.

A PLATINUM-GOLD DEPOSIT IN SOUTHERN NEVADA.

By Adolph Knopf 990

The ore of the Boss gold mine, in the Yellow Pine mining district, has been shown to contain platinum. The deposit occurs in a dolomite of Carboniferous age.

PALLADIUM: ITS CHARACTERISTICS, USES, AND DISCOVERY IN THE BOSS MINE 990

Palladium is one of the rare metals belonging to the platinum group, and as it is strongly resistant to oxidation by atmospheric oxygen and moisture, and also to the effect of sulphur-bearing gases, it is peculiarly adapted to certain scientific apparatus.

EXAMINATION OF PLACER GROUND.

By Thomas A. Graves 991

Examination of placer ground has been the subject of considerable discussion in the columns of the *Press*, and the present article contains a wealth of detail as to methods and results in this class of examination work. The matter of records is of primary importance in this work, and the methods of keeping them are discussed with field data and observations.

MELTING OUT SLAG NOTCHES 994

An ingenious iron-oxygen torch for melting out frozen slag notches and similar work in furnace operation. The method is of European origin and introduced in this country by David H. Browne.

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The sulphide plant at the Yuanmi began operations in September of last year, and has been in satisfactory operation since that time. The notes presented give an idea as to the work which is being done as reported by Bewick, Moreing & Co., general managers for the Company.

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A detailed statement of production costs at these properties in the East Murchison goldfield of Western Australia.

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The Rand Banket. *By C. Baring Horwood* 996
In this letter Mr. Horwood replies to the discussion of his series on the Rand banket by H. Foster Bain. It closes the discussion.

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large enterprise and, speaking in general, we believe that the railways can offer in this particular much more to commend than to condemn. The other difficulty, that of excess capitalization and heavy bonding, is a more serious one, and one not to be settled offhand. It is being studied and progress is being made, if only in the particular that property values are increasing up to the capitalization. In the meantime the railway must live and the systems must grow. A small increase in rates is not serious to the consumer of transportation and will greatly help the railways and their security holders. Therefore we welcome the decision. Most of all, however, we welcome it as an expression of what we feel to be profoundly true; that the public and public officials want to be fair to the railways and will be fair when met fairly and with a good case. This increase in rates has a moral effect. It stands, we think, in the same category as the five per cent decrease in wages accepted at one time by the coal miners in convention with the coal operators. It is an earnest of good intentions and a bond to keep the peace and work in harmony. As such, it is particularly welcome.

NICARAGUAN newspapers announced the cancellation of the so-called Deitrick Concession which blanketed a large part of eastern Nicaragua and in practice has served for several years to discourage mining development. In the judgment of a mixed commission which has been studying the situation the terms of the concession were never fulfilled and it has therefore been declared void, with compensation of $104,000 to its owners for the actual damage that this cancellation causes. The concession was granted originally to Mr. James Deitrick, but passed later to a group of Pittsburgh capitalists and politicians with whom Mr. Philander C. Knox was associated. It was popularly regarded as an incident to the 'dollar diplomacy' which he, as Secretary of State, promoted. It might have been the means of promoting development in a large and rich area, but actually it operated to hinder the opening of properties. The boundaries were not accurately known, only part of the transportation facilities to be furnished by the concessionaires ever materialized, and the hope of the United States & Nicaragua Company seems to have been to have others undertake developments from which it might collect a royalty. Engineers examining properties in the Pis Pis district under these conditions were unable to recommend them to their clients and the inflow of capital was blocked. Naturally there is rejoicing in that district now that the incubus is removed. At the same time it should be remembered that Nicaragua is a large and unsettled country; the building of roads, establishment of steamer lines, and other essentials to development will require much capital upon which immediate return is hardly to be anticipated; and unless the Nicaraguan government undertake these things in earnest the country is likely to remain largely undeveloped until some powerful financial group is given large privileges for a term of years.

THE END OF THE YEAR

The year closes with the world at war. At a time when by long established custom our thoughts should be those of peace, we can only read and think of the greatest conflict of modern times. Instead of Christmas carols and Christmas good wishes, more than half the world hears only the boom of guns, the shriek of shells, or, far from the field, the quiet words that tell of another loved one having died for [illegible]. At a season when the World and his wife are accustomed to cease work and play at least one day with the 'kiddies,' thousands of children are starving to death. It is a terrible condition; one which we, here in peaceful America, can by no means visualize. We have troubles of our own, business has been poor with most of us, thousands are out of work, the Associated Charities have had to face increased demands with decreased revenues, and we are uncertain what the immediate future holds for us. With all that, by the good old method of contrast, we find ourselves well off, and out of the fullness of our gratitude we have been giving liberally to our less fortunate friends abroad. The work of the Belgian Relief Association, in which Americans have had such prominent and honorable part, is the one bright spot in the picture as the year draws to a close. The task is unthinkably large and the larger part remains to be done, but thousands of men, women, and children have already been saved from starvation. If that were all, it would in itself be a record of which humanity might well be proud. But it is not all. Perhaps the better part, the part that in the long years will count for most, has been the drawing out of the deep lying instinct to be helpful, that all mankind feels. The spirit of self-sacrifice is one of the most precious things in the world, and those who have gone without giving or receiving Christmas presents to help those they have never seen and will never see, have contributed to the making of a right *zeitgeist* more than they have given in dollars or in pounds. In turn, they have received more of value than any presents of other years. At a time when passions are roused, when smoldering racial hatreds are being fanned into flame by the incidents of the war, when men are ceasing to think in terms of the world, and organized murder is rampant, such an incident as the organization of international relief for the sufferers in Belgium is worth much. The war will end one of these days, and then will come the more difficult matter of readjusting international relationships so as to minimize the danger of recurrence of any such catastrophe. The work will be the easier and results a bit more certain because in the fight against suspicion, hatred, and self-interest this brilliant charge was made. Whether a boundary line be here or there, within limits, matters little as against the question whether we shall hate a man because he is a stranger and an alien. The Christmas spirit must struggle in this our year 1914 against many counter currents. Let each of us do what fate gives us the opportunity, to help it break through opposition.

EDITORIAL

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MINING ENGINEERS will be glad to know that a new and enlarged edition of 'Who's Who in Mining' is in preparation. Even incomplete as the early editions have been, the book has served a useful purpose, and it has the possibility of becoming extremely useful. The editor, Mr. George Safford, asks us to say that he will welcome from engineers in all lands, sketches of their lives that he may use in preparing the new volume. He may be addressed at 18 Eldon street, London, E. C., England.

PLANS for building a large zinc smelter at Swansea, Wales, to treat Australian concentrate, are reported to be temporarily in abeyance. The alternative plan of arranging for treatment in the United States through one of the existing zinc smelting companies or a new plant to be built by one of the larger metal companies, is also still under discussion. Great changes in trade movement cannot be made in one day and, for example, there is a question whether ore contracts with the German smelters have been terminated by the war or merely suspended. Profound changes in zinc smelting seem certain to result from the present war, but just what the changes will be cannot yet be stated with certainty.

CHILEAN nitrate producers are in a critical position, as is shown by the exports to Europe in October. Shipments to the Continent were less than 49,000 tons, compared with over 260,000 tons in the same month of 1913. Exports to the United States totaled 13,000 tons and 46,340 tons, respectively. On November 1, the estimated loadings for the United States amounted to 8240 tons, as against 5460 tons, but those destined for Europe were estimated at only 88,030 tons, as against 163,810 tons last year. The producers are making efforts to find a larger market in the United States. One difficulty is that the natural field for expansion is in the fertilizer trade, and here Americans are handicapped for the nonce by lack of potash.

DIRECT charges of graft are made in the suit recently instituted in the Supreme Court of New York county by Mr. Robert Holmes against the St. Joseph Lead Company and certain of the officers and directors. It is charged that an inferior grade of coal was substituted for the Carterville coal ordered and paid for by the Company, and that the purchasing agent profited thereby. The loss to the Company is estimated at $50,000 per year. We have previously referred to the difficulties in which the St. Joseph company has found itself despite the possession of large and valuable mines and the presence of most capable technical men on its staff. The situation emphasizes again the old truth that after all mining is a business and must be conducted with scrupulous regard to sound business principles, if it is to be successful.

COPPER stocks in Germany, according to the weekly report of the American Association of Commerce and Trade of Berlin are large and the Association quotes one of the foremost companies supplying war material, especially metal, as saying that should the war extend a great length of time, a sufficient supply of copper is on hand, and also that the company in question is in position to supply other industries. It has been reported, though how accurately is not known, that trolley wires were being torn down in Belgium to furnish copper for war purposes. In view of the German production and large stocks at the beginning of the war, it is not probable that this is true as yet, whatever may prove necessary in the future.

RAILWAY men are not the only ones pleased at the decision of the Interstate Commerce Commission allowing a five per cent increase in Eastern territory. It is only too true that the prosperity of the roads and of the country are so bound up together that one cannot be hurt without harming the other. The railroads must be allowed to earn enough to cover operating charges and suitable sums for maintenance and renewals. They must also earn enough to pay for expansion as needed or to pay interest and sinking funds on money borrowed for such work. All this is self-evident and generally admitted. The trouble has been that the general public has believed, and for that belief there has been entirely too much good basis, that operating charges have been excessive because of inefficient management, and fixed charges because of sums diverted from proper railway uses to the personal profit of insiders. By no means all railway companies can be properly so charged, but, as usual, innocent have had to suffer with the guilty; which is a crude rule society has evolved to make those who know an industry best police it. Management that is 100 per cent efficient cannot be expected in any very

TITANIUM

One of our subscribers who has discovered a deposit of rutile asks for information on the production and uses of titanium, and inquires what market there is for it. The situation in regard to titanium has materially changed during the past year, and its discussion is therefore of general interest. Titanium is one of the most abundant elements of the earth's crust, being present in most igneous rocks. Mr. F. W. Clarke has estimated that it forms 0.30 per cent of the earth's crust; in other words, it is one-half more abundant that carbon, ten times as abundant as barium, and fifteen times as abundant as nitrogen. It chiefly occurs as its oxide, TiO_2, and as a constituent of the mineral ilmenite, which may be roughly described as hematite in which part of the iron is replaced by titanium. Both of these minerals commonly occur in small amounts in igneous rocks, but large deposits, or concentrations, of rutile are not very abundant, as it does not seem to be easily taken into solution and re-deposited in rich concentrations. Nevertheless important deposits occur in Virginia, Georgia, New York, Maine, Arkansas, and other states, as well as in foreign countries. Ilmenite is quite commonly associated with magnetite, and until a few years ago it was generally supposed that immense deposits of titaniferous magnetite existed throughout the world, awaiting the discovery of a process by which they can be profitably smelted. An investigation made for the Bureau of Mines by Mr. J. F. Singewald disclosed the fact that the deposits are small, irregular, lean, and inaccessible except in a few instances, notably those at Sanford Hill, New York, and Iron Mountain, Wyoming, where large bodies of mixed ilmenite and magnetite occur free from gangue.

Early this year the McIntyre Iron Company leased a blast-furnace and began a series of experiments to determine the feasibility of smelting the ore from Sanford Hill, which contains approximately two-thirds ilmenite and one-third magnetite. By treatment with Wetherill separators a concentrate was obtained averaging about 55 per cent iron and 11½ per cent titanium. The blast-furnace was blown in on ordinary magnetite, and by gradual additions the charge was successively changed to $\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, and $\frac{5}{16}$ of titaniferous concentrate on the total charge. It was found that with the smaller amounts no change from normal working was noticeable except the formation of an unusually fluid slag. With the larger amounts it was found that the temperature of the slag was 150°F. higher than with ordinary ores, and the fluidity was much greater than normal. The titanium shows a tendency to replace silicon in the pig iron, and it was therefore hard to make a pig containing 2 per cent of silicon or over; malleable pig iron made from a charge $\frac{5}{16}$ titaniferous concentrate containing nearly ½ per cent titanium. It has been generally asserted that the presence of titanium in the smelting charge gives rise to a thick viscous slag and a high coke consumption; the experiments showed that the slag was unusually fluid and the coke consumption was normal. The pig iron produced during these experiments has been sold to consumers, but the records of the results attained in their use of it are not yet available.

All the rutile output of this country is produced by the American Rutile Company at Roseland, Virginia, which in 1912 produced 275 tons of rutile concentrate, containing 80 to 85 per cent TiO_2, and in 1913 produced 305 tons, containing 94 to 96 per cent TiO_2. The rutile occurs mixed with ilmenite, which is removed on magnetic separators, the material thus removed being well suited to the making of ferro-titanium. Much of the material produced by this Company is sold for export to Europe, but the quantity which can be sold is much less than the possible production, and the mill is only in operation during part of the year. It is evident, therefore, that the owners of deposits in the Western states would find it impossible to compete with the Virginia company, on account of the higher freight charges to the eastern seaboard, and it follows that the prospector has no incentive to search for rutile deposits.

Titanium is chiefly used for the production of ferro-titanium, which is made in this country by the Titanium Alloys Manufacturing Company, of Niagara Falls; the product containing about 15 per cent titanium and selling for 8½ to 12½ cents per pound. Some 1600 tons of this material was sold in 1911, chiefly for adding to bessemer steel for the production of rails, 153,000 tons of rails having been treated with titanium during that year. The titanium causes the steel to be more free from mechanically held slag, giving a superior quality of rail that sells for $1.50 to $2 more per ton than ordinary bessemer rails. Last year, however, less than 50,000 tons was so treated, the apparent reason being the growing use of open-hearth steel rails, which are also of superior quality and cost about $2 more than bessemer rails. The untreated open-hearth rails are of good enough quality so that the railroads are unwilling to pay for the additional cost of treatment. This decline in the use of ferro-titanium for treating rail steel, coupled with the success of the experiments in the direct production of titanium bearing pig iron, described above, seems to indicate that the demand for ferro-titanium for this purpose is likely to decline rather than to increase. Research work done by the staff of the manufacturing company indicates, however, that there will be a growing field for the use of titanium as an addition to copper and brass for the making of castings of those metals, it having been found excellent as a deoxidizer and therefore an aid in the making of sound castings.

Other uses of titanium are the making of 'magnetite' electrodes for arc lamps, the making of artificial teeth, the preparation of glaze for earthenware, the making of fused silica utensils, the preparation of titanium oxalate for use in dyeing leather and fabrics, and a few minor uses. The value of the total domestic output of rutile last year was estimated at $49,000 and it would therefore seem that the field of rutile production offers little attraction for the miner.

LOOKING FORWARD

This seems to be a day of proclamations and manifestos in Mexico when the various chiefs and *jefes* court the plaudits of the peon by statements which have proved in most cases empty of everything except words designed to be pleasing to the ear of the listener. These public expressions of plans and platforms have been both numerous and ridiculous as to application, but through them may be gleaned the real state of mind which has been responsible for the turmoil of the past four years, namely the struggle of the proletariat against the patrician, the peon against the great landlords.

Alberto Carrera Torres, general-in-chief of the 'Gustavo A. Madero' division of the Constitutionalist army, in a recent manifesto to the Mexican people declares the principles upon which the new *nacion* must be founded and what the Constitutionalist cause stands for. In reading over this wordy document one is impressed with the Utopian doctrines which he would expound for the uplift of the peon, and the bitterness of the class hatred which has been the cause of the trouble.

The purpose of the Constitutionalist cause, according to Torres, is "to secure happiness for our country by an era of peace and justice, and to guarantee to the *clases populares* an administration which will not oppress and exploit the peon class as has been the practice in the past. Under the old régimé there were no courts of justice established for the people, and as a result they have been the victims of a *rapacidad refinada* (refined robbery) by this *cientifico body*, who have looked upon the people as slaves." He thereupon proceeds to dispossess and depose by this manifesto all those connected with the old régimé, an act which has been repeated so often by Constitutional chiefs that it has become the standard procedure. He recognizes the authority as represented at the Aguascalientes convention as supreme and representing the purposes for which his army has fought. The laws of the country are recognized to be sadly deficient, and a reform is necessary whereby the lower classes of society will be received on a plane of equality with those of the upper class. It is emphatically stated that "The corrupt and rich class represented by Porfirio Diaz, Victoriano Huerta, and their followers has been protected by authority which was wrongfully set up, and under this protection have oppressed our brothers who form the supreme lower and middle class of society. It is necessary for our welfare that we break forever these chains which have wrongfully held us subjects of this *cientifico* class."

To meet the requirements essential to the welfare of the people, the debts which were contracted by the nation through the medium of the *cientifico* party and its successors—Huerta's administration—will in no manner be recognized. All bills owed to the *cientifico* party and representatives of this class are automatically canceled. In dealing with the officers of the federal army, it is ordained that no military titles conferred by the old régimé will be recognized by the new Constitutionalist government. A new military system is to be established whereby military instruction will be given throughout the Republic, this system to be in accord with the best principles of democracy and not for the establishment of a military despotism. Companies, battalions and regiments will be organized in the various districts and given instruction in the use of arms and military discipline. Under the new *nacion* the Mexican people will have the full power of self government and will name and elect the officers in the various branches of the government.

The agrarian question, which has been the subject of such great diversity of opinion, is to be solved in a manner which will be entirely satisfactory to the lower classes. Property rights of those who have acquired property by means not approved by Constitutionalist *jefes* will in no way be respected, but confiscated and returned to the people. For the solution of this problem a committee has been appointed and given full power to act for the nation, which committee is to be known as the *Primera Junta Agraria*. This committee is to arrange details for the redistribution of confiscated lands and will be advised to distribute at once all *haciendas* which have fallen into revolutionary hands and that property formerly owned by Porfirio Diaz, Felix Diaz, Huerta, Mondragon, Blanquet, Reyes, Orozco, Iñigo Noriega, Creel, Terrazas, and others. This ground is to be subdivided into small holdings of 100,000 square metres (about 30 acres) each, and the title to one of these small farms is to be given to each of the families who have proper credentials and constitute the *"libre y soberano pueblo bajo y la clase media."* In order to give an impetus to the agrarian movement, it is planned to drill wells and promote irrigation projects for the improvement of the lands to be distributed. The class to be particularly favored is designated in the manifesto as the *proletario*. Soldiers of the federal army who fought for the Huerta administration will not be barred from participation in this distribution, but will be apportioned land subject to their becoming and remaining loyal to the Constitutionalist cause.

Such is the material of which manifestos in Mexico are made, and the causes for the state of unrest. In the working out of the many plans proposed, the difficulties are many, and it is these details of the program which will cause no end of trouble. Manifestos, such as the Torres manifesto, have been numerous, and while the pervading sentiment is similar, there has yet to be developed an organization which will meet all the requirements of this many-sided people. Just how these manifestos will be translated into action and the people remolded into a commonwealth of one social status with unity of purpose and political creed is the task for a Titan. The Mexican reformer can see visions of such a Republic, but when reduced to the finite—*quien sabe*.

Persistence of Ore at the St. John del Rey

By T. A. RICKARD

Two [illegible] gold mines [illegible] in the state of Minas Geraes, in Brazil. Of these the Ouro Preto has no pretensions to profundity but the [illegible] Velho mine of the St. John del Rey company [illegible] mines that have reached to 5550 ft. vertical[1] and 7600 ft. on the dip, 45° decreasing [illegible] the orebody. This mine was bought for £56,434 by the present Company in 1[illegible]. In 1867 a fire and the collapse of the open-cut workings necessitated the cessation of operations and the sinking of two shafts, 1122 and 1422 ft. deep, respectively; in 1874 work was resumed, but a second caving of the ground ensued in 1886, and the mine again became unproductive. Two new vertical shafts were sunk through the orebody to a depth of 2264 ft., this work being completed in 1892. Since then the mine has been developed by a series of internal shafts, each 1200 ft. deep, in steplike succession, the first being started 610 ft. east of the main shafts sunk from surface, and each of the succeeding ones 1420 ft. farther east, to be connected by a level parallel with the lode at a safe distance north in the country rock. This method is in itself an indication of the cautious policy of the manager, George Chalmers, who has never felt justified in looking sufficiently far ahead to incur the heavy expense of a more comprehensive system of development.

According to Orville A. Derby, of the Brazil Geological Survey, the lode lies[2] in calcareous schist, which is older than the Upper Silurian and possibly of even pre-Cambrian age. This schist, or calcareous phyllite, is, in part at least, a sheared representative of an older eruptive rock intercalated within an ancient sedimentary series that has been highly metamorphosed in consequence of orographic movements of considerable extent. Granite intrusions, in the form of bosses and dikes, exist in the vicinity of the mine. The ore is mainly a massive mixture of pyrrhotite, with arsenopyrite and common pyrite. Quartz is a subordinate ingredient. The typical composition of the ore is as follows: pyrrhotite 28.5%, arsenopyrite 5%, iron pyrite, 6.5%, quartz, 24%, carbonates of iron, lime, and magnesia together making 36%. Copper pyrite is usually present to a minor degree. According to Derby the lode occupies a fault plane dipping eastward at an angle of about 45°, the shape of the orebody being controlled by systems of jointing in the schist.

The annexed section (Fig. 1) of the mine is the one published in the Company's annual reports. It looks like the cross-section of a thick vein dipping at about 45°. This is not the case, as Mr. Derby's description has already indicated. The real character of the deposit is suggested by the plan (Fig. 2), in which I have shown the shape of the orebody at successive levels by difference of shading so that the superposition is made evident. The foliation of the schist is nearly vertical and the strike is 17°45′ east of north. Owing to the sinuous outline of the orebody and the progressive modification of shape downward, I am emboldened to suggest that faulting and jointing will not suffice to explain the structure of this deposit. The facts, to my mind, suggest a lenticular orebody within a folded schist. It is irregularly lenticular in horizontal section and incompletely funicular to vertical view. Apparently it lies in the vertical plane of the schist and pitches eastward in sympathy with an acute torsional fold, accompanied by slipping and shearing of the encasing rock. This interpretation is more favorable to the relative persistence of the orebody than one based on the structural conditions specified by Mr. Derby.

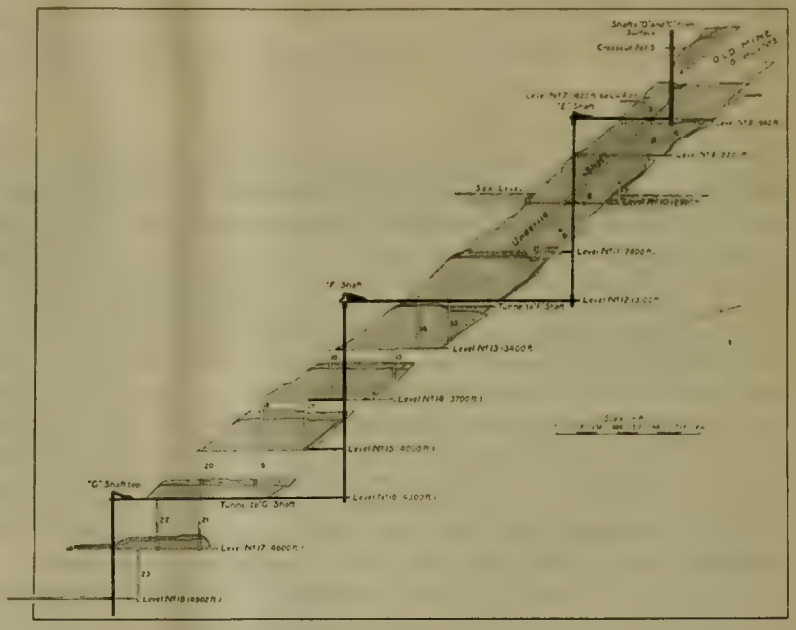


FIG. 1. LONGITUDINAL SECTIONS OF ST. JOHN DEL REY OREBODY.

*From 'Persistence of Ore in Depth,' a paper presented to the Inst. M. & M. London, November 19.

[1]In 1916 the shaft should reach Horizon No. 20 at 5826 ft. below the surface.

[2]As reported by him to the St. John del Rey company in 1901 and 1904.

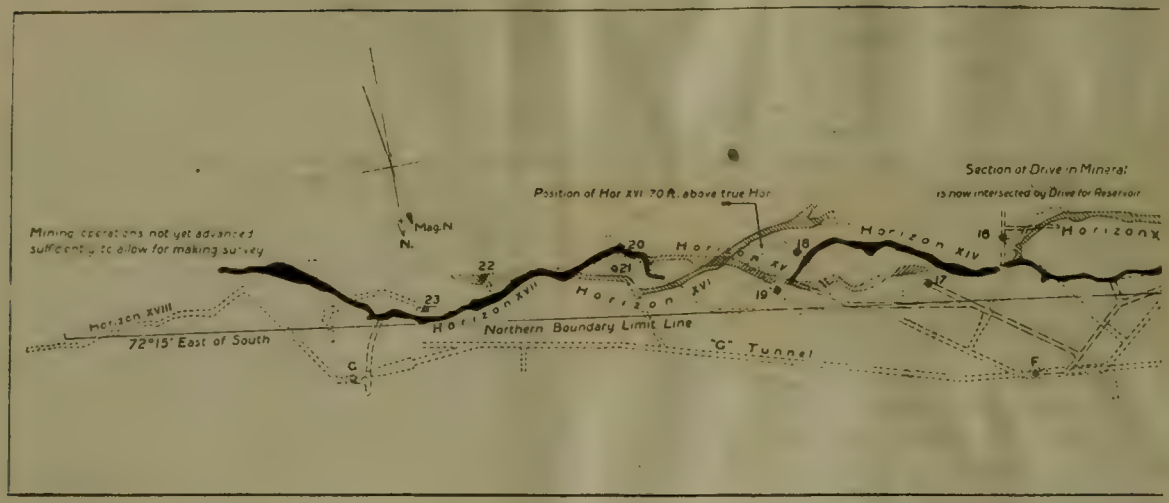


FIG. 2. PLAN OF ST. JOHN DEL REY

At the ninth level a 'horse' or inclusion of country splits the ore in its western and widest part. Indeed, down to the thirteenth the mine was in a parlous state, but on the fourteenth an enrichment of the eastern end became evident and has persisted ever since. Below the big open-cut the mine is dry. In 1901, however, on the eleventh horizon (3126 ft. below surface) some water was found; and it is said that this water contained "all the constituents of the lode." An analysis would be of great interest. In his report for June 1913, the manager, Mr. Chalmers, refers to the problem of persistence in depth. He mentions the careful study made by Mr. Derby, who expressed a favorable opinion at the time (in 1901) when the orebody showed one of those contractions to which it has been subject at intervals. Mr. Chalmers proceeds to state: "Since Mr. Derby gave his opinion we have explored the lode down many hundreds of feet, and find it has altered a little in shape, a very little in quantity, and improved in contents." He concludes that the increase of temperature, unless mitigated by improved ventilation, is the only obstacle to the deeper exploitation of the lode. The temperature increases 1°F. in 126 ft., so that the rock temperature at 6400 ft. will be 117°. This would be no serious obstacle, if the mine had vigorous ventilation through two main openings; as it is, the air comes down through a tortuous series of shafts, to ascend by an even more tortuous series of winzes. Ventilation is stimulated by a Sirocco fan of 150 hp. at the top of the C shaft. Another factor prejudicial to deeper mining is the system of hoisting, in step-like series up the various intermediate shafts and along their connecting levels. This must be costly. An incline-shaft, on the pitch of the orebody, was tried from the eighth to the eleventh horizon, that is, for a distance of 900 ft., but it was found to be too dangerous, as the schist 'blisters' and comes away in dangerous falls of ground. In depth the orebody has become longer (about 1000 ft.) and narrower (12 to 15 ft.) as compared with the nearly uniform length of 600 ft. and the width of 45 ft. exposed throughout the older upper workings.

From 1835 to 1892 the output of the mine was 2,958,593 tons, yielding £5,167,592, or nearly 35s. per ton; while in the period from 1892 to 1913 the output has been 2,715,933 tons, yielding £5,498,352 in gold, equivalent to 40s. per ton. In the first period 7.3% was rejected or sorted; in the second period only 5.7%. The total output was 5,674,526 tons mined or 5,313,028 tons milled for a yield of £10,665,944, which is equal to a yield of 39s.11d. per ton crushed. The mine was unprofitable for the first five years; between 1842 and 1867 the total dividends and bullion tax amounted to £896,500; from 1874 to 1886 the profit, as above specified, was £556,600; from the re-opening in 1892 to 1913 the profit was £730,266, so that the total dividends and tax payments amount to £2,183,366. During the last period a bond interest of £277,700 also has been paid. From the commencement about £1,000,000 has been raised for working capital.[3]

Reviewing the history of the mine according to the three productive periods, 1850-1865, 1875-1886, and 1900-1913, I find that the working cost (not the total cost) ranged from 17 to 23s. in the first period, from 26 to 30s. in the second, and from 25 to 31s. in the third. During these respective intervals the extraction in the mill has ranged between 52 and 80%, 70 and 75%, 71 and 93%. Dividing the history of the mine into two parts, before and after 1892, in accord with the statistics available concerning tonnage and yield, I find that the extraction averaged about 65% in the early period and 87% in the late one, improving to 92% during the last seven years. Now, if we make these allowances for loss in milling, we shall find that the 35s. per ton extracted from the shallower workings represented gold contents equivalent to nearly 54s. per ton as against the 40s. extraction and 46s. gold contents in the ore mined in the deeper workings. On the face of the evidence, allowing

[3]For these facts I am indebted to a historical account prepared by George Chalmers, the general manager in 1913.

ORE BODY AT SUCCESSIVE LEVELS.

for difference in sorting, it seems to me that the lode cannot be said to have become either richer or poorer as it has been deepened, and that the St. John del Rey is an example of persistence to great depth. Yet I consider that the experience of other mines warrants us in commending the cautious policy of the management, which does not assume the continuity of the orebody for more than two or three hundred feet as measured at any time from the bottom level.

If the orebody follows a fold in the schist, it is obvious that similar folds along the strike of the schist may enclose other orebodies. Looking at the longitudinal section published in the reports, it is remarkable that so little exploratory work has been done outside the immediate limits of the known ore-bearing ground. Having regard to the unusual vertical extent of the workings, it would appear that lateral search for other orebodies is abundantly justified.

Origin of the Rocky Mountain Phosphate Deposits

By ELIOT BLACKWELDER

*Among the world's known deposits of lime phosphates, at least six genetic varieties have been clearly recognized:

Primary Pegmatitic (Norway), Guano (Redonda, Idaho), Marine Sediments (Tunis).

Secondary or Metamorphic—Surface residual concentrations (Quercy), Phosphatized limestone and other rocks (Florida 'hard phosphate'). Detrital deposits (Florida 'river pebble').

The voluminous Permian(?) phosphate strata of Wyoming, Idaho, and adjacent states are marine sediments analogous to dolomite and limestone. Some points about their origin have already been established by Girty, Gale, or other observers. These are considered and to them are added other safe inferences as to the conditions of origin. The Rocky Mountain phosphatic beds apparently resemble those of Algeria-Tunis, Belgium, Wales, Sweden, and Tennessee (Devonian only): but are unlike those of Estremadura (Spain), southern France, Norway, Florida, the Carolinas, and the Peruvian islands. They belong, therefore, to the third class above noted. The foreign deposits most resembling those of the Rocky Mountains have been carefully studied, and the best interpretations of them, appropriately modified, seem to apply quite as well to our western beds. Omitting arguments, the chief points in the partial explanation thus far elaborated are the following: In the ocean, special conditions of currents, temperature, etc., not yet understood, may have induced the wholesale killing of animals over a large area and accumulation of the putrefying matter on the sea-floor in moderate and shallow depths. Anerobic decomposition produced ammoniacal solutions which dissolved the solid calcium phosphate present in bones, teeth, brachiopod shells and tissues. The putrefactive conditions also prevented the existence of sessile bottom organisms, and most calcareous shells descending from the surface were probably dissolved by the abundant carbonic acid arising from the decay. For physico-chemical reasons, already partly understood, the phosphatic materials were quickly redeposited in the form of hydrous calcium carbo-phosphates, locally filling, incrusting and replacing shells, teeth, bones, etc., but especially forming oölithoid granules of collophanite, and finally a phosphatic cement among all the particles. The granular texture is ascribed to physico-chemical conditions like those which result in oölithoid greenalite, limonite, aragonite, etc. After having been formed in quiet water, some of the granules were reached by bottom-scouring currents and incorporated in clastic deposits, and in some instances were even strewn over eroded rock surfaces and so become constituents of basal conglomerates.

*Abstract of a paper read before the Geological Society of America, Philadelphia, December 29-31.

New Plant at Mt. Morgan, Queensland

*Considerable alterations have been made at the Mt. Morgan company's plant during the past two years, and the general manager, B. Magnus, supplied the following data in November:

The old smelter has been entirely replaced by one consisting of three 54 by 336-in. blast-furnaces fitted with 16-ft. forehearths and auxiliary forehearths. The height of charge possible is 25 ft. 7 in. Each furnace is provided with two outlets, one at each end, for discharge of matte and slag. All tapping blocks on the forehearths are of Australian chrome ore, in place of the usual cast-iron water-cooled blocks. Each furnace has a complete bustle pipe around it, and a main bustle pipe on both sides. The water system is in duplicate. The charge floor is airy and light, and devoid of fume. Ore and fluxes are conveyed in side-tipping cars, drawn by a 10-ton electric locomotive, to the floor, the furnaces being mechanically fed. Slag is carried in Dewhurst slag bowls, end-tippers holding 10 tons, and side-tippers 20 tons each. They are drawn by a steam locomotive. Two men handle about 1000 tons of slag per 24 hours. The flue system is as follows: a down-cast enters an independent dust chamber behind each furnace, connected by a catenary flue, which in turn joins with the main dust chamber on a hill. The latter chamber is 47 ft. wide, 31 ft. high, and 71 ft. long, with a stack 250 ft. high and 11 ft. diameter.

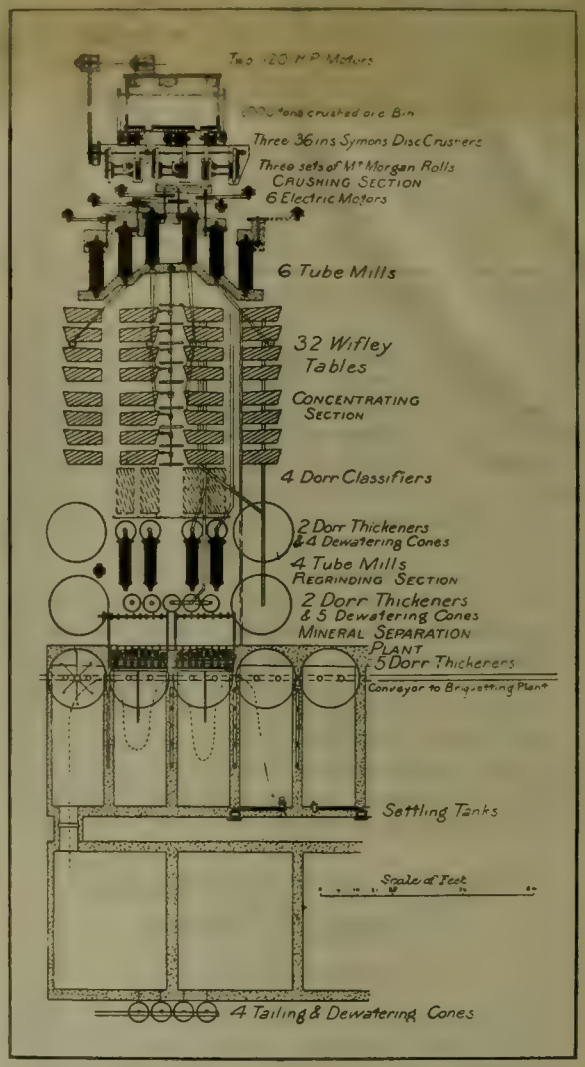
The New Concentrating Mill.

The new concentrating mill of 500-ton daily capacity is now in operation, treating the silicious ores of the mine, not economically treated by smelting. The accompanying cut explains the processes used. At the mine the ore is broken by gyratory crushers and delivered to the mill at 6-in. size. Two jaw-crushers reduce this to $2\frac{1}{2}$ in. Suspended above a belt-conveyor which feeds these crushers are two high-power magnets which collect any iron and steel mixed with the ore, and which might damage the machines. The ore is then conveyed to a 1000-ton bin. Three Symons disc crushers crush to $\frac{3}{4}$ in., after which come three geared rolls and six Krupp tube-mills. The latter produce an 80-mesh product which passes over 32 Wilfley tables. The slime from these is thickened in Dorr machines, and the resulting pulp is treated by the Minerals Separation flotation process. All concentrates are drained, briquetted, and fed to the blast-furnaces. Basic converters are used.

The power plant for the mine and plants consists of the following: Six Babcock & Wilcox boilers of 20,000 lb. steam per hour capacity, and four smaller boilers; two 4000-ft. and one 2000-ft. Bellis and Morcan air-compressors; a Fraser & Chalmers mixed turbo-blower using exhaust steam from the compressors, compressing 10,000 ft. of air per minute to 14-lb. pressure; two Fraser & Chalmers blowers delivering 40,000 ft. of air per minute at 4 lb. pressure to the blast-furnaces; two Curtis turbo-generators of 1500-kw. capacity, and circulating pumps, condenser, and ice-making machine.

The smelter and power plant were erected on a slag dump, which is 70 ft. high in places.

The workshops are 480 ft. long and 60 ft. wide, and during construction of the new plant, $100,000 of work



FLOW-SHEET OF MT. MORGAN CONCENTRATING PLANT.

of all descriptions was turned out. About 200 men are employed in them.

The output in the four weeks ended October 18 was as follows: The concentrating plant treated 6785 tons of ore, producing 1771 tons of concentrate containing 137 tons of copper and 1467 oz. gold; and the smelter handled 21,474 tons of Mt. Morgan ore, 5968 tons of Many Peaks pyrite, and 1629 tons of concentrate, producing 724 tons of copper and 9211 oz. gold. The value of this return was gold, $187,000, and copper, $190,000, a total of $377,000.

*Abstract from the Queensland *Government Mining Journal*.

Cyaniding Tailing in the Willow Creek District, Alaska

By J. T. TERRY, Jr.

The centre of the Willow Creek district, is about 35 miles northeast of Knik, a small town of approximately 200 population, situated on the northeast shore of Knik arm, a long narrow strip of water stretching northeasterly from the head of Cook's inlet. The country rock is a quartz diorite intrusive in a mica schist, and there are three sets or systems of veins. Those in the diorite strike almost at right angles to the schist-diorite contact. Those apparently parallel to the contact but in the diorite, and those in the schist strike at right angles to the contact. The latter are of the greater magnitude, but are barren or of low value so far as known.

The mines of proved value are on the first mentioned set of veins. The diorite is blocky and the fissures seem to traverse it for great lengths with small cross-fissures coming in from both hanging and foot-wall side. The quartz is usually accompanied by a gouge and vein filling and is from a white to bluish tint with reddish and green streaks due to arsenic and iron minerals. Many specimens show free gold, but the greater portion of the gold is finely divided and not visible till the ore is pulverized and panned. The veins in the diorite are from a seam to 12 ft. wide, averaging about three feet. The lodes that up to the present time have been profitably worked are near the summits of the divides between Craigie, a tributary of Willow, and Willow creek, and between Willow and Fishhook, a creek that flows southeast into the Little Susitna river which empties into Cooks inlet. The mountain ranges are steep and precipitous as a result of glacial erosion. The bottoms of the valleys and cañons are covered with detritus of boulders and gravel from terminal moraines.

The Gold Bullion mine where I erected and operated the first sand leaching cyanide plant in the territory, is the best equipped property in the district. It is situated near the top of the divide between Craigie and Willow creeks. The vein is of the blanket type and shows outcrops on both sides of the mountain. At several points where rich outcrops were opened, cuts were run or stopes driven to get out the ore, which stoped about two feet. The ore is transferred from the mine to the mill by two aerial jigback trams, the distance to the transfer or intermediate bin being 1300 ft., and from that to the mill 3800 ft. The drop between the mine and mill is approximately 1500 feet.

The ore is crushed in a five and a two-stamp battery to 50 mesh, the pulp going over plates to a Wilfley table, thence to tailing ponds, and is subsequently cyanided. The cyanide plant consists of six leaching vats, sump, storage, and solution tanks, and has a daily capacity of 45 tons of tailing. The tanks, pipe, solution pump, etc., were furnished by the Pacific Tank & Pipe Co., and shipped from its Portland factory to Seattle, thence by steamer to Knik, and hauled in on double-end sleds

GOLD BULLION MINE AND CYANIDE PLANT.

drawn by horses shod with wooden snow shoes, during the winter of 1913. There is no road to the property. The equipment was transported over 2500 miles from the factory to the mine and arrived in perfect condition.

The plant was erected last May, the site at the time being buried under six feet of snow that had to be shoveled. Leaching operations began June 7, 1914. An extraction of 86.6% of the gold was attained from sand averaging $13.50 per ton. The cyanide consumption was 0.8 lb. sodium cyanide (129%), 2 lb. lime, and 0.57 lb. zinc shavings. The product assayed $34 per pound in gold, and about $4 per pound in silver. The product from the extractor boxes was roasted in a cast-iron pan without stirring, cooled, screened, sacked, and shipped to the Selby Smelting & Lead Co., San Francisco. The lime used was slacked by mixing one bucket of lime with three-fourths of a bucket of water, producing a dry powder which was screened, and a measured portion added to the cars.

The tailing, a 40 to 50-mesh sand fairly free from slime, was shoveled from the dam below the mill into cars holding two-thirds of a ton, dry weight, by two men, and run to the foot of a tramway 85 ft. long with a 30% grade, which then extends on a down grade of 2 in. in 16 ft. over the leaching vats. The cars are elevated by a water-wheel hoist. This power also drives the solution pump. The water is conveyed through 130 ft. of 8, 7, and 6-in. slip-joint pipe from the mill penstock, and applied under a 35-ft. head through a 2½-in. nozzle to a 36-in. wheel to which 24 iron elevator buckets are bolted. A loose belt and tightener operated by a lever is used as a control on the hoist. The water-wheel equipment was furnished by Meese & Gottfried Co., from their Seattle stock, and being light was easily transported; which is a very important factor in Alaska.

There is about 2000 tons of slime in the ponds which will be treated next summer by agitation and decantation. Agitation is to be accomplished by mechanical stirrers driven by water-power. The milling season in the Willow Creek district is from June 1 to October 1.

A Platinum-Gold Lode Deposit in Southern Nevada

By ADOLPH KNOPF

*The ore of the Boss gold mine in the Yellow Pine mining district, Nevada, has recently been shown to contain considerable platinum. The deposit occupies a vertical zone of shattering in dolomite of Carboniferous age. The gangue consists mainly of fine-grained quartz, but streaks of plumbojarosite are found carrying as high as 111 oz. gold, 99 oz. platinum, and 16 oz. palladium. Some 600 ft. from the mine is a small intrusion of granite porphyry, but no basic intrusives occur; in fact, none are known to occur in the whole district, which is the most productive lead and zinc district in Nevada.

*Abstract of a paper read before the Geological Society of America, Philadelphia, December 29-31.

Palladium: Its Characteristics, Uses, and Discovery in the Boss Mine

*Palladium is one of the rare metals belonging to the platinum group and occurring almost invariably associated with platinum or other metals of this group. The metal was discovered in 1803 by Wollaston, and named for the planetoid Pallas in honor of its discoverer, Olbers. The other members of the platinum group are platinum, iridium, osmium, rhodium, and ruthenium.

These metals collect in the lead button formed in the regular course of a fire assay for gold and silver. When this button is cupelled, the metal osmium is driven off, but all the other metals collect in the gold and silver button. If they are present to the extent of 2½% of the weight of the button, their presence is made apparent by a frosting and darkening of the button, while smaller proportions usually make themselves known in the course of the operation of parting.

Palladium is a ductile, malleable, white metal, which looks like platinum and is distinguished from the other metals of the platinum group by the ease with which it dissolves in nitric acid. It is strongly resistant to oxidation by atmospheric oxygen and moisture and to the effect of sulphur-bearing gases. For this reason it is employed for the inner mechanism of chronometers and watches, for the construction of fine balance beams, for the divided scales of delicate apparatus, and for surgical instruments. Like platinum, it is employed in the preparation of toning baths for use in photography. Another property of palladium which renders it valuable in some of the newer chemical processes is that of absorbing hydrogen. The price of palladium is practically the same as that of platinum, or more than twice that of gold, although on account of the somewhat lighter demand, it occasionally falls lower.

Most of the palladium comes from the placer mines of the Urals, Russia. Until recently the only mine in which palladium was found in this country was the Rambler mine, in Wyoming, where it is associated with platinum and copper. That it occurs elsewhere in minute quantities associated with copper ores is known from the fact that it is found in electrolytic copper.

A sample of ore from the Boss mine, Yellow Pine district, Clark county, Nevada, has just been analyzed by Walter S. Palmer in the state mining laboratory at the Mackay School of Mines with the following results: Palladium, 60.4 oz.; platinum, 12.28 oz.; gold, 38.92 oz.; and silver, 10.96 oz. per ton. A carload of 56,267 lb. from the mine, shipped to the American Smelting & Refining Co., gave the following returns: Palladium, 5.47 oz.; platinum, 1.1 oz.; gold, 8.752 oz.; silver, 9 oz.; copper, 0.97%; insoluble, 80.7%; sulphur, 0.5%; and iron, 6.7%. An assay made by Ledoux & Co., of New York, of a 340-lb. sample, gave the following results: Palladium, 16 oz.; platinum, 99.08 oz.; gold, 111 oz.; and iridium, a trace, per ton.

*_Press Bulletin_ 4, Mackay School of Mines, Nevada.

Examination of Placer Ground

By THOMAS A. GRAVES

The close agreement between the values as shown by prospecting and the actual returns from dredging under good conditions, together with the accuracy of estimates of the proportion of gold to be recovered under conditions not ideal, make dredging differ from other mining operations inasmuch as it becomes more of an investment and less a speculation. The greater the number of prospect holes, the nearer the two values approach each other. The personal equation of the engineer, however, is equally important. Aside from the amount of gold in gravel, the geological, economical, and climatic conditions must be given due consideration.

The geological conditions to be considered are: distribution, value, and nature of gold per cubic yard; depth of gravel to bedrock; size and frequency of boulders; hardness of bedrock and general contour of same; position of water-level referred to surface; and general nature of soil and gravel.

The economical conditions are: cost of land; cost of dredge suitable to use; cost of transportation; cost of supplies and repairs; cost and kind of power; cost of water for dredging; and wages and available skilled labor.

Climatic considerations are: whether arid or wet climate; whether cold or hot climate; and length of working season.

Effect of Various Conditions

Dredges designed to dig in exceedingly deep ground are more expensive to build and to operate; more power is consumed in operating digging ladder, and the stacker ladder has to be longer to prevent tailing from coming in too close to the dredge and thus prevent the spud from holding, which necessitates the use of inconvenient and more expensive head lines. Too shallow a gravel means loss of gold. Ground too hard causes additional expense for blasting and loss of much valuable ground. Gravel with a large amount of clay is injurious as clay forms a film around gold, making it not easily amalgamated. Ground containing large and numerous boulders prevents considerable ground from being dredged, and a close-connected bucket, which handles more gravel than open-connected, cannot be used. Frequently the richest gravel lies near bedrock or in crevices in it, and too hard or extremely uneven contour of bedrock makes it impossible to recover all this. If water-level is too high it may prevent the digging ladder reaching the lowest depths, but frequently it supplies the dredge with water for working. Fifty miner's inches is sufficient water for dredge operation in clean gravel, but where large amounts of slime and mud are present, 100 in. or more may be needed. Whether or not the economical and climatic conditions are favorable is governed by the geological conditions.

Placing Prospecting Holes

There is no definite rule as to the number of holes required to be drilled to examine thoroughly a property. This can be ascertained as drilling progresses, but at the start the land may be divided into sections of from five to ten acres, depending upon the area to be examined, and a hole drilled in the centre of each. Before starting to drill or place holes, it should be noted whether bedrock projects to surface at any place and the probable course the gold took in deposition determined if possible. This precaution will often save many unnecessary holes being drilled, as one may start some distance from projecting bedrock and work out from either side and avoid shallow or valueless holes. On examining one property I observed that under the general course of a small surface stream, the bedrock was deepest and the gold most abundant and that from either side the holes to bedrock decreased both in depth and value. The elevation of each hole to be drilled is determined in reference to a common bench mark and from the depth of each hole the contour of the bedrock is determined, as is also the cross-section of ground.

Fig. 1 shows plan of test holes and Fig. 2 shows cross-section of ground and general contour of surface and bedrock for each row of holes drilled.

Method of Prospecting

My experience in prospecting placer ground has been with the Keystone No. 3 traction drill. This machine seems to keep its popularity mainly because of its being comparatively cheap to purchase and to operate, having few breakable parts, standing rough usage, and above all, giving satisfactory results. I have been in a position to know what the actual returns from dredging have been, and I was surprised to see in many cases how close the returns from prospecting and from dredging agree under favorable conditions, with sufficient number of holes drilled.

After the proposed distribution of the holes to be drilled is determined, the machine is moved to one of them, preferably near the centre of the channel and the following holes drilled on either side as conditions warrant. The machine, being placed, a hole is dug about two feet deep and shoe joint placed in it and soil filled around. The casing is then driven by driving blocks as far as soil will allow or until gravel is reached and then drilling is commenced. If no soil overcaps the gravel the drill is used at the beginning and casing settles as the drill goes down or it is driven with blocks.

Casing is kept a few inches in advance of the drill point to prevent any ground from running into the hole and to keep the area of hole the same as the shoe or 7½ inches in diameter. As each length of casing is drilled or driven to head, the succeeding piece is screwed on and

the process continued. (In making connections care should be taken to clean carefully and oil the threads, graphite being preferred to prevent oil getting into hole.)

After driving the casing the drill stem is lowered into the hole and the difference between the mark on the stem and top of the casing represents the amount of core or material in the casing. Water is then poured in and drilling continued. Before all the core is drilled, the drill-stem is removed and the vacuum sand-pump is lowered into the hole and the material taken out and given to the panner. The machine man reports length and depth of casing and length of core, while the record

TABLE I

A, ft.	B, ft.	C, ft.	D, ft.	E, ft.	F, No.	G, mg.	H.	I.	J.	Remarks.
3	2.0	0.4	0.4	2.6	. . .	..	1.00	Soil	Loose	.....
4	2.0	0.4	0.4	3.6	. . 3T	..	1.00	Soil	Loose	Sm. Blk. S.
5	2.0	0.3	0.3	4.7	. . 3^2	1	1.00	S. F. G.	Loose	Sm. Blk. S.
6	1.5	0.5	0.5	5.5	. . 3^4	2	0.75	S. F. G.	Loose	Sm. Blk. S.
7	1.5	0.4	0.4	6.6	. 3^2	2	0.75	S. F. G.	Loose	Sm. Blk. S.
8	1.5	0.3	0.4	7.7	. . 3^3	1	0.75	S. F. G.	Loose	Sm. Blk. S.
9	2.0	0.5	0.4	8.5	. . 3^3	2	1.00	S. F. G.	Loose	M. Blk. S.
10	2.5	0.6	0.5	9.4	. 2^4 3^{10}	9	1.50	S. M. G.	Loose	M. Blk. S.
11	2.5	0.4	0.5	10.6	. . 3^5	5	1.50	S. M. G.	Loose	M. Blk. S.
12	3.0	0.4	0.4	11.6	2 3^4	7	1.00	S. M. G.	Firm	M. Blk. S.
13	2.0	0.4	0.4	12.6	. . 3^3	4	0.75	Sand	Firm	M. Blk. S.
14	2.0	0.3	0.3	13.7	. . 3^2	2	0.75	Sand	Firm	M. Blk. S.
15	1.5	0.3	0.3	14.7	. 3^3	1	1.00	S. C. G.	Firm	Md. Blk. S.
16	1.8	0.3	0.3	15.7	. 3^3	1	1.25	S. F. G.	V. firm	Md. Blk. S.
17	2.0	0.4	0.4	16.6	. 3T	..	1.50	Sand	Firm	Md. Blk. S.
18	2.0	0.6	0.5	17.4	. . 3^3	3	1.50	S. C. G.	Firm	Md. Blk. S.
19	1.7	0.5	0.5	18.5	. . 3^5	4	1.75	F. G.	Firm	Md. Blk. S.
20	1.7	0.3	0.4	19.7	. . 3^2	2	0.75	F. G.	Loose	Sm. Blk. S.
21	1.8	0.4	0.3	20.6	. . 3^4	3	1.75	F. G.	Loose	Sm. Blk. S.
22	2.0	0.4	0.4	21.6	. 2^2 3^4	6	1.75	S. C. G.	Firm	Sm. Blk. S.
23	1.8	0.4	0.4	22.6	2^5 3^5	9	1.50	S. C. G.	Firm	Sm. Blk. S.
24	1.6	0.5	0.5	23.5	. 2^2 3^4	6	0.75	C. G.	Firm	Sm. Blk. S.
25	1.5	0.5	0.5	24.5	. . 3^6	3	1.50	C. G.	Firm	Sm. garnets
26	1.5	0.6	0.7	25.4	. . 3T	..	1.25	C. G.	Firm	Sm. clay
27	2.0	0.3	0.4	26.7	. . 3^4	3	1.00	C. G.	V. firm	Sm. clay
28	2.0	0.9	0.7	27.1	. 3^2	1	2.00	C. G.	V. firm	M. Blk. S.
29	2.0	0.5	0.5	28.5	. . 3^2	2	2.00	C. G.	V. firm	M. Blk. S.
30	2.5	0.3	0.4	29.7	. . 3^4	4	1.00	C. G.	Firm	Sm. clay
31	2.0	0.3	0.4	30.7	. 2^2 3^4	6	1.00	S. F. G.	Firm	Sm. Blk. S.
32	1.8	0.4	0.4	31.6	. 2^4 3^6	10	1.25	S. F. G.	Firm	Sm. Blk. S.
33	1.7	0.5	0.5	32.5	. . 3^3	3	1.25	Sand	Firm	Sm. Blk. S.
34	1.5	0.6	0.6	33.4	. 3^2	2	1.25	S. F. G.	Firm	Sm. Blk. S.
35	2.0	0.6	0.6	34.4	. 3^4	4	1.00	M. G.	Loose	Sm. Blk. S.
36	2.5	0.4	0.4	35.6	. . 3^2	2	1.00	C. G.	Loose	Sm. Blk. S.
37	1.8	0.3	0.5	36.7	. . 3T	1	1.00	C. G.	Firm	Garnets
38	1.7	0.4	0.4	37.6	. . 3^5	3	0.75	C. G.	Firm	Garnets
39	1.5	0.5	0.5	38.5	1^1 2^5 3^5	17	1.00	C. G.	V. firm	Sm. Plt.
40	1.5	0.7	0.7	39.3	1^3 2^{10} 3^2	40	1.00	C. G. & B. R.	V. firm	Garnets
41	1.5	0.8	0.7	40.2	. 2^8 3^5	20	0.75	Bedrock	Firm	Garnets
42	−0.9	−0.9	−0.9	41.8	. 2^1 3^6	9	0.50	Bedrock	Loose	.....
43	−2.0	−2.0	−2.0	42.8	. . 3^3	3	0.50	Bedrock	Loose	.. ..
44	−2.5	−2.5	−2.5	43.6	. . .	..	0.50	Bedrock	Loose	.....

A, is the depth to which casing has been driven before drilling.

B, is the depth of the core after driving. (It is measured by the core left in the casing before driving, plus the amount of material forced into the pipe by driving.)

C, is the depth of the core after pumping.

D, is the difference in the depths of the bottom of the casing and core. (This enables the driller to know whether the casing is at all times below the point drilled. At no time should the drilling get below the casing except in particularly hard or coarse ground where the casing cannot be driven. The casing should be driven before pumping and a note taken as to whether any excess of material is taken out of the hole.)

E, is the depth of the hole after pumping.

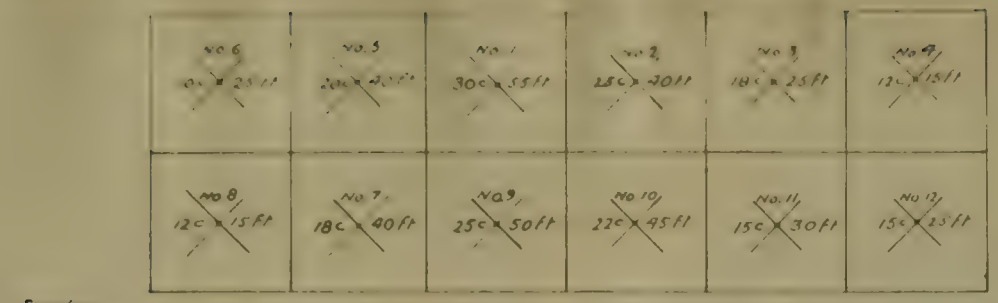
F, is number of colors of No. 1, 2, and 3 classes of gold, No. 1 being largest and No. 3 gold the smallest size; 1^1 means 3 pieces of 1 mg. or under, 2^4 means 4 pieces of 2 mg. or under, 3^6 means 6 pieces of 3 mg. or under.

G, is the approximate weight of gold for each foot.

H, is the estimated volume of material from each foot after pumping, measured by the number of pans, each pan representing 0.01 cu. yd. for each foot drilled.

I and J, formation.

Remarks, include any other information considered important.



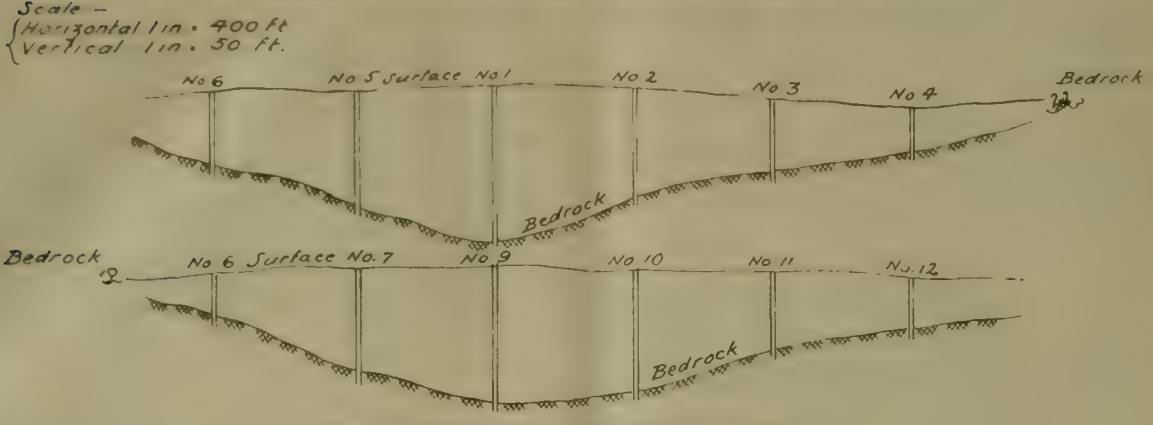


FIG. 1, PLAN, AND FIG. 2, CROSS-SECTION OF GROUND.

is kept by the panner. These operations are repeated with each successive foot that is drilled, and are carried on until lower limit of the pay-streak is reached, which is usually bedrock or a couple of feet below. When the desired depth of hole is reached, the pulling jars are used and the casing is removed from the hole and the machine is taken to the next location.

DETERMINING AMOUNT OF GOLD FROM HOLE

Each foot of material is pumped and panned and the gold estimated as to weight and number of colors. The apparatus needed by the panner in recovering the gold is a sluice box, rocker, tub, and pans.

The material is delivered from the sand pumps to sluice box and then transferred to the rocker. The concentrate is recovered from the rocker and then panned in a tub of clear water. The particles of gold found are preserved for assay when the hole is finished. If at any depth an unusual amount of gold is recovered, it is kept separate, as the gold may have come from a small seam that does not represent the true value of the surrounding material.

For assay the combined gold from each hole is amalgamated, then boiled first with diluted and then with concentrated nitric acid to dissolve the silver. The bead is then thoroughly washed, dried, annealed, and weighed. A small amount of alcohol added to the water wash prevents sputtering of the gold.

LOG

The accuracy with which the value of ground may be estimated depends upon the completeness of the record of the field data and observations. Records should be entered by the panner and checked by the engineer in charge whenever possible. Measurements should be in feet and tenths. Table I shows a good practical log, and this, supplemented by that shown in Table II, make a complete record.

TABLE II

TIME LOG. TRACT ————. HOLE NO. 1

8—1—10.

Commenced hole at 6 a.m.
Drilled 9 hours. Depth 15 ft.

8—2—10.

Repaired 2 hours. Sharpening bits.
Drilled 6 hours. Depth of 28 ft.
Delayed 1 hour, rain.

8—3—10.

Drilled 5 hours. Depth 43 ft.
Struck bedrock at depth 44 ft.
Repairs 1 hour, pipe jar.
Pulled pipe 3 hours. Finished hole at 3 p.m.

SUMMARY, HOLE NO. 1

	Hours.
Pulled pipe	3
Repaired	3
Delays	1
Drilled	20
Total time	27

1. Force: driller, panner, fireman, and teamster.
2. Commenced drilling 6 a.m.—8—1—10.
3. Finished drilling 11 a.m.—8—3—10.
4. Commenced pulling 12:00—8—3—10.
5. Finished pulling 3 p.m.—8—3—10.
6. Delay—cause and length: Rain, 1 hr. Repairs, 3 hr.

7. Length of pipe: No. 1—6.6
2—6.0 12.6
3—5.3 17.9
4—5.0 22.9
5—5.5 28.4
6—5.5 33.9
7—F6 39.5
8—4.5 44.0
8. Sand 13, 33.
9. Gravel loose 5-11, 20-21, 35-36.
10. Gravel firm 12, 14-15, 18-19, 22-26, 30-35, 41.
11 Gravel very firm 16, 27-29, 39-40.
12. Gravel fine 2-9, 16, 19-21, 31-32, 34.
13. Gravel medium 10-13, 35.
14. Gravel coarse 15, 18, 22-30, 36-40.
15. Clay 22-23, 27.
16. Cement ———.
17. Volume by core, 0.47 cu. yd.
18. Volume calculated, 0.43 cu. yd.
19. Total colors by weight, 200 mg.
20. Number of colors, 250.
21. Value of hole per cu. yd., 28c.
22. Remarks:

Calculating Volume

Great care should be exercised in ascertaining the amount of material taken from each hole. If ground has run into the hole while drilling, allowances should be made. The volume of material extracted from the surface to the bedrock or down as deep as pay goes, should be multiplied by area of shoe of 7.5 in. diam. and not area of casing. Radford's factor of 0.27 should be used if no ground has run into hole. Multiply depth in feet by 0.27 to get volume in cubic feet, and reduce to cubic yards by dividing by 27 or, divide the depth of hole by 100, which gives the same results.

Calculating Values

Each milligram of gold is worth approximately 0.06c. The value from this hole is 200 (milligrams) by 0.06c., equalling 12c. Volume of hole No. 1, 43 ft. deep, is by Radford's factor, equal to 0.43 cu. yd. Dividing the value of the gold in the hole by the volume in cubic yards of material gives the value per cubic yard, 28 cents.

Final Valuations of Ground

To obtain the average value of the ground, multiply the average yield of gold per cubic yard for each hole by its depth in feet. Add these various products and divide by sum of depths. The value of the ground equals the area multiplied by the average depth. The gross value of the ground equals the volume multiplied by the average value per cubic yard. The net value of the ground is equal to the difference between the gross value and the cost of land and dredge, cost of treatment, working capital, loss in tailing, and interest.

Cost of Drilling

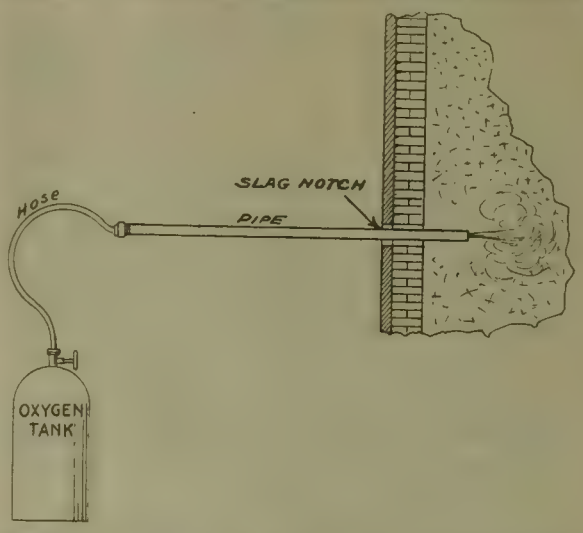
The cost of drilling varies from $1.25 to $3.50 per foot, depending upon the locality and the character of the ground. When drilling in countries where skilled labor is scarce it is better to pay men more and get those who can fill the various positions connected with the prospecting so that more accurate results may be obtained, and delays avoided. Approximate costs per day may be estimated as below:

Superintendency	$ 4.00 to $ 7.00
Machine man	3.50
Panner	3.00
Fireman	2.50
Teamster and team	4.00 to 5.00
Fuel	2.50 to 5.00
Miscellaneous	4.00
Repairs	2.50
Total	$26.00 to $32.50

Melting Out Slag Notches

An ingenious iron-oxygen torch for melting out frozen slag notches of blast-furnaces, and for similar work, is in use in a few places in this country, having been introduced here by David H. Browne from abroad.

When the slag notch of a furnace becomes frozen up the usual practice is to attack it with bars and sledges, and it not infrequently happens that the end of a bar is broken off in the notch, rendering the work even more



difficult. The hole may be quickly cleared by melting it out with this torch, which is constructed as follows. An iron pipe, so long that those handling it will not be burned by flying sparks, is attached by a short length of strong hose to an ordinary cylinder of compressed oxygen. The end of the pipe is then heated red hot in any convenient way, and the oxygen is then turned on. The red-hot iron at once takes fire and burns with an intense heat, giving off very brilliant sparks. It is at once introduced into the frozen slag notch and the fluxing action of the nascent FeO, combined with the intense heat, serves to penetrate the frozen mass with almost the ease and rapidity of a scoop penetrating cheese. The oxygen cylinder is the only part of the equipment necessary which is not commonly available at any smelting plant, and that may be obtained from an oxy-acetylene torch outfit, which is now usually not difficult to secure.

Treatment of Sulphide Ore at the Yuanmi Mine, Western Australia.

*The sulphide plant at the Yuanmi mine started in September 1913. The ore, after drying, is crushed in a No. 8 Krupp ball mill, and roasted in an Edwards duplex furnace with 60 rabbles. Cyanide solution is then added, and the roasted and oxidized ores are mixed, classified and reground together in a tube-mill. The ore is finely ground but not slimed, about 14% being 150 mesh. The ground pulp then flows to mechanical thickeners, the resulting pulp being agitated. It then passes to a vacuum-filter of the fixed-leaf gravity filling type.

Typical analyses of the ore treated are as follows:

Contents	Sulphide. Per cent.	Oxidized. Per cent.
Insoluble	70.64	80.26
Fe	8.30	9.46
Sb	0.21	0.09
As	0.96	0.37
S	5.62	0.02
Co	trace	....
MgO	2.74	0.26
CaO	3.36	
Al_2O_3	2.02	5.09
Alkalies, etc.	6.15	4.45

The gold is very fine, but even in the oxidized ore is not always readily amenable to treatment by cyanide.

Oxidized ore from certain portions of the mine has the gold locked up in a hard flinty matrix, impermeable to cyanide solution. To obtain a good extraction from this particular class of ore, either very fine grinding or roasting is required, the latter being the process adopted here. Experiments have shown that extraction can thus be increased in some cases to from 56 to 96% with roasting.

With sulphide ore, a thorough roasting is preferable, as the solution does not then foul. This does not appear to be indispensable, the addition of lead acetate and lime having marked corrective effects in cases of an imperfect roast.

Sulphocyanides are frequently present in the plant solution, and some trouble has been experienced with precipitation, due, probably, not so much to these impurities as to small quantities of arsenic and antimony. The precipitation troubles have been eliminated by substituting zinc-dust in place of shaving, a special type of extractor having been designed for this purpose.

Laboratory tests show that extraction is largely effected by fine grinding, sweet roasting, agitation, if not too thick a pulp, and the addition of lime and lead acetate.

The presence of unroasted sulphide ore in roasted or oxidized pulp lowers the possible extraction.

The antimony and arsenic are not totally removed by roasting, but, being oxidized, they do not prevent a good extraction.

Attempts to treat the unroasted sulphide ore by the Gutsch process proved unsuccessful. Other methods have also been tried but so far without success.

Typical sulphur determinations are as follows:

Before roasting		After roasting	
Total sulphur. Per cent.	Sol. sulphur. Per cent.	Insol. sulphur. Per cent.	Total sulphur. Per cent.
1.44	0.54	0.02	0.56
1.07	0.65	0.27	0.92
1.13	0.75	0.21	0.96
1.80	0.69	0.20	0.89

During the 12 months ended August 31, 1914, 19,954 tons of mixed oxidized and sulphide ore was crushed and treated, the residue averaging $1.48 per ton, the extraction obtained being 83.5%. The tonnage handled was low, owing to the mill being closed down for a period of 77 days while the workmen were on strike.

The following table shows the proportions, etc., of oxidized and sulphide ore treated:

	Oxidized.	Sulphide.
Tons crushed and treated	30,111	19,843
Residue	$1.20	$1.90
Extraction, per cent	83.7	83.3

The annual report of the Yuanmi Gold Mines, Ltd., is reviewed on page 1013 of this issue.

*Notes prepared by Bewick, Moreing & Co., general managers.

Costs at the Yuanmi and Oroya Black Range Mines

These mines are in the East Murchison goldfield, Western Australia, and the following data are the report for the year ended June 30, 1914: The Yuanmi 20-stamp mill crushed 40,135 tons of oxide ore, and the Krupp ball-mill, 18,959 tons of sulphide ore. An Edwards furnace roasted the latter, while the vacuum-filter plant handled the joint pulp, the average recovery being 84.13%. The stamps averaged 9.93 tons per day. The Black Range 20 stamps averaged 8.75 tons, crushing a total of 54,460 tons. By amalgamation, leaching sand, and vacuum-filtering slime, a total extraction of 95.27% was made. Costs per ton were as under:

Items of cost.	Yuanmi.	Oroya Black Range.
Breaking ore	$1.38	$2.28
Filling stopes	0.20	0.09
Tramming and hoisting	0.87	1.20
Total mining	$2.45	$3.57
Rock-crusher	$0.10	$0.12
Ore transport	0.06	....
Milling	0.53	0.49
Vacuum-filter	0.70	0.48
Grinding sand	0.07	0.15
Precipitation and clean-up	0.16	0.10
Cyaniding by percolation	....	0.31
Disposal of residue	0.05	0.19
Drying	0.09	....
Roasting	0.34	....
Total treatment	$2.10	$1.84
Bullion charges	$0.11	$0.11
Re-treatment	0.05	0.10
Grand total, mine and mill	**$4.71**	**$5.62**

DISCUSSION

Readers of the MINING AND SCIENTIFIC PRESS *are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.*

The Rand Banket

REPLY BY MR. C. BARING HORWOOD TO DISCUSSION BY H. FOSTER BAIN*

Mr. Bain agrees with the importance I have attached to the retaining influence of shales, but reasons that as the gold occurs above and not below them, this forms an argument in favor of a detrital origin for the gold.

It may therefore be well to recall that I particularly called attention to the fact that the conglomerates have not such well defined or impervious walls as normal fissure veins, and that traces of gold can be found in all of the various series of conglomerates that occur in the Witwatersrand beds and in much of the intervening quartzites, demonstrating that the whole of these beds have been, to some extent, permeated by mineralizing solutions, but that the main circulation and mineralization had been confined to the well defined Main Reef series, that is, the lowest of the three series lying below the thick band of Kimberley slates and above the thick bank of Main Reef 'foot-wall' slates. The other two known as the Bird and Livingstone series are at a higher geological horizon and consist of small pebbles, and are relatively ill defined, and therefore, as one would expect, they usually contain only traces of gold. The flow of the mineralizers was thus practically confined to this well marked horizon, which is cut by dikes and large structural faults, by impervious beds both below and above, and this is what was to be expected if the gold is derived from deep-seated up-rising solutions.

Mr. Bain admits that I have advanced convincing proof that the so-called 'pebbles' of pyrite in the banket are metasomatic replacements, but he still has lingering doubts that this process took place long after the deposition of the Witwatersrand conglomerate, or that the pyrite and gold were introduced at a later period. I would therefore remind him that the mineralization extends into the numerous fractures that run through both pebbles and matrix of the conglomerate, and are parallel to the main fracturing and faulting of the district. Also, similar pyrite 'pebbles' of metasomatic origin occur in the well defined conglomerate beds of the Kimberley series and also in the banket beds of the Black Reef formation, and the gold in these beds is associated with pyrite, and also with these pyrite replacements, and frequently also with carbon. Further, the gold and mineralization generally of the bedded quartz deposits of the Dolomite formation, in the Pilgrim's Rest district of the Transvaal have been assigned by the Geological Survey to the neighboring intrusive igneous sheets and diabase dikes; and my own observations in this district confirmed this view. In like manner, I ascribe the mineralization of the Rand banket to the influence of the neighboring diabase dikes there, and I maintain (as de Launay[1] had previously suggested might be the case, if the theory that the gold was introduced after the deposition of the conglomerates be accepted) that there is no reason to assume more than one general period of mineralization to account for all the foregoing; and as de Launay remarked, this would merely mean that the banket is a special type of lode formation, and is a simple but particular type of those deposits (represented in South Africa by the various formations that carry gold-bearing pyrite) due to impregnation under pressure and in depth by mineralizers from an eruptive magma.

Before proceeding further, it may be instructive to recall the words of J. Malcolm Maclaren under the heading of 'Source of Gold' in his admirable work on the geological occurrence and geographical distribution of gold.[2] Maclaren states that "In the investigation of auriferous deposits no feature stands out in greater relief than the constant association of the primary goldfields with igneous rocks, and it therefore becomes necessary to examine the evidence available for the occurrence of gold as an original constituent of an igneous magma." He contends that the close connection between igneous rocks and auriferous regions may have been brought about in either, or both, of two ways. The gold may have been brought near the surface and within the reach of meteoric waters by inclusion within an ascending magma, or auriferous solutions may have been introduced by ascending waters that have a connection with igneous masses. In the absence of definite data, he assumes that the gold contents of many waters, especially those set in circulation by intrusive igneous rocks, as by the pre-Cambrian diabases, are derived from emanations from intrusive magmas, the emanations being finally dissolved in percolating waters, and by them carried into vein-fissures. He regards primary auriferous deposits as phenomena dependent on the intrusion of igneous magmas, and further as having an origin indissolubly bound up with that of metalliferous

*The delay in replying to this discussion has been due to illness.

[1] 'Observations on the Rand Conglomerate,' by L. De Launay, *The Eng. & Min. Jour.*, 1903, p. 519 *et seq.*

[2] 'Gold,' J. Malcolm Maclaren, p. 100 *et seq.*

sulphides or of the chemically related tellurides, and consequently, as he further remarks, work that throws light on the origin of pyrite is to be welcomed as assisting inquiry into the genetic relations of gold. Then under the heading of 'Transport of Gold' he states that gold in vein waters may most reasonably be regarded as ionized and balanced either as auro-sitheanion, as thio-auranion, or as telluro-auranion, that in the first case the deposition products are silica and free gold, in the second, free gold and sulphides, or possibly sulphides (including gold sulphide) alone, and in the third case, gold tellurides. He expresses the opinion that the first combination is the more probable in all those cases in which free gold is found studding clean quartz; and adds that even in many pyritous veins, deposition of pyrite, quartz, and gold has been contemporaneous. In such cases the gold would appear to have been held by both the first mentioned ions and to have been freed on deposition.

Now, it seems to me that these remarks have a considerable bearing on the Witwatersrand deposits; the latter constitute a vast goldfield occurring in a very ancient formation, and associated with igneous rocks. In this instance there is insufficient reason to ascribe the connection between the igneous rocks and the gold in the deposits of this region to inclusion of more ancient auriferous sediments that have been caught up and enveloped by the intruding magma. The oldest known sediments of the southern portion of the African continent are those comprising the Swaziland system, their geological horizon being between the Witwatersrand beds and the basement Granite, and it has always seemed to me that so far as one can judge from what remains of them at the present day, that it is improbable that they were sufficiently auriferous to account for the vast amount of gold in the Rand banket, either on the foregoing theory or on any placer theory; and the latter certainly does not explain why the gold should be confined in profitable quantity to only a few of the many well defined conglomerate beds. Some portion of the gold may possibly be explained by the first, or 'inclusion theory,' that Maclaren advances. The second alternative explanation that the gold was introduced by ascending waters that have a connection with igneous masses is, however, the view that I have advanced to account for the general mineralization, both auriferous and otherwise, of the Rand bankets; but I consider the rising solutions may have been largely in the gaseous condition.

I assume, in my discussion, that the mineral contents of the solutions were set in circulation by the agency of intrusive igneous rocks, such as are represented so largely throughout the mines in the form of diabase dikes, which are, as I have shown, doubtless genetically related to the Ventersdorp diabase, and that the mineralization of these solutions was derived from emanations from the diabase magma, and finally found a home between the walls of those pebble beds that presented even easier passages than ordinary normal fissures, and so became the channels of maximum circulation.

Tellurides do not figure in the Rand deposits. The latter are, however, certainly indissolubly bound up with metalliferous sulphides in the form of iron pyrite.

In my paper I showed by numerous analyses that the diabase dikes associated with the Rand banket contain both gold and pyrite, and also carbon, which latter also occurs in the banket.

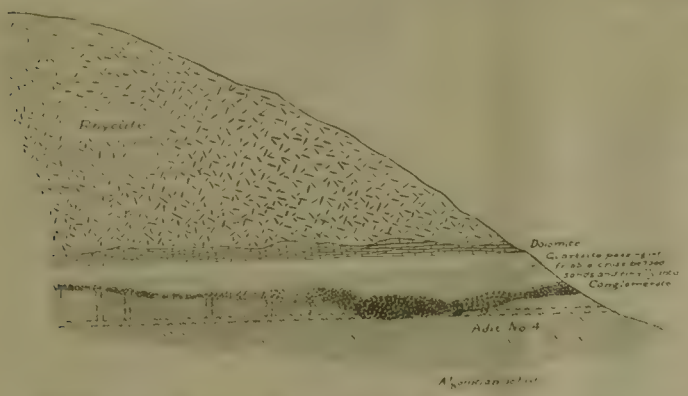
Then again, Maclaren's explanation of how the gold is carried in the mineralizers in an ionized condition and the consequent deposition products would account for the deposition of the gold, pyrite, and of the secondary silica in the banket. He states that in many pyritous veins the deposition of the pyrite, gold, and quartz has been contemporaneous, and I particularly pointed out that in the Rand bankets some of the gold and pyrite had been simultaneously precipitated.

Mr. Bain states that I give no figures as to the amount of iron present in the banket. The iron occurs, except in the oxidized zone, as iron pyrite, and in the first part of my paper I twice gave the amount of pyrite present as approximately 2 to 3% by weight of the auriferous banket. He thinks the sulphur of the pyrite may have been derived from sedimentary processes. This assumption was ably discussed in the criticisms on the paper read by Gregory in 1907 and was then shown to be highly improbable; I have already dealt with this theory in my reply to Gregory's discussion.

Mr. Bain says that the great supplies of gold have always come from placers. This may have been so in the days of more primitive gold mining. Apart from the Rand, which is the region under discussion, since the introduction of the cyanide process and the exploitation of the Western Australian goldfields and those of western North America, such a statement is no longer correct. Even if it were, it is not evidence in favor of the Rand banket representing an ancient placer. Advancing it in support of such a theory merely shows how difficult it seems to be (owing to the incident that between the walls of the Rand lodes ancient pebble-beds are enclosed) for readers and observers to reason from essential field-relations, lode-characteristics, and facts, rather than from the supposition that auriferous pebble-beds can hardly be other than placer deposits.

Mr. Bain refers to those very interesting Cambrian gold-bearing conglomerates of the Black Hills of South Dakota described by J. D. Irving; he mentions them as an example of a fossil placer, apparently considering them somewhat analogous to the Rand banket. He says that Irving considered much of the gold was detrital, but that the pyrite represented action subsequent to deposition and was accompanied by enrichment of certain areas in the conglomerate. Bain then proceeds to argue that original sedimentary processes might explain such enrichment. Now, Irving's description of these Cambrian conglomerates of the Black Hills is very clear. They are at the base of the Cambrian series and lie on the Algonkian, from which they are separ-

ated by an unconformity. Above these is a bed of dolomite lying more or less horizontally, and above this again is a thick mass of rhyolite. Irving advances conclusive evidence to show that these conglomerates are of littoral origin and points out that as such they are exceptional in that they were not uniformly deposited along the shore, but were confined to the vicinity of a large gold-lode outcrop, and that the detrital material



CROSS-SECTION THROUGH THE HAWKEYE-PLUMA MINE, SOUTH DAKOTA.

from that lode was held in irregular depressions in the submarine surface in its vicinity. The pebble beds vary in thickness from a few inches to more than 30 ft. They are overlain by cross-bedded beach sands passing upward into quartzite. They are described as being often cemented by more or less indurated sandstone of a quartzitic nature. They are auriferous only in one locality, namely, in the vicinity of a great mineralized zone in the underlying Algonkian rocks, which Irving thinks was probably in the old Cambrian sea at the time of the deposition of the conglomerates. Upon this zone are the Homestake and other mines, and about it, occupying depressions in the old Algonkian surface, are the productive portions of the Cambrian banket.

The latter consists of rounded water-worn pebbles of quartz or Algonkian quartzite with an intersprinkling of schist fragments that seem to increase in abundance as the distance from the Homestake lode increases; it can be distinguished from the non-auriferous conglomerate by being cemented with iron oxide in the weathered, or pyrite in the unweathered, portions. Irving states that much of the gold is detrital, as proved by its water-worn condition, it is concentrated on the bedrock; and he states his opinion that this gold was derived from the erosion of lodes in the Algonkian rocks, and that enrichment of the lowermost layers of conglomerate has occurred through some of the gold having been dissolved later by ferric sulphate (resulting from the oxidation of the pyrite) and having been redeposited lower down, also that possibly some gold was introduced with the pyrite that once formed a large portion of the matrix of the pebbles. In the only productive areas then completely accessible it was found that along definite lines, in the centre of the stopes, there were values of from $5 to $12 per ton, while at distances of from 10 to 100 ft. away the values sink to between $1 and $2 per ton. Iron-stained fractures are found in the roofs of these stopes, and Irving suggests that the gold, which is distributed in low and fairly uniform value, is of detrital origin, and that the additional gold has been introduced with the pyrite along zones of fracture. In support of the latter part of this theory, he states that much of the gold does not yield to amalgamation, and that consequently the cyanide process is employed. He adds that the pyrite was introduced after the deposition of the conglomerate, as the mineralization extends into fractures in the quartz pebbles, and he thinks the pyrite is a replacement of the original cementing material, which elsewhere consists of quartzose sand.

He states that the rhyolite intrusions, which cut the conglomerates in places, are much mineralized with pyrite that is thought to be of post-intrusive origin, and that consequently this places the pyritic mineralization subsequent to the rhyolite intrusions.

I am very grateful to Mr. Bain for having called my attention to this occurrence, but the analogy that I draw between it and that of the Rand is different from his. If one refers to the accompanying sketch, which is a reproduction of one of Irving's sections through the Hawkeye-Pluma mine, it will be seen that there are several features of the occurrence that resemble those of the Rand. In each case the beds can be represented by geological columns that closely resemble each other. In the Dakota example they consist from below upward of ancient schists separated by a great unconformity from the overlying quartzite-shale-conglomerate series. Above the latter is dolomite, and this again by an outpouring of igneous rock. In the case of the Transvaal the base of the column again consists of ancient schists that are also separated by a great unconformity from the overlying quartzite-shale-conglomerate series. Above the latter is dolomite (with its thin basal Black Reef beds), and this is also capped by an outpouring of igneous rock. In the auriferous banket of the former example, the origin of the fairly uniformly distributed gold, averaging between $1 and $2 per ton, is ascribed by Irving to a neighboring lode in the older series of schists, and his evidence in favor of this is the adjacent locality of its occurrence, and its water-worn appearance. In my paper I admitted that some of the gold in the Rand banket may be of detrital origin derived from lodes in the ancient Swaziland schists. If so, since it shows no sign of being water-worn, it must have been subjected to those resolvent influences of which Gregory makes so much. Even if this be so, it is remarkable that in so vast a deposit none of it should have escaped this process sufficiently to still exhibit some indication of its original water-worn character. However, considering that the Witwatersrand conglomerates have been derived from the

denudation of the Old Granite and of the ancient schists of the Swaziland system it is only reasonable to assume that they would have contained some detrital gold derived from these sources.

However, what I do maintain is that this great gold repository of the Rand had a much more plentiful source of supply of the precious metal than was afforded by the ancient underlying granite and schist, and that this reservoir was the barysphere.

Also, as in the Dakota example, much of the Rand gold does not yield to amalgamation, and the mineralization also extends into the fractures in the quartz pebbles. When dealing with the genesis of the carbon in the banket,[1] I pointed out that these fractures, running through pebbles and matrix, are parallel to the main structural faults of the district, demonstrating that the mineralization took place long after the deposition of the conglomerates, and later in my paper on 'The Rand Banket' I showed that much of the pyrite has metasomatically replaced not only the matrix but also the pebbles of the banket. I also demonstrated the close relationship between the pyrite and the gold, and that, to some extent, there had been simultaneous precipitation of the two, and that the evidence indicated the gold to have been introduced with the pyrite along zones of fracture communicating with the pebble beds. Irving lays stress on the fact that the rhyolite, which has broken through the conglomerate, is much mineralized with pyrite, and so thinks the pyritic mineralization was subsequent to the rhyolite intrusions. I showed that the diabase dikes of the Rand contain appreciable amounts of pyrite, gold, and carbon, all of which occur in association in the neighboring bankets, and that these dikes are genetically related to the Ventersdorp diabase, which is also appreciably mineralized with pyrite, and I consider the pyrite and gold mineralization of the bankets as one of the effects of the intrusion of these dikes.

Mr. Bain then refers to the gravels that are being dredged at various places along the Sierra foothills of California and says that the gold in them occurs distributed as on the Rand. Here I distinctly join issue with Mr. Bain. Can he instance a single example from among them showing not only regular alternations of relatively rich and poor zones in one and the same bed, but also showing similar alternations of rich and poor zones, as between itself and an underlying parallel bed, some 200 ft. beneath it, that is, rich opposite poor zones in the underlying bed and the reverse, like the examples illustrated by me in figures 25 and 26 of my paper? He speaks of the profitable beds as being miles in extent. So are the auriferous deposits of the Rand. What one wants to know, and what Mr. Bain is careful not to state, is not their extent along the strike but along the dip, or in other words, their width. On the Rand the profitable ground has been exploited to a distance measured on the dip corresponding to a vertical depth below the surface of from 4000 to 5000 ft., or some 6000 to 7000 ft. or more along the dip. Needless to say, the Californian placers do not average in width anything like this distance. Personally, I fail to see any real analogy between them and the Rand orebodies. Mr. Bain realizes that these Californian placers are delta deposits, he quite frankly admits that the diagrams given by me in illustration of the way the gold is distributed in the Rand banket make it quite clear that they bear no resemblance to river placers.

It seems to me that the Californian placers are largely responsible for the amount of mysticism that has arisen in regard to the genesis of the Rand gold. Many of the engineers who were first on the Rand in the early days of this great goldfield were well acquainted with the Californian placers, and owing to the strong superficial resemblance of the Rand deposits to the latter, they not unnaturally placed them both in the same category. Many who arrived later somewhat blindly accepted their dictum, as it is always easier to fall in with an already ventilated and plausible theory, rather than by careful observation to bring forward facts and arguments against it. There is, however, no longer any excuse for such procedure now that the mines have been so extensively worked and to such great depth, and for some 60 miles along the strike, and now that so much evidence is available that in those days was unknown.

I am glad Mr. Bain refers to the great contrast and unlikeness (brought out by Mr. Rickard in his discussion) between the Rand banket and the gold-bearing beach gravels of Nome. At Nome the profitable gold is limited to a narrow band, at most only about 100 ft. wide, corresponding to 100 ft. on the dip of the Rand banket.

The nearest analogy to the Rand deposits that Mr. Bain has seen are certain silicious deposits described by Irving as sandstones mineralized by solutions entering along transverse fissures and cracks. As a result of a brief visit to them, Bain considers the result is not at all the same as on the Rand, as he says the gold is localized and is more definitely related to fissures, which served as channels for the mineralizers, than is indicated by the Rand stope-plans published by me, and that 'pay-streaks' were formed rather than mineralized beds. Now, the stope-plans to which he refers are diagrams to show enrichment due to faulting, to illustrate the influence of faults on the distribution of the gold in the bankets. That we have mineralized beds rather than 'pay-streaks' in the case of the Rand is merely an incident due to the greater freedom offered to the circulation of the mineralizing solutions throughout the entire length of the beds, due to the porous nature of the conglomerates, which acted as pseudo-fissures. In ordinary fissures the original walls are relatively closer to each other, and the fissures as a whole do not permit such uniform and free circulation throughout their length, and such is only possible along certain parts, where consequently the maximum circulation and result-

[1]The Mode of Occurrence and Genesis of the Carbon in the Rand Banket, *loc. cit.*

ant maximum deposition occurs, such portions or channels often having been determined by dynamic forces that resulted in relative movement of the two walls, causing the intervening space to be diminished at certain points and increased at others, and so pay-streaks have been formed.

The Rand deposits must be viewed not with cramped vision but as a whole, when it will then be realized that the structural faults and the openings now occupied by the igneous matter of the numerous longitudinal dikes have furnished more than sufficient communications between the conglomerates and the deep-seated mineral reservoir of the earth's crust.

If the Rand gold is of subsequent origin to the deposition of the conglomerates and was introduced later as an incident of igneous activity, where, Mr. Bain asks, is any analogous deposit? This question gives me the opportunity of bringing forward an example to which Mr. Rickard has already directed attention, and that I consider is strikingly similar in essentials to the Rand deposits. The example to which I allude is that of the copper-bearing conglomerate of the Lake Superior district. Mr. Rickard describes this conglomerate as composed mainly of water-worn fragments of quartz-porphyry and allied rocks cemented by calcite, quartz, epidote, chlorite, prehnite, and copper, the pebbles of the first-named ranging in size from a pigeon's egg to that of a turkey. He states that in the deeper workings of the Franklin Junior mine the copper passes from the conglomerate into the underlying amygdaloidal diabase. Copper has been won on a large scale from the conglomerate in the Calumet & Hecla, Tamarack, Franklin, and Allouez mines. He describes the conglomerate in the Calumet & Hecla mine as from 10 to 25 ft. thick and dipping from 36 to 39° northwest, the profitable portion being in the form of an ore-shoot and pitching north. A bed of copper-bearing sandstone was exploited in the Nonesuch mine. Rickard points out, however, that in the majority of the mines the copper occurs in the associated amygdaloidal diabase, as for example in the Quincy, Atlantic, Baltic, and Wolverine mines. Also besides the copper in the beds of conglomerate and in the amygdaloidal rocks, copper-bearing veins occur that have been formed along lines of fracture, some of which have proved very productive. He aptly remarks that no American has attempted to establish an alluvial origin for the copper. I am tempted to wonder whether any of those who have, in the case of the Rand banket, suggested a detrital origin for the so-called 'pebbles' of such an easily oxidizable mineral as iron pyrite, would have dared to suggest such an explanation for the copper in what Rickard has termed the 'copper-banket' deposits of the Lake Superior region.

Rickard further points out that the associated basic lavas generally contain native copper, some of them being rich enough locally to invite mining operations; further that the copper banket has been formed by infiltration of solutions from which the metal in its native state has been generously deposited.

Native copper was first found in this region in the transverse fissures crossing the Keweenaw series.[1] Sulphides and arsenides of copper occur in fissure-veins in this region,[2] indicating that the source of the copper is deep-seated, and their close association with the diabase rocks suggests that their presence in the various deposits is due directly or indirectly, to the agency of these basic eruptives.

No 'fossil placer' bears such a close analogy, in those essential features that relate to genesis, as the 'copper banket' of the Lake Superior region does to the Rand gold-banket.

C. Baring Horwood.

London, November 3, 1914.

[Responding to Mr. Horwood's questions relative to the distribution of the gold in California placers now being dredged, we can assure him that the gold is distributed in a "direction corresponding to dip" fully as far as the instances he cites on the Rand. There is at Oroville a lower pay-streak than the one now being dredged. Being beyond the depth possible at present to work, it has been little studied, and it is impossible to say how the gold is distributed in it, whether according to the system he has illustrated from the Rand mines or some other. We are glad to say that arrangements have just been made for the U. S. Geological Survey and Bureau of Mines to join in a systematic study of placer deposits and mining methods. It is hoped that this will yield many significant results, and among others that it will throw light on this matter of the distribution of the gold at Oroville and elsewhere that the dredges are working.

Just a year ago we printed the last of Mr. Horwood's significant and interesting papers on the Rand. Today we close what has been an equally interesting and stimulating discussion which has run through the year and been participated in by many of the leading students of ore deposits. The papers and the discussion will now be reprinted in book form so as to make the whole permanently and conveniently available to students. In closing the discussion we wish to thank Mr. Horwood and those who have contributed to it, for the part they have taken in what we consider to be one of the most valuable series of papers that it has been our pleasure to print.—Editor.]

A cement plant with a capacity of 150,000 bbl. per year is about completed, at a cost of ₱600,000, at Binangonan, province of Laguna, Philippine Islands. A 5-mile aerial tramway will carry limestone to the plant. A pier has been built for shipment of cement to Manila. A barrel factory will use native timber. The works will be driven by electricity generated by steam, and 1000 men will be employed.

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[1] 'The Copper Mines of Lake Superior,' by T. A. Rickard *The Eng. & Min. Jour.*, 1905, p. 25.

[2] 'The Ore Deposits of the United States,' by J. F. Kemp (1893), p. 142.

CONCENTRATES

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

GOLD PRODUCTION OF THE WORLD in 1913 totaled 411 tons, of which 274 tons came from the Transvaal.

RAINFALL at Johannesburg, Transvaal, averaged 31.5 in. for 26 years. Evaporation in 10 years averaged 73.59 inches.

WIRE ROPE of the locked coil construction is for heavy track cable service on aerial wire-rope tramways and cableways, and it is so named on account of the outer wires of the rope being of such shape as to permit them to lock within one another.

ACID MINE WATER in the Consolidated Gold Fields mines on the Rand is now neutralized by finely crushed carbonate of lime. This has resulted in less corrosion of pipes and pumps underground, and less burnt lime is needed in the mills and cyanide plants.

MANY IRON-ORE DEPOSITS on the Mesabi range contain as much as 20% moisture. This ore is not desirable for blast-furnaces, and gives trouble by freezing in cars during transport. Two drying plants are in operation in the Mesabi district during the shipping season. The ore passes through cylindrical rotary dryers heated by hot air from attached coal furnaces, a fan drawing off the water vapor from the ore, according to Edwin J. Collins. The Brunt plant contains two Ruggles-Coles dryers, 90 in. diameter and 55 ft. long, and two Economy dryers 84 in. diameter and 55 ft. long. These differ in heating and furnace arrangement from the Ruggles-Coles dryers. The Whitesides drying plant contains four Ruggles-Coles dryers, 108 in. diameter and 57 ft. long. In traveling through a 55-ft. machine, the ore passes 900 ft. of hot air. Moisture is not reduced below 7.5%, as fine particles are not suitable for blast-furnaces. The cost is 5.76c. per ton of ore for fuel, and about 20 to 30c. for all charges, while the value of the ore is increased by 35c. per ton.

AN INTERESTING PHENOMENON of the Ely, Nevada, district is the 'blout' or jasperoid, according to Alfred R. Whitman of the University of California. This is a compact granular silicious rock, generally of a yellowish brown color, forming bold outcrops along the copper belt. In a general way, it is arranged peripherally to the ore-porphyry; but the arrangement is irregular and ambiguous. A. C. Lawson has advanced the hypothesis that these deposits may be of the nature of an encasing shell about the porphyry due to contact action. But the better exposures due to mining operations of recent years have revealed evidence which does not support this view. The 'blout' in many cases caps the porphyry, but is nowhere found within it, while it is certain that a considerable thickness of the intrusive has been eroded away over the points where it is found. The occurrences of 'blout' are also notably conformable to the present topography. Had it originated from magmatic emanations, it must have incrusted the original periphery of the intrusion in addition to being distributed through the neighboring limestones and

SHOWING OCCURRENCE OF A 'BLOUT' AT ELY, NEVADA.

The irregular white line above the adit is the bottom of a mass of 'blout' five feet below the surface. The adit is in limestone dipping to the right.

shales as it is. These hard shells of silica, then, should have controlled the topography, preserving the underlying rock from weathering and erosion. But this is not the case. Many of the hills have jasperoid outcrops on the summits but they also have the same sort of outcrops in places here and there on the sides, even to the bottoms. In a few places the under sides of these outcrops have been exposed in prospect tunnels, as shown in the accompanying illustration; and in such cases are seen to extend irregularly down as fingers into the underlying limestones as complete replacements of it, as if they had resulted through the agency of slowly descending surface waters.

REVIEW OF MINING

As seen at the world's great mining centres by our own correspondents.

BOSTON

Stock Exchanges Reopened with Good Trading.—Copper Producers' Association.—La Exposición Mining Co.—North Butte.—Southern Montana Railroad.—W. B. Thompson.

The Boston Stock Exchange opened on December 10 for limited trading, after having been closed since July 30. There were over 100 brokers on the floor, and a large and enthusiastic crowd of onlookers filled the balcony. When the gong rang it was apparent that there was a large number of buying orders on hand, and dealings started in a spirited manner. The strength of Boston's zinc issues, Butte & Superior and American Zinc, was the leading mining feature, both of them holding several points above the July 30 figure. Alaska Gold was several points higher, and Copper Range, Utah Copper, Inspiration, and North Butte were fairly strong. Many members of the Stock Exchange who do not usually visit the floor were present at the opening, and the feeling is quite optimistic as to the stock-market outlook. Boston traders are looking for the coppers to come back, and there is some feeling to the extent that the Lake issues, always favorites here, will lead the procession in the recovery. The position of the Lake stocks is very conservative and strong, and it is realized here that quite a number of the companies, both producers and development properties, are in sound condition through the restrictions enforced during the labor strike and the 10 months which have followed since the strike was settled. The passing of the dividend the second time by Calumet & Hecla is conservatively construed here, and the resumption of dividends by Quincy is well regarded. The strength of Copper Range since the Exchange reopened indicates renewal of interest in the Lake district. Lake, South Lake, North Lake, Mayflower, Old Colony, New Arcadian, New Baltic, and Oneco are prospect properties which have market promise. The Calumet & Hecla subsidiaries are in good financial shape, and a strong movement in them may be expected when the market turns.

The rumor that North Butte may acquire the East Butte mines and smelter is not given much credence in Boston, although it is recognized that such an eventuality is possible.—Freeman I. Davison, of Boston, will go to London in January to take up the campaign with financial interests there of placing $3,000,000 bonds of the Southern Montana Railroad, south of Butte.

It begins to look as if the monthly statements of the Copper Producers' Association are to be issued no more. The last one covered conditions as at July 1. There has been formidable opposition to the maintenance of a publicity bureau by the copper producers ever since the Copper Producers' Association was organized in 1909. The advocates of publicity having prevailed, the statements, once started, could not be discontinued for any logical reason until the war. However, it has been argued that the producers were financing a club to place in the hands of consumers, inasmuch as consumers, on that account, reduced the amounts of copper carried in their yards very heavily in comparison with amounts previous to the publication of monthly figures. L. C. Graton, a professor at Harvard, went to New York once a month to compile the figures as they have been gathered in by his office force there. Since July, producers to some extent have withheld the information they have been sending to the Association.

William B. Thompson, of New York, a member of the Stock Exchange house of Thompson, Towle & Co., and prominently identified with Inspiration, Mason Valley, and other mines, will retire from that firm at the end of December, as his position as a member of the Federal Reserve Board in New York forbids his sustaining such business connection. The business under Mr. Towle and some of his associates will be continued.

Application will be made to list the stock of the La Exposición Mining Co. on the Boston Curb at an early date. The moving spirit in this Company is Apollos Fuller, of Pasadena, California, who has been operating mines of this Company in Mexico and in the Turquoise district, Courtland, Cochise county, Arizona. The Company is capitalized for $2,500,000 and has an authorized convertible bond issue of $400,000. Calumet & Arizona and Phelps-Dodge interests have adjoining properties in the Turquoise district. The management has spent over $100,000 on the Arizona property, and the Mexican properties were producing and had paid dividends for some time prior to the war forcing them to suspend.

WASHINGTON, D. C.

Progress in Mining Legislation.—Bureau of Mines Publication.——Illinois Operators' Troubles.

Mining legislation in Washington proceeds at no faster gait than heretofore noted. While Congress is preparing to rush things, and will even sit through most of the holiday period, the skies will not become cleared for a sure outlook as to what will happen in legislation until after the new year. Meantime an interesting mining event is the forthcoming publication by the Bureau of Mines of a volume which shall be a compilation of all the mining laws of all the states together with those of the federal government. Such a compilation should be of great value. It will be tantamount to a sort of codification. It will certainly be handy to have around when the codification commission, which will come some time, begins to revise the national mining laws. The volume is not, however, going to be distributed free by the Bureau, it is announced.

Mining operators from Illinois have been in Washington to tell how sadly depressed the mining world is in many places. They have placed their claims and cases before the Secretary of the Interior, Franklin K. Lane, who can be helpful by the agencies of the department. The laws can be liberally enforced; stretching them tight might hurt.

AUCKLAND, NEW ZEALAND

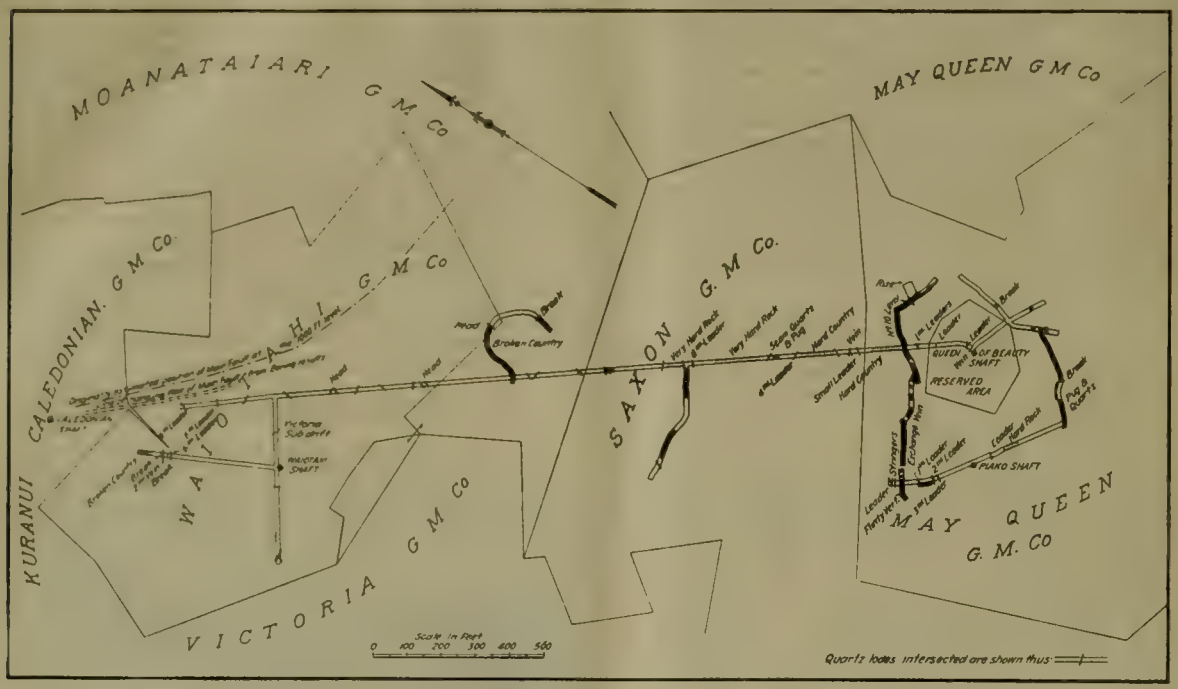
Résumé of the Past Year.—The Thames Deep Levels.—Waihi and Karangahake Districts.—Consolidated Group.—Oil Prospects.

The war in Europe, following on the strike toward the end of 1913, has naturally had a depressing effect not only on gold mining, but also the kauri-gum industry in New Zealand. Added to this there was a disastrous explosion at the Taupiri coal mines north of Auckland, which resulted in the death of 43 miners, and the stoppage of operations for some time. Even this did not end the troubles for the year just closing, as the sulphur company's works at White island, off the east

coast, were completely destroyed by a volcanic outburst and 10 or 11 men were killed. Thus 1914 has been an unlucky period for the mining industry of Auckland province. At the same time the important companies in the Waihi and Karangahake districts have carried on operations as usual, and yielded regular dividends to shareholders.

The most serious effect of the stringency of the money market as the outcome of the war, has been that shareholders in development properties have declined to pay assessments, and this has led to the stoppage of operations which means throwing a number of men out of work. The most regrettable thing was that this had the effect of compelling the Thames Drainage Board to stop pumping operations at the end of October. This resulted in the stoppage of work in the low-level crosscut, at 1000 ft., across the Thames district, to which no less than $106,000 has been spent during the past four years, and about a similar sum in keeping the pumps going. This suspension will thus mean the practical wasting of nearly $240,000, as once the water has been allowed to rise and fill the old workings, it will be a long time before any companies will be prepared to face the cost of unwatering the field again. The Waiotahi company had already sunk its shaft to 1000 ft. and connected with the cross-cut when the war started, but of course no development work could be undertaken.

On October 19 the government mine inspector gave formal notice that the deep-level cross-cut must be discontinued owing to the carbon dioxide gas being present in such large quantities as to make it a positive menace to the lives of the miners, if the ventilation plant should have an accident that caused it to stop for even five minutes. Under these circumstances there was no option but to stop work. Following this came an intimation from the Thames Drainage Board that it intended to cease pumping at the end of October owing to the interested companies declining to pay further contributions. This alone was enough to cause the stoppage of work on the deep levels, as the Drainage Board is a separate body that does the unwatering of the field. The only hope for the Thames area is that all the five companies will amalgamate into one strong company, do away with the expense of a Thames Deep Level Board and Thames Drainage Board and have all the operations carried out under the supervision of one competent mining superintendent. It is hopeless to do anything at the depth of 1000 ft. with a number of small companies attempting to carry on operations with penny assessments. The time has arrived when systematic development should be undertaken at the Thames to try to locate a second floor of auriferous country, in which might be found a downward continuation of the rich shoots of ore that yielded so generously near the surface in the early days of the district. It may be said that several mines here are independent of the pumping plant, and are at the other end of the field, but yields are small.



PLAN OF THE 1000-FT. LEVEL OF THE THAMES GOLDFIELD, NEW ZEALAND. THE CROSS-CUT, TO DRAIN AND PROSPECT THE AREA, IS ABOUT 2400-FT. LONG. THIS WORK IS DONE FROM THE QUEEN OF BEAUTY SHAFT, OTHER MINE WORKINGS BEING CONNECTED WITH THE CROSS-CUT. THE FUTURE OF THIS ONCE HIGHLY PRODUCTIVE FIELD DEPENDS ON RESULTS FROM THIS SCHEME.

The real mining work on the peninsula is in Ohinemuri county. The Waihi has produced a regular monthly output of gold and silver worth $120,000, paying quarterly dividends of 25c. per share. Better grade ore has been opened in the Waihi Grand Junction, and a dividend of 35c. per share was paid in November. The scheme to prospect the six miles between Waihi and the coast by a long adit and cross-cuts has fallen through owing to the war. The Waihi Reefs and Waihi Consolidated have been amalgamated and will sink to 1200 ft. to cut the Waihi lode system. At Karangahake, 9 miles away, the Talisman has yielded about $110,000 per month, the ore averaging about $24 per ton. The Crown mine, which adjoins the Talisman, and has produced $3,900,000 to date, had to suspend work owing to the lack of funds for development. Ohinemuri county has produced bullion worth $72,000,000, of which $28,000,000 has been paid in dividends.

The value of the gold mining industry to the Auckland province is shown by the fact that the total output of bullion from 1857 to the end of last year was $106,000,000, the total yield for the whole Dominion for the same period being $394,000,000.

In the Consolidated group of mines at Reefton, in the South

Island, important developments have taken place in the Progress section, which promise well for the future of that property. The Blackwater company had good returns throughout the year and paid regular dividends. According to recent advice, a vein has been cut in the mine at a depth of 1081 ft. assaying $35.50 per ton for a width of 36 inches.

The Ross Goldfields gravel mine, from which so much was expected when the fine new plant was in working order, and the Cassius lead was opened, has not so far fulfilled the hopes of the promoters, as the weekly returns are not equal to expenses. At the same time, there is still a hope for the company if vigorous development is undertaken, but at a time like the present people are not anxious to pay assessments, and this tends to limit exploration work in all mining ventures.

Development of the oil wells in the New Plymouth district seems to be slow business. In some places holes have been drilled to 3000 ft., and while barren as far as oil was concerned, gave valuable data for other operations. One of the companies appears to have spent all its capital on a refining plant, and was left without funds to prosecute boring operations. In some wells water has intruded in the oil measures with serious effects. No doubt in time all these difficulties will be overcome, and the day may arrive when New Zealand will be able to have a steady output of petroleum. That the oil exists in various places has been proved beyond doubt, but that it can be worked at a profit, still remains to be demonstrated.

PORCUPINE, ONTARIO

McKinley-Darragh Company Turns Down Jupiter Mine.—Teck-Hughes, Hollinger, Dome, Porcupine Crown, and McIntyre Mines.

The action of the directors of the McKinley-Darragh company, of Cobalt, in turning down the Jupiter property of Porcupine came as a surprise. The mine has been under option to the prospective purchasers since last spring, and all reports coming from the property and from the directors of the Company have encouraged the view that the option would be exercised. During the past few weeks the market for the shares had been strong, and the price gradually rose to 17c. A day or so before the decision of the directors was made public, large blocks of the stock were thrown on the market and the price broke to 10c. The option was for 51% of the stock and called for the expenditure of $30,000 on development, $50,000 for the retiring outstanding bonds, and providing an additional $40,000 for working capital. A couple of months ago the option was extended to December 17 to permit further development on the lower levels. This work is claimed to have given satisfactory results, sufficient to justify the property being taken over. It is understood that P. A. Robbins, of the Hollinger mine, who was formerly manager of the McKinley-Darragh, made an examination of the mine and advised that the option be exercised, while R. B. Watson, consulting engineer for the purchasers, was averse to taking up the property under the terms of the option. The directors of the McKinley-Darragh did make an alternative proposal which was not acceptable to the Jupiter company. Since the option was allowed to lapse, another offer has been made for the property by other people, but it has not been decided as yet whether to accept it or whether it would be more advisable to work the property for the Jupiter company.

Recent developments on the Teck-Hughes property in Kirkland Lake, which is under option to the Nipissing company of Cobalt, have not been as satisfactory as was anticipated. The ore-shoot on the 180-ft. level was much shorter than on the 80-ft. level, and the indications point to there being only a small tonnage of ore, on which the development charges will be high. The owners, however, agreed to remit part of the payment due, and the Nipissing decided to continue development, and is now sinking to reach a new level. The next payment on the property is due in March of next year.

Hollinger stock has been showing unexpected strength during the past few days, and this may presage the completion of the arrangements for the absorption of the Acme.

Minor changes are being made in the Dome mill with a view to increasing the tonnage to 28,000 tons per month. It is understood that total operating costs, including development, are approximately $2.85 per ton.

The Porcupine Crown has declared the regular quarterly dividend of 3%, payable January 2. While work below the 500-ft. level has not succeeded in opening any more ore, the southern extension of the orebody has been found beyond the fault, and development in that vicinity is satisfactory. The directors of the Crown Reserve company, of Cobalt, which holds the controlling interest in the Porcupine Crown, have intimated that it will again be necessary to cut the dividend of the Crown Reserve. This Company formerly paid 2% regular and a 3% bonus monthly, making 60% per annum. This was subsequently cut to 2%, and it is expected that the next rate will be 1% per month. If it were not for the revenue derived from Porcupine Crown, it is doubtful if even the latter could be paid very long from earnings.

During October the McIntyre mill treated 7510 tons averaging $8.84, and recovered $64,732. It is expected that the production for November will be in excess of October. A continuous decantation plant is being installed, and will shortly be in operation.

DEADWOOD, SOUTH DAKOTA

Homestake Affairs.—Anaconda Mine.—Tin Production.

With the declaration of an extra Christmas dividend of $1 per share, the Homestake gives substantial proof of having enjoyed a prosperous year. This payment will amount to $251,160, and with the regular monthly dividend of 65c. per share, will make a total of $414,414 paid to the stockholders in December, and a total for the year 1914 of $2,210,208. The property is now equipped with 1020 stamps, and during the year ended October 31, according to the report of the state mine inspector, 1,587,000 tons of ore was treated, yielding $6,046,000. Everything about the great property is working smoothly; there have been no changes of policy or methods, and while a number of changes have been made and are under contemplation, they are in the nature of permanent improvements and installations for the purpose of increasing efficiency and reducing operating costs. Along this line might be mentioned the central boiler plant, now under construction, from which will be operated a steam-driven electric generating station and a mammoth new hoisting equipment at the B. & M. shaft. The installation of electric pumps at Hanna, where water from Spearfish creek is pumped over a divide to a height of 382 ft. for supplying the mills, will effect a saving over the present steam-driven pumps. The poles and wires for the transmission of the power have been erected over the four miles from Englewood to Hanna, and the pumps are ordered. Next year, as soon as the ground is in shape for excavating, work will be started on a large and perfectly appointed hospital to cost upward of $25,000.

McNish & Mills are making an earnest endeavor to produce tin at Hill City, and are confident of success. They have already made a test run in a mill they have leased, and have had encouraging results. The mill is equipped with crusher and rolls, in which the ore is handled in a dry way. After crushing, it is sent to the trommels, where a large proportion of the mica is eliminated. This, by the way, can be marketed at $12 to $15 per ton. Following the second trom-

mel where the water is added, the pulp is given a rough classification and fed to two Wilfleys and a slimer. The result is a clean separation on the Wilfleys, and, owing to the coarse crushing and thorough screening, a minimum of slime which contains almost no cassiterite. No further milling will be done until spring, but in the meanwhile the plant will be equipped with some additional screening devices and a small furnace for producing metallic tin from the concentrate. These people have several properties under lease, but will probably be able to take care of a limited amount of custom ore. It is their intention to hand sort the ore and keep the grade at a minimum of 2% tin.

Removal of the hoist of the Anaconda company from the Elk Creek slope to the opposite side of the divide, on the Bare Butte Creek slope, has been completed, and sinking is under way. A two-compartment shaft is being put down and has reached a depth of 50 ft. Should the gold content of the ores at this point prove to be as good as in the old shaft, it will undoubtedly mean the construction of a large mill. Minneapolis capital is backing the enterprise.

LORDSBURG, NEW MEXICO

Work of the 85 and Bonnie Mining Companies; New Plant and Increased Production.

The 85 Mining Co. and the Bonnie Mining Co., both operating in this district, are making periodical shipments of copper, gold, and silver ore to Arizona and New Mexico smelters under general curtailment. The former's shipments for the past week have been retarded on account of bad roads between the mine and the loading point on the New Mexico & Arizona Railroad, but as soon as the weather permits, things will move along at a livelier rate than they have since August, when a curtailment went into effect. At the annual meeting of this Company held here last week, the following officers were re-elected: Arthur Warner, president; P. B. Yates, vice-president and treasurer; and C. H. Warner, secretary. W. F. Ritter will continue in the capacity of general manager, the position he has filled for the past few years. At the meeting, no decisions were made affecting the present operations of the 85 mine, owing to the unsettled condition of the copper market; however, it is stated by officials that an increase in production is contemplated. The Company decided to install an electric hoist at the mine, but the character was not settled upon. A night shift may be added to the working force of the 85 mine before long, and at which time connection will be made with the 85 power house for supplying the town of Lordsburg with electricity.

NEW POWER HOUSE OF THE 85 MINING CO., LORDSBURG, NEW MEXICO. PRIME MOVER CONSISTS OF A 450-HP. DIESEL ENGINE (LYONS.)

The Bonnie Mining Co. is working along steadily, and is installing new machinery. A steam hoist arrived at Lordsburg this week, and will be removed to the property as soon as road conditions permit.

NEW YORK

Safety and Sanitation Conference — Butte & Duluth Deals. — Shannon Costs — Braden Improvements — Inspiration Buys the Keystone.

The feature of last week in New York was the Safety and Sanitation Conference, held under the auspices of the American Museum of Safety, in connection with the Second Exposition of Safety and Sanitation at the Grand Central Palace. Meetings were held during the week, dealing with the question of safety and sanitation throughout the whole country, and in every phase of work. Many of the papers were illustrated by moving picture films. So many papers were presented that it would be impossible to list them at length, but the ones most interesting to the mining profession were 'Safety in the Handling and Transportation of Explosives,' by W. B. Dunn, inspector of the Bureau of Explosives in New York. Various papers on fire prevention were given on Tuesday, December 15. Wednesday was industrial safety day, and the best papers were 'Safety in Underground Construction,' by Emil Diebitsch; 'Recent Progress of Safety in the Steel Industry,' by C. L. Close, head of the sanitation and welfare department of the U. S. Steel Corporation; 'How the United States Government is Helping to Decrease Accidents in Mines,' by H. M. Wilson, resident engineer of the Bureau of Mines Experiment Station at Pittsburgh. There were various other papers on standardization of safety devices and accident prevention. Thursday was devoted to transportation, and Friday to health and sanitation. Many good papers were presented, including one on conserving the health of workers at National Lead Co.'s plants, by Charles P. Tolman. Saturday was devoted to the welfare of employees, and a great variety of papers was presented. The sociological and safety work of the New Jersey Zinc Co. was described by Miss Florence Hughes, of the welfare department of that Company. The exposition was even larger and more interesting than last year, and the museum's work is showing a gratifying growth and increased influence in public life.

The Butte & Duluth seems to be rather elusive just now. A couple of weeks ago it was reported that it had been sold to Hayden, Stone & Co. It has since then developed that this is not a fact, but it is now reported that the Anaconda Copper Co. has taken an option on it at a price said to be near $2,000,000. The report is not confirmed by the Anaconda officials, and presumably the deal is not yet closed. There have been many rumors as to the future of the property.

The Braden mine has been doing well lately and the cost of copper at the mine last month is given as 7½c. The recovery from mill operations is reported as being better than before, and presumably the smelter is working more smoothly, as Mr. Sorensen has been in charge for some time. H. C. Bellinger has been retained in a consulting capacity, and has been in Chile for the past few months.

The announcement that the Inspiration Consolidated Copper Co. will take over the Keystone, is an interesting conclusion to the suit which the Inspiration brought to secure permission to drive an adit through the Keystone ground to reach some of its own orebodies. The property of the Keystone lies between the Inspiration and Live Oak orebodies and consequently formed a bar to economic operation of the two as one property. The absorption is to be brought about by the exchange of 40,000 shares of Inspiration for 360,000 shares of Keystone. This property is under the management of the Lewisohn interests, though Ladenburg-Thalmann company are supposed to control the property. Development work has so far proved 2,500,000 tons of sulphide and 5,000,000 tons of oxide ore. This will form a substantial addition to the large tonnage of the Inspiration, though it is not enough to have promised much profit if the property had been operated as a single one.

THE MINING SUMMARY

The news of the week as told by our special correspondents and reflected by the local press.

ALASKA

A preliminary report on mining in the territory, by Alfred H. Brooks, of the U. S. Geological Survey, will appear in the next issue of this journal.

Nome

Commercial business at Nome during the past season was as follows:

Vessel tonnage (arrivals and departures)	116,621
General merchandise received, tons	13,687
Fuel oil, tons	7,560
Coal, tons	2,087
Lumber, feet	1,482,350
Passengers arrived	1,584
Passengers departed	2,056
Placer tin sent to the United States, tons	108
Gold exported, customs and post-office, ounces	144,546
Value	$2,653,225

The Empire Tin Mining Co. is to develop its Bartel claims this winter, in charge of G. L. Blevins.——It has been reported that the large deposit of iron ore at Sinrock has been sold for $400,000.

ARIZONA

Cochise County

A considerable amount of general work is under way at the Copper Queen property at Bisbee. In the Czar and Holbrook sections of the mine, additional ore has been proved at 200, 300, and 400 ft. Shipments of the lead ore are going regularly to El Paso. In the Gardner mine at 700 and 800 ft., Lowell at 1100 and 1200 ft., and Sacramento at 1300 and 1500 ft., reserves of copper ore are larger than before. The new steel head-frame and hoist at the Czar are giving good service. The old boiler plant there is being remodeled, and a new trestle for disposal of waste is under construction. At the Holbrook the old sawmill and boilers are being dismantled. The central sawmill and drill-sharpening plant are at the Gardner mine. The experimental mill is testing concentration methods on the low-grade Sacramento ore. The precipitation plant at the Czar has been superseded by the new one at the Lowell. The new dispensary for the medical department is finished.

The report of the superintendent of the Shattuck Arizona, Arthur Houle, for the 24 days ended November 30, shows encouraging results, especially at 200 ft. The ore there contains silver, gold, and copper. A rise at 600 ft. is in 6% ore, while a rise at 900 ft. has opened good copper-gold-silver ore.

Gila County

The Old Dominion company is to do some churn-drilling between Globe and Miami, about two miles from the former town. The purpose of this work is to examine the formation in that part of the Company's property, according to the general manager, P. G. Beckett.

Graham County

The Shannon Copper Co.'s report for the third quarter of 1914 shows that 49,254 tons of Shannon and 11,459 tons of other Company ore yielded 2,964,764 lb. copper, 412 oz. gold, and 18,449 oz. silver against 56,085 tons, 11,379 tons, 3,118,156 lb., 420 oz., and 20,702 oz. the previous quarter. The cost of production was 11.396c. per lb., which covers all expenses. Including that from the railway, the total profit was $26,562. Owing to the war it was decided to shut the mine and smelter in September. The financial condition is good, as there was at December 7 the sum of $180,000 cash on hand, and 746,900 lb. of copper, which is worth $90,000. The Company also owns bonds in the Shannon-Arizona Railway Co. worth $383,000.

Greenlee County

The Arizona Copper Co. produced 2,690,240 lb. of copper in November.

Mohave County

Five feet of lead ore has been cut at 1100 ft. in the Tennessee mine at Chloride. A large flow of water followed this development. This property is operated by the Needles Mining & Smelting Co., a subsidiary of the United States Smelting, Refining & Mining Co., and ore is shipped to the smelter at Needles.

Yavapai County

The Arizona Copper-Gold Mining Co. has been reorganized, according to R. H. Burmeister. The claims are at Cherry creek. The Leghorn has been opened to 650 ft., showing mostly gold in the vein which averages two feet in width. A Lane mill has recovered $15 per ton. The main shaft is to be sunk to 2000 ft., and a mill and cyanide plant is contemplated.——There are several other properties in this district.

The Big Pine and Mascot companies have made an agreement for joint operation. The former's property on Senator mountain has been opened by 3000 ft. of adits and lateral work, proving a large tonnage of ore averaging $9.50 per ton. Additional ground was secured, and an adit will be driven about 4100 ft. and will open more ore and act as a means of transporting ore to the mill and cyanide plant to be moved from Harrington to Hassayampa creek. Equipment from the Mascot will be used.——Five mills in different parts of the county have been overhauled lately, and others are to be installed.

CALIFORNIA

Amador County

Coal from Ione is to be produced in marketable form by the National Briquetting Manufacturing Co., which is erecting a plant.

Butte County

Two boats of the Oroville Dredging Co. recovered $3781 during the week ended November 5.——The El Oro company's boat is now digging toward the main road out of Oroville, on the other side of which is the Gardella dredge.

Calaveras County

(Special Correspondence.)—The Royal mine at Hodson is being unwatered rapidly, a Starrett pump now lifting 1000 gal. per minute. The workings are estimated to contain 30,000,000 gal. As the mine contains a large tonnage of profitable ore, the draining is being watched with interest. The 120-stamp mill is ready for crushing.

The Womble property, on the south of the Royal, is at present being examined by San Francisco people. This is also a large low-grade property.——On the north of the Royal, the Mountain King owners are preparing to sink 200 ft. below the present depth of 600 ft., having recently cut a fine ore-shoot which extends from the surface to the said level.

Hodson, December 22.

Eldorado County

Nevada mining men have secured a lease of the Lukencompany's mine near Pilot Hill. It is fully equipped.

Kern County

The Werninger Mines Co. has been incorporated with a capital of $500,000 to operate the Werninger Greenback copper mine at Woody, 25 miles from a railroad. The output to date is $40,000, and ore reserves are estimated at 4000 tons. So far the ore has returned from 8 to 33 per cent.

Nevada County

A rich shoot has been cut in the Pennsylvania by a crosscut driven at 3400 ft. from the Empire adjoining. The former is owned by the Empire company.——The You Bet Mining Co. has failed to make payments on the Jerry Goodwin and Nichols gravel claims at You Bet, and representatives of the latter estate have assumed control. Litigation is expected to follow this action.

Placer County

An extensive magnesite deposit near Auburn has been sold by J. H. Johnson and J. D. Sullivan to an Eastern syndicate.

Shasta County

The old Summit mine at French gulch is being reworked by E. J. Parnes and others of Redding. This property is between the Brunswick and Majara.——Nevada people have acquired the Clipper gold mine near Kennett, and power lines of the Northern California Power Co. are being erected from the Uncle Sam mine nearby.——A pocket in a claim recently bought by C. Bading and J. McBride near Kennett yielded $900 in gold last week.

Sierra County

(Special Correspondence.)—Options have been taken on the Russell placer holdings and a large area of contiguous territory by engineers said to represent Natomas Consolidated. Arrangements have been made to drill the ground, preliminary prospecting indicating rich gravel near the bedrock.

Redding, December 15.

Rich ore has been cut in the Keystone mine near Sierra City.——The Cleveland quartz mine has been sold to Eastern people who will start work in January, in charge of D. McGonigal.

Trinity County

It is reported that work at the Lagrange gravel mine, near Weaverville, has been curtailed considerably, and the superintendent of ditches and mine foreman's positions held by L. P. Poage and P. Jensen, respectively, have been abolished.

TRINITY COUNTY, CALIFORNIA.

Tuolumne County

(Special Correspondence.)—The foundation for a 10-stamp mill is being constructed at the Mangante mine, near Lancetown. At present only five stamps will be installed. The machinery was purchased from a property above Columbia.——The Clio mine is being unwatered for inspection, with a view to the resumption of operations.——The old Mazeppa mine, near Stent, owned by J. F. Parr and others, will shortly be worked. The work planned will be done east of the present developed portion of the claim. Preparatory work was begun this week.——Articles of incorporation of the McAlpine Mines Co. were filed here this week. The Company, organized under the laws of California, has a capital of $1,500,000, the shares having a par value of $1 each. The Company owns the McAlpine group of four claims, situated in the southwestern part of the county. The directors of the new corporation are F. R. Whitcomb, C. L. LaRue, and M. C. Hassett, of San Francisco, A. L. Bernard, of San Anselmo, and Fannie W. McLean, of Berkeley.——Considerable new machinery has been purchased for the Blue Eagle mine, situated in the Jawbone district, and operated by an Oakland company. The property is in an isolated region, necessitating the transportation of the machinery on sleds and pack-animals. The heavier pieces were Burleigh drills, an air-compressor, and a gasoline engine, the latter weighing about 800 lb.——It is reported that work will at once be resumed at the Montezuma Tunnel gravel mine, on Table mountain. The property is owned by C. F. Montgomery of San Francisco.

Sonora, December 5.

COLORADO

Gilpin County

Increased activity is noticeable in the Hughesville district, which is an old silver producer. Lessees are reported to be getting fair results, and development at the Hope, Cracker Jack, Atlantic, and Alaska mines is encouraging. The Iron City concentrating plant below Black Hawk is treating from 60 to 75 tons of custom ore per day. The output in November was 33 cars of concentrate. William Crosley is in charge.——The Fagan mine is shipping ore to the Polar Star mill at Black Hawk.——A car of ore from a mine in Wyoming recently arrived at the Chamberlain sampling works at Black Hawk, and is being treated at the U. P. R. mill.——The Togo, in Willis gulch; Buckeye, in Quartz valley; and Eureka are yielding good returns.

Lake County (Leadville)

(Special Correspondence.)—The Banker mine, which belongs to Mr. Rittenhouse, of Los Angeles, is to be unwatered and operated, according to latest information. This property has a shaft down 1100 ft., and has produced gold and zinc ores. The property is about 90 ft. distant from the Yak tunnel, with which it is proposed to connect it. It is stated that the property has a prospect of getting the extension of the Jonny vein, which is producing so much rich gold ore.

Boston, Massachusetts, December 11.

The Lake County Metal Mining Association met on December 12, but there were only 25 members present, which attendance the *Carbonate Chronicle* thinks shows that the movement is attracting little attention, and should have more interest taken in it.

Ouray County

The Ouray County Metal Mining Association held a meeting on December 14. There was a fair attendance. The society had a call from the Colorado Metal Mining Association to go to Denver on January 11.

On December 14 an explosion at the Wanakah smelter wrecked the flue and dust chamber, and injured two employees. The Company thinks this was the result of dynamite placed

by outsiders. The old furnace will be used while the new one is undergoing repair.

PARK COUNTY

The London mine is attracting increased attention from lessees, who have good chances in this property. A number of Leadville miners have blocks.

TELLER COUNTY (CRIPPLE CREEK)

An interim dividend, No. 9, of 5%, was paid by Stratton's Independence on December 10. In October the mill treated 9140 tons of ore, with a profit of $6279. The mine made a loss of $1527 ——Four feet of $100 ore has been cut by Wilcox and partners in the Upper Granite mine on Bull hill.——Rich shoots of sylvanite ore have been exposed by recent work in the Vindicator. Installation of surface equipment proceeds steadily.——A large tonnage of good ore has been opened at 1700 ft. in the Portland.——At 100 ft. in the Orpha May, on Bull hill, 18 in. of ore assaying up to $81 per ton is being extracted by lessees.——Prominent business men of the district have formed a syndicate to prospect Gold hill and adjacent ground. The C. O. D. shaft is to be sunk from 800 to 1300 ft. ——Machinery is being erected on the Half Moon property on Gold hill.——Eighteen inches of rich smelting ore has been cut in the Ajax on Bull hill.——Next to the Cresson is the Gold Sovereign, and 6 ft. of $54 ore has been cut at 1050 ft. This is thought to be an extension of the rich Cresson shoot.

IDAHO

BONNER COUNTY

(Special Correspondence.)—The Idaho Gold & Radium Mining Co. has been developing its property at Lenia for four years, 40 to 50, mainly shareholders, being employed. Inclusion of 'Radium' in the Company's title does not mean that this element metal is to be produced, but the word is simply a distinguishing mark from other Idaho gold mining companies. The property consists of 800 acres of gravel, and 40 claims containing four gold-bearing veins. Assessment work only has been done on the latter, yet they are promising. A hydraulic plant is being installed, Boulder creek being the source of supply. A four-mile ditch, 27 ft. wide, will deliver 10,000 miner's inches under a head of 400 ft. A hydro-electric plant is also to be installed to use 200 ft. head, and will generate 2500 hp. for use on the property. The sluice-boxes will discharge gravel into a cañon 1000 ft. wide and about a mile long. The distance from camp to the Great Northern railroad is 1½ miles, but to cover this distance at a uniform 4% grade it was necessary to construct 5 miles of auto-truck road. Two additional miles were also made leading to various works. Much of this road was cut through solid rock. Work on the ditch is well on toward completion. So far, the Company has spent $190,000.

Lenia, December 7.

OWYHEE COUNTY

(Special Correspondence.)—An effort is being made at Boston, Massachusetts, to finance the reopening of the Henrietta or Big I mine. This mine has a 30-stamp mill and has been opened by shaft and adit. It was discovered on a Sunday morning in 1876 by three old miners who stood talking on a bluff about eight miles northeast of Silver City. As the story goes, a little dog, belonging to one of the party, scratching at a rat or gopher hole uncovered a rich nugget of ore. It is claimed that some ore was sold at Silver City at $1 per pound, and these early shipments totaled $750,000. The plan is to mill the dump of about 40,000 tons, with estimated values of about $30 per ton.

Boston, December 11.

SHOSHONE COUNTY (COEUR D'ALENE)

At 900 ft. in the Hypotheek, 10 ft. of high-grade lead ore has been opened. A large pump has been ordered from Spokane. P. F. Rodgers is superintendent.——Hardinge mills are being installed in the Hunter mill. The Company employs from 125 to 150 men.——A large tonnage of ore has been developed in the Black Bear Consolidated. A mill is contemplated for next spring.——The Gertie adit, in Cañon creek, was driven 280 ft. in November, two shifts working. Two water Leyner drills are used. The adit will be driven a further 2900 ft. to cut the Gertie vein at 3600 ft.——In the suit of the Marsh Mining Co. v. the Washington Water Power Co., wherein the former lost its case in the matter of power rates, a rehearing is to be held on January 15.

MISSOURI

JASPER COUNTY

Ore output of the Missouri-Kansas-Oklahoma district for 50 weeks of this year is as follows: blende, 232,702 tons; calamine, 14,985 tons; and lead, 40,180 tons; with a total value of $11,197,971. Three Webb City mining companies sold 1200 tons of zinc ore for $62,000 to the American Metal Co. last week. Those concerned in the deal were the Century, 600 tons; Coahuila, 300 tons; and Oronogo Circle, 250 tons, the two former receiving $50, and the latter $49 per ton. The Company is said to be in the market for 10,000 tons in all.

MONTANA

MADISON COUNTY

Owing to a bolt coming loose in a controller, causing a short circuit, two men were electrocuted on No. 3 dredge of the Conrey Mining Co., near Ruby, on November 8. Leon Dusseault was winchman and received the shock through two control levers for the digging ladder and the shifting gear of the boat. J. J. Hagenach also came into contact with a lever when rendering assistance to the former employee.

POWELL COUNTY

The Elliston phosphate field is described in *Bulletin* 580-N of the U. S. Geological Survey by R. W. Stone and C. A. Bonine. They were assisted by J. E. Richardson, Jr. The deposit is two to seven miles of the Northern Pacific line. Owing to its recent discovery there has been no development, also as there is no market reasonably near to justify mining and reduction to a fertilizer. A total of 86,000,000 tons is estimated in the whole area, the thickness being four feet.

SILVERBOW COUNTY

A sectional spout for the flow of slag from blast-furnaces to settlers is used at the Washoe smelter, and Albert R. Bink is suing the Anaconda company for $50,000 for alleged infringement of the device. The plaintiff previously lost a similar case against a subsidiary of the Company.

NEVADA

ESMERALDA COUNTY

The Western Ore Purchasing Co. is overhauling its sampling plant at Goldfield, on account of recent developments in the district.

Through a deal made by C. O. Whittemore, of Los Angeles, and Charles S. Sprague, of the Jumbo Extension company, the Lone Star Consolidated has been financed for further development.——A 20-ton roller mill has been secured for the Gold Prince in the Gold Crater district east of Goldfield, by the manager, Charles Orr.——Work at 921 and 1017 ft. in the Jumbo Extension continues to open rich ore.

In spite of the present boom at Goldfield, there are 325 idle miners in the district, according to the Goldfield Consolidated company.——The Goldfield Consolidated output in November was 28,425 tons, yielding a net profit of $145,312. Costs totaled $6.62 per ton. Development totaled 2359 ft. at $6.08 per foot. No. 4 level of the Combination, 100 ft. northeast of the shaft, produced 447 tons of $25 ore. No. 1 level of the Mohawk yielded 545 tons of $20 ore.

Humboldt County

A fine specimen has been extracted from the Nevada Packard mine at Rochester. It is an altered rhyolite weighing 140 lb. spotted with horn and ruby silver, and assaying 1500 oz. also $2.60 gold per ton.——I. A. Friedman of Lovelocks has purchased 150,000 shares in the Rochester Mines Co., also 600,000 in the Rochester Weaver Mining Co. Lessees in the Seven Troughs are doing well, according to the manager, C. W. Poole, and royalties received by the Company are from $1000 to $2000 per month.

Lyon County

Cyanide plants at Silver City have been closed for the winter. The stamp-mills have been busy lately.

Mineral County

The Lucky Boy adit, five miles from Hawthorne, is in 5100 ft., and indications point to the contact being near. Progress amounts to about 8 ft. daily. During the driving of this adit, four veins were cut, from which some rich ore has been shipped.

Nye County

Five mines at Tonopah produced 9001 tons of ore, valued at $187,978, during the week ended December 19.——In November, the Belmont treated 14,880 tons, yielding 348,835 oz. silver and 3825 oz. gold, with a profit of $135,532. Profits for 11 months total $1,490,027. The Jim Butler profit was $28,390 from 3087 tons. The Tonopah mill at Millers produced 249,150 oz. bullion, giving a profit of $72,400. Profits for 11 months total $1,010,713, but since the war started the monthly net returns have been very erratic. The dredges in Colorado add to this amount considerably.——The Extension mill is now treating 271 tons per day. The last bullion shipment was 28 bars, weighing 52,180 oz.——Development in the Montana last week amounted to 134 ft.——The Jim Butler-West End suit is making good progress. Judge Averill has been underground to see the area in dispute. Testimony for the West End is finished, and that for the Jim Butler may end by Christmas.——Development in the North Star at 1050 ft. is promising.——Energetic prospecting continues at Tonogold, but there is nothing important to chronicle.

Mining at the White Caps costs $1.35 per ton. The Manhattan Milling & Ore Co.'s 10-stamp mill and cyanide plant is now operated by the White Caps people.——The new mill at the Big Pine is working.——A heating system has been installed in the Associated mill, which will prevent a further freeze-up. There are 32 men employed in the mine and plant.

Storey County

During the past financial year the Ophir Silver Mining Co. extracted $64,290 from 2248 tons of ore, 1738 tons of tailing, and 3087 tons of dump material, according to the superintendent, T. F. McCormick. His report covers work at 2000, 2350, 2400, and 2500 ft.——Another fire has started in the Comstock, this time at the 1500-ft. station of the joint Crown Point-Belcher incline in Gold hill. This shaft is used for pumping. Bulkheads have been built below the 1400 ft. station, and it is expected to soon get the outbreak under control.

The committee of northend mine superintendents consisting of William E. Sharon, Whitman Symmes, and Thomas F. McCormick, to whom was referred the matter of unwatering that portion of the Comstock lode an additional 200 ft. from the 2500 to the 2700-ft. level, have presented their report to William C. Ralston, president of the Comstock Pumping Association at San Francisco. They report that they have taken under consideration the use of the old winzes which run from the 2500 to the 2700-ft. level, and in this connection have considered their most available use for unwatering the mines and also for mining and ventilating purposes. They decided on a method which gives the best use of all the old winzes now accessible, the joint Ophir and Mexican winze to be used for pumping only, and the others to be used for mining and ventilation. It will be both feasible and more advantageous to locate the pumps for unwatering the 2700-ft. level in the old joint Ophir-Mexican winze which goes down from the 2500 to the 2900-ft. level. That winze was carefully sounded and apparently only 8 to 12 ft. of plank and other debris will have to be removed from near the 2700-ft. level in order to drain completely that level in the centre of the North End mines. In order to drain completely all of the North End mines on the 2700-ft. level, it probably will be necessary to install a small auxiliary pump in the Consolidated Virginia east winze on account of the grade in the connecting drift, but this, however, is unnecessary at present and has not been taken into consideration in this report. The installation of pumps in the joint Mexican and Ophir winze has the advantage that it will drain the ground that is now most urgently desired for exploration upon the 2700-ft. level, and in case it should be desirable in the future to reach the 2900-ft. level, this is the only winze that would be available to reach that point. Under this plan the Ophir, and, if thought desirable, the Consolidated Virginia, can work upon the 2700-ft. level through the old joint California and Ophir east winze, which runs from the 2500 to the 2700-ft. level. The Mexican, and, if thought desirable, the Union, can mine through the old joint Union and Mexican east winze that runs from the 2500 to the 2700-ft. level. The old joint Sierra Nevada and Union east winze from the 2500 to the 2900-ft. level will also be available for exploration in the Sierra Nevada and Union mines. The necessary pumps for this work are on hand, and a considerable amount of other material that is required. Additional material to the extent of about $4000 must be purchased to complete the pumping installation. The expense of installing the necessary pumps and of lowering the water to the 2700-ft. level, including the cost of power, is estimated at $6000 per month, and it will require three months' time to complete this work. This total of $22,000 covers everything which is possible to estimate at this time. It is advisable, however, to add $5000 more to that amount to cover unforeseen contingencies.

White Pine County

Some notes on the copper ores at Ely, by Alfred R. Whitman, are given in the *Bulletin* of the department of geology of the University of California, of December 5. The writer studied the deposits in the summer of 1913. An abstract is given in another issue of this journal.

NEW MEXICO

Grant County

There are 61 mining concerns in this county, as well as individual operators, and the total assessed valuation of the county is $20,660,067. Of this, the Chino Copper Co. amounts to $4,062,252. One-third of the valuation is subject to taxation. The total of taxes due on the 1914 assessment is $244,388, the Chino company contributing $43,409. The county last year taxed mine products, to which the Company objects, and a test case is being prepared to prove the right of the county to collect this tax, a suit of interest to all New Mexican mining companies.

SOUTH DAKOTA

Lawrence County

In *The Pahasapa Quarterly* of the South Dakota School of Mines, Victor Ziegler states that two minerals have to be added to those in his 'Minerals of the Black Hills.' These are sillimannite, an aluminum silicate, found near Custer; and pseudomalachite(?), a copper mineral found in certain pegmatites of the Keystone district.

Development in the Heidelberg has been good, and shipments of ore are to be resumed to the Golden Reward cyanide plant at Deadwood.——The Hidden Treasure has resumed

work in charge of Stewart Thompson.——The Homestake aid fund for employees has a cash balance of $39,557. Revenue in November was $3403.——A test run has been made on tin ore near Hill City by McNish and Mills. Work will be resumed in the spring.

TEXAS

Burnet County

(Special Correspondence.)—The Darling Mining Co. has been organized for the purpose of conducting extensive mining operations in Texas and Arkansas. Its principal office is in Galveston, the incorporators being J. E. Howard, T. A. Kindred, and T. D. Lufkin, all of that city. It is stated that the Company will open lead mines in the Burnet district, situated near the town of that name, also in Arkansas.

Austin, December 15.

UTAH

Juab County

Two developments have occurred in new ground of the Lower Mammoth at Tintic. At 700 ft. there is 4 ft. of ore assaying 27 oz. silver, $1 gold, and 1% copper; and at 1000 ft. is a shoot of 4 to 6% copper ore.

Salt Lake County

The report of the South Hecla Mining Co., George H. Watson, general manager, covers the year ended September 1. Development totaled 1190 ft., mostly on the Wedge vein. As far as opened, the orebody is 18 ft. wide. Work to date totals 17,928 ft. Ore sold amounted to 4118 tons, yielding $46,510 net. It contained 141 oz. gold, 85,618 oz. silver, 1,030,066 lb. lead, 586,867 lb. zinc, 1405 lb. copper, and 82,675 lb. iron. The surplus is $36,524. Until metal prices improve, a further curtailment of production is advised.

The Montana Bingham adit is in 3460 ft., and 700 ft. from the objective, the Cougar vein. More money is necessary to complete this work, which will yield revenue from other companies for ore transport and sale of water, and a 1c. assessment has been levied. Lessees are opening a vein cut about 450 ft. from the present face of the adit. The ore contains copper, silver, and gold.

Summit County

During 11 months of the current year the Park City district shipped 1475 cars of ore, equal to 64,541 tons, as follows: Silver King Coalition, 28,890; Daly-Judge, 32,665; Daly West, 3495; Silver King Consolidated, 7707; Mines Operating Co., 763; American Flag, 166; Charles Moore, 481; Coleman, 33; Daly Mining Co., 82; Thompson-Quincy, 240; Ontario Mining Co., 12; Glencoe, 103; and Little Bell, 76 tons.

The president of the Silver King Consolidated Mining Co. of Utah, Solon Spiro, has issued a circular to the shareholders containing the following information: All litigation between the Company and the Silver King Coalition Mines Co. is finally settled. There being some adjustment necessary regarding certain mining claims, the Consolidated 'quit-claimed' all rights to the Delaware, Vesuvius, Ladies Drum, and Mayflower to the Coalition, in exchange for deeds to the Andes and Custer claims, both of which are desirable acquisitions. Developments in the Consolidated mine have been excellent of late. Ore has been opened from near the shaft at 1500 ft. to 1700 ft. at the western boundary, a distance, measured diagonally, of about 1000 ft. Its width north and south is 375 ft. with ore in both ends. The upper and lower edges in the main vein 'bed' or flatten to 2 to 6 ft. wide, ore in the 'beddings' assaying 50 oz. silver, 2% lead, 0.05 oz. gold, and 1.13% copper. From wall to wall the ore is uniform in value. Of 502 mine cars of ore hoisted in the first 10 days of November, only two were rated as second-class. Rises and drifts are further opening the shoot, which contains a large tonnage of ore. On account of the low price of lead and silver, only the ore extracted in development is being marketed, but 100 tons of smelting ore could easily be shipped daily. Under the management of Harry A. Lee the mine was opened, and new machinery erected. The latter includes a 10,000-ft. water pipe, a two-stage motor-driven Allis-Chalmers air-compressor of 2600-cu. ft. capacity, new bunk-houses, sanitary system, and mine telephones. The president commends the work done by the manager; the surveyor and assayer, Norman N. Blye; master mechanic, Lee Hernon; shift-bosses, S. Prudence and Lee Glockner; chief timberman, Julius Lee; time-keeper and boarding-house manager, W. H. Middaugh, and a score of faithful miners. Co-operation and harmonious relationship has been excellent. The Company will pay a dividend of 10c. per share on December 31.

CANADA

British Columbia

Dividends paid by the principal mining companies of the province in 1914 are estimated as follows: Consolidated Mining & Smelting, $464,352; Granby, $449,955; Hedley, $360,000; and Standard, $475,000; a total of $1,749,307. The war has affected the metal companies considerably.

Four blast-furnaces are now running at Grand Forks, with a corresponding increase in mining at Phoenix.

Ontario

The Dome mine yielded $96,771 from 22,040 tons of ore in November, giving an average of $4.39 per ton.——On No. 1 vein at 800 ft. in the Hollinger, two faces are being opened with good indications. A 3% dividend will be paid on December 30, making 36% for the year and 87% to date, equal to $2,610,000.

Silver shipments from Cobalt during the week ended December 12 totaled 398,153 oz., valued at $197,346.——The Trethewey mine's output in November was 40,080 oz. from 3100 tons of ore assaying 16.5 oz. per ton.——The Buffalo Mines, Ltd., states that development since August has been satisfactory. The plant is to be worked at full capacity; but it is intended to store concentrate for the present.

COLOMBIA

The Pato dredge recovered $32,500 from 52,000 cu. yd. of gravel during the two weeks ended November 24.

MEXICO

An advertisement in the *Globe*, Toronto, Canada, is to the effect that the Mexican Light & Power Co., Ltd., will default on payment of the half-yearly interest coupon due December 1 on the $9,733,333 of 5% second mortgage 50-year bonds, owing to the conditions that prevail in Mexico.

Hidalgo

The Santa Gertrudis Co. reports as follows for the third quarter of 1914: Operations continued unmolested. The interior counter shaft was sunk 9 ft. to 230 ft. below No. 20 level, when work was suspended. In the upper portion of the mine 718 ft. of work was accomplished, of which 339 ft. was in average low-grade, profitable ore. On No. 13 level, the hanging-wall shoot, lying between the North and No. 8 veins, was opened to a length of 60 ft. and width of 30 ft., averaging $7.20 per ton. Development generally was confined to ore already located; a shortage of dynamite, since overcome, made other work inadvisable. The mill restarted on July 6, and by the end of the quarter was at 85% capacity. Until regular supplies of cyanide can be secured, and Mexican and European conditions bettered, it is not intended to increase production. This was $336,000 from 66,634 tons of ore. The net profit was $97,000. The profit in October was $58,000.

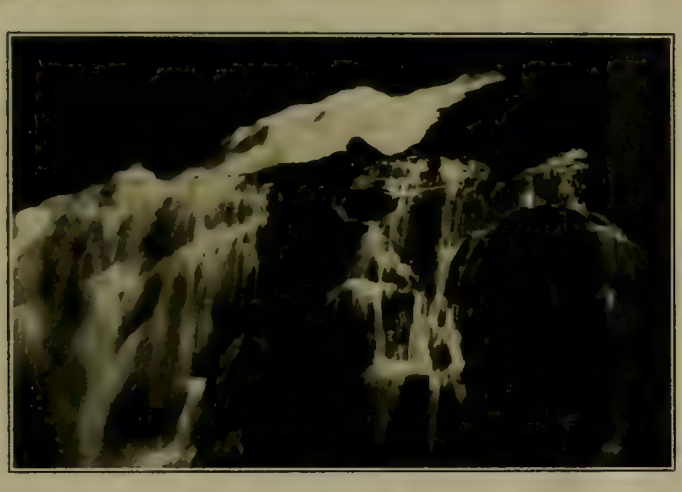
Tamaulipas

According to vice-consul Thomas H. Bevan, writing on November 3, the attention of the oil men around Tampico during October centred on the great fight of the Eagle Oil Co. to extinguish the Portrero del Llano fire. This well is said

to be the largest in the world, its estimated production being 150,000 bbl. per day. Steam and chemicals have so far failed to put out the fire, and the Company is now digging an adit up to the well and will attempt to cut off the flow from beneath the ground. The same Company has just successfully capped its Naranjos well No. 1, which broke loose during the early part of October and flowed at the rate of 15,000 bbl. per day down the Tancochin river for two weeks. The river was covered with a heavy coating of oil for a distance of 25 miles to its mouth in Lake Tamiahua. It has been estimated that 500,000 bbl. of oil was lost before the well was recapped. The movement of crude oil out of Tampico during October shows a considerable decrease compared with the same month of the preceding year. During October, 1913, 1,032,706 bbl. was shipped to the United States, while during October of this year 886,245 bbl. was exported.

NICARAGUA

According to A. Busher in *The American* at Bluefields, conditions in the Pis Pis district are bad, although there are indications of increased activity. The large number of options granted have not helped the country much, as no sales have been concluded.- At the Lone Star, work has continued as usual. Slime from the mill is being saved, and a plant for its treatment is contemplated. Norman McInnes is owner.——Owing to the Grenfell failure in England and the war, it is reported that the options on the Bonanza, Siempre Viva, Lone Star, and Mars have been given up. Most of the staff left the Bonanza several months ago. The Mars and Siempre Viva mines are closed, but the latter's hydro-electric plant is supplying power for the Concordia mine, in charge of Paul Reuer. ——The old Constantia is being reopened by R. A. O'Brien. ——Developments in the Experiencia are promising. A 3-stamp mill is to be worked.——The Tonopah Mining Co. of Nevada is actively opening the Panama mine, in charge of Louis Garbrecht. Results are considered good.——The Tunky Mining Co. is exploiting its claims near the Panama and Bonanza.——The Deitrick concession has been ordered canceled.——The police department seems to have collapsed, as every *mozo* carries a gun and murders are becoming more frequent. *Aguardiente*, a liquor, is being made at many *fincas* and sold at the mines, where the only effort is made to stop its sale. Most of the men are quiet, but a few should be removed. It is hoped that better conditions as to policing may be brought about soon.



SIEMPRE VIVA FALLS, IN THE PIS PIS DISTRICT, NICARAGUA. THEY ARE 98 FT. WIDE AND 102 FT. HIGH, AND THE FLOW OF WATER IS SUFFICIENT TO GENERATE 100,000 HORSE-POWER.

PERSONAL

C. Colcock Jones is in southern Utah.

A. A. Blow was in New York last week.

Wm. Smith was in San Francisco Monday.

C. W. Merrill has returned from New York.

H. M. Stronck is in California for the winter.

E. W. Keith was in San Francisco Wednesday.

James W. Neill was in San Francisco last week.

B. B. Thayer has returned to New York from Butte.

L. D. Ricketts has returned to New York from Arizona.

F. W. Bradley expects to return to San Francisco next week.

Thomas H. Leggett has returned to New York from California.

Ernest Stein is with the Rosario Mining & Milling Co. at Durango, Mexico.

T. A. Rickard is serving as a special constable guarding bridges, etc., in England.

The Geological Society of America will hold its twenty-seventh annual meeting at Philadelphia on December 29 to 31.

Ralph Arnold was in New York last week, returning from Venezuela, and is on his way to California.

A. L. Hurley, of the Daly-Judge Mining Co., has been appointed superintendent of the Cardiff mine, near Park City, Utah.

Theo. Denis, being a French born subject, has received notice to hold himself in readiness for recall from Quebec to his native land.

N. O. Lawton, mining and consulting engineer of Lawton, Michigan, has gone to Hurly, Wisconsin, where he will be engaged in special work for the Montreal Mining Co. until about January 1, 1915.

Officers of the Royal Gold Mines Co., operating the old mine at Hodson, Calaveras county, are as follows: Managing director, F. W. Page; assistant manager, H. W. Condar; and underground superintendent, W. H. Clary.

Robeson T. White, manager for the Caucasus Copper Co., near Batum, Russia, was wounded by Turkish troops in an attack on the property on December 17, according to reports from Petrograd. Two members of his staff were taken prisoners, but one of them, an American, has been released.

SCHOOLS AND SOCIETIES

The Illuminating Engineering Society, Chicago branch, met on December 18.

The Colorado School of Mines, at Golden, will start a short course for prospectors on February 8, 1915. No fees will be charged save a nominal sum to cover supplies used.

The American Electrochemical Society met in New York on December 11. The Pittsburgh section met on the previous day. The spring meeting will be held in Atlantic City on April 22, 23, 24, 1915.

The University of California has issued its *Register* for 1913-14, with announcements for 1914-15. The publication consists of 875 pages, and contains everything connected with the work of the institution.

THE MARKET PLACE

Weekly Summary of Prices of Shares and Metals

Metal Prices

San Francisco, December 24.

Antimony	15 —15¾
Electrolytic copper	14 —14½
Pig lead	4.05—5.00
Quicksilver (flask)	$53.00
Spelter	6½— 6¾
Tin	34½—36
Zinc dust, 100-kg. zinc-lined cases	9

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, December 24.—Copper is quiet and weaker, lead is dull, and spelter weaker. Phelps, Dodge & Co. has declared another dividend, making $14 per share, against $16.50 in 1913.

SILVER

Below are given the average New York quotations in cents per ounce, of fine silver.

Date.		Average week ending	
Dec. 17	49.50	Dec. 2	49 33
" 18	48.87	" 9	49.91
" 19	48.75	" 16	49.83
" 20 Sunday		" 23	48.66
" 21	48.37		
" 22	48.12		
" 23	48.37		

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	63.01	57.58	July	58.70	54.90
Feb.	61.25	57.53	Aug.	59 32	54.35
Mch.	57.87	58.01	Sept.	60.53	53.75
Apr.	59.26	58 52	Oct.	60.88	51.12
May	60.21	58.21	Nov.	58.76	49.12
June	59.03	56.43	Dec.	57.73	....

The tendency of prices has been weaker. Samuel Montagu & Co., of London, stated on December 3 that the amount of supplies has been limited, and this fact really governed prices, rather than urgency of demand from any particular quarter. In so narrow a market, comparatively small orders are sufficient to affect prices. The stock of bars in Bombay, India, increased from 3800 to 1000.

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
Dec. 17	3.80	Nov. 11	3.50
" 18	3.80	" 18	3.70
" 19	3.80	" 25	3.90
" 20 Sunday		Dec. 2	3.80
" 21	3.80	" 9	3.80
" 22	3.80	" 16	3.80
" 23	3.80	" 23	3.80

Monthly averages.

	1913.	1914		1913.	1914
Jan.	4.28	4.11	July	4.35	3.80
Feb.	4.33	4.02	Aug.	4 60	3.86
Mch.	4.32	3.94	Sept.	4.70	3.82
Apr	4.36	3.86	Oct.	4.37	3.60
May	4 34	3.90	Nov	4.16	3 68
June	4.33	3.90	Dec.	4 02	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound

Date.		Average week ending	
Dec. 17	5.37	Nov. 11	4.85
" 18	5.37	" 18	5.00
" 19	5.37	" 25	5.10
" 20 Sunday		Dec. 2	5.20
" 21	5.37	" 9	5.50
" 22	5.37	" 16	5.50
" 23	5.37	" 23	5.37

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	6.88	5.14	July	5.11	4.75
Feb.	6.13	5.22	Aug.	5.51	5.45
Mch.	5.94	5.12	Sept.	5.55	5.16
Apr.	5.52	4.98	Oct.	5.22	4.75
May	5.23	4.91	Nov.	5.09	5.01
June	5.00	4.84	Dec.	5.07	...

COPPER

Prices of electrolytic in New York, in cents per pound

Date.		Average week ending	
Dec. 17	13.00	Nov. 19	11.75
" 18	12.87	" 25	12.25 to 12.50
" 19	12.87	Dec. 2	12.62
" 20 Sunday		" 9	12.75
" 21	12.80	" 16	12.70
" 22	12.75	" 23	12.84
" 23	12.75		

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	16 54	14.21	July	14.21	13 26
Feb.	14.93	14.46	Aug.	15.42	12.34
Mch.	14.72	14.11	Sept.	16.23	12.02
Apr.	15.22	14 19	Oct.	16.31	11.10
May	15.42	13.97	Nov.	15.08	11.75
June	14.71	13.60	Dec.	14.25	....

The price of copper was lifted upward at a steady rate last week until the cables brought the news that the German fleet had sallied out and attacked towns on the coast of England. The possibility that shipping might be disarranged had its immediate effect in decreased foreign orders, and domestic buying as usual fell off at the same time. Probably confidence will gradually be restored unless there is more news of the activity of the German fleet. There is little change in regard to the ability to ship copper for export, except that the British government has ordered the release of the copper shipped on the 'Tellus,' which is detained at Gibraltar. This may have some effect in reassuring the Italian lines, which have been unwilling to accept copper shipments ever since the wholesale seizure of copper consigned to Italy. The Department of State has inquired of the British government as to what its attitude is in regard to the embargo placed on the exportation of copper by the Italian government, but so far no reply has been received. It is reported that altogether about 20,000,000 lb. of copper has been held up at Gibraltar. One of the prominent Italian copper dealers has come to this country to see what can be done in regard to getting the metal through to Italy, and has been in consultation with the Italian embassy at Washington. Producers here evidently expect a rising market for copper, as the sheet copper manufacturers have increased their base price to 18½c. for sheets and 16½c. for rolls. A month ago the price was 16½ and 14½c., respectively; the advance is a notable one. Of course the increased demand in war orders has been mostly felt by the brass trade since the war does not give rise to any increased demand for wire.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb, are given below:

Week ending			
Nov. 25	55.00	Dec. 10	52.50
Dec. 3	55.00	" 17	52.50
		" 21	53.00

Monthly averages.

	1913.	1914		1913.	1914
Jan.	39 37	39.25	July	41.00	37.50
Feb.	41.00	39.00	Aug	40.50	80.00
Mar.	40.20	39 00	Sept.	39 70	76.25
Apr.	41.60	38.90	Oct.	39 37	53.00
May	40.25	39.00	Nov.	39 40	55.00
June	41.00	38.60	Dec.	40.00	....

TIN

Prices in New York, in cents per pound.

Monthly averages.

	1913.	1914.		1913.	1914.
Jan.	50.45	37 85	July	40.70	31.60
Feb.	49.07	39 76	Aug.	41 75	30.20
Mch.	46 95	38.10	Sept.	42.45	33 10
Apr.	49.00	36.10	Oct	40.61	30.40
May	49 10	33.29	Nov.	39 77	32.51
June	45 10	30.72	Dec.	37.57	....

The tin situation is quiet. Arrivals in 17 days totaled 565 tons, while 2540 tons is afloat due up to December 28. Shipments from the Straits Settlements to England have been on a larger scale than of late.

COMPANY REPORTS

AMALGAMATED ZINC (DE BAVAY'S), LTD.

The report of this Company, which buys zinc tailing at Broken Hill and treats it by flotation methods, covers the six months ended June 30, 1914. From the treatment of 247,386 tons the yield was 69,918 tons of concentrate assaying 48.6% zinc, 6.1% lead, and 8.9 oz. silver; also 687 tons of lead concentrate assaying 53.5% lead, 14.1% zinc, and 53.1 oz. silver. The profit was $290,000. Dividends of 25c. per share each were paid in February and May, making a total to date of $2,260,000. Owing to the war, contracts for the sale of concentrate were suspended, and a dividend of 25c. on August 12 was withheld. The reserve for depreciation is $240,000, and surplus $490,000.

CORNWALL TAILINGS COMPANY, LTD.

This is a concern financed by Australians to treat old dumps of tailing at the Carn Brea and Tincroft mines, near Redruth, Cornwall, containing about 1,000,000 tons. The plant consists of four tube-mills and concentrators, the product being smelted. During the year ended February 28, 1914, 113,116 tons of tailing yielded 370 tons of black tin. In the previous term there was 78,885 tons treated. The net profit was £3749, against £15,836, the decrease being due to the low price for the metal. Two dividends of 5s. per share, on 50,000 shares, were paid. Costs decreased from 4s. 6.5d. ($1.09) to 3s. 6d. (84c.) per ton of tailing treated. In September 1914 this was further reduced to 72c. per ton. Owing to the financial condition, tests for a better recovery have been suspended.

YUANMI GOLD MINES, LTD.

This Company operates the Yuanmi and Oroya Black Range mines in the East Murchison goldfield, Western Australia, and the report is for the year ended June 30, 1914. The general managers are Bewick, Moreing & Co., and consulting engineers, James Bros., the superintendent being H. G. Walton.

In the Yuanmi property, development totaled 4747 ft. at a cost of $1 per ton of ore milled. The main shaft is 519 ft. deep. The principal objective of the work done has been the delimitation and further opening of the known orebodies at four levels, and the shaft was sunk 68 ft., preparatory to proving the mine on No. 5 level. Ore reserves are estimated as 9235 tons of oxide ore worth $7.54 per ton, and 29,635 tons of sulphide ore assaying $9.70 per ton. The total is equal to eight months' supply for the mill.

Work in the Oroya Black Range mine amounted to 2527 ft., costing 70c. per ton milled. The most important work was sinking a winze 263 ft. to 548 ft. depth.

Results from the two mines are as follows:

Details of operation.	Yuanmi.	Oroya Black Range.
Stamps working on oxide ore	20	20
Krupp ball-mill for sulphide ore	one No. 8	.....
Ore crushed, tons	59,094	54,460
Yield, fine ounces	22,037	20,653
Revenue from gold, slag, etc.	$451,000	$423,000
Joint revenue	$874,000	
Expenditure	710,000	
Depreciation	106,000	
Profit	58,000	
Credit of profit and loss account	97,000	
Dividend of 24c. per share	84,000	

Buildings, plants, stores, etc., are valued at about $240,000, and cash $67,000. Details of costs will be given in another issue of the *Press*. On page 1002 appear some notes on treatment at the Yuanmi mill.

RECENT PUBLICATIONS

Proposed Building Law for the State of Illinois. Report of the commission appointed to revise and codify the laws of the state. P. 143. Index. Springfield, 1914.

Mineral Production of California in 1913. By E. S. Boalich, statistician for the California State Mining Bureau. *Bulletin* 68. P. 138. Ill., maps, index. San Francisco, 1914. A résumé of this work was published in the *Press* of December 12.

Some Benefits of 'Safety First' in Mining, including a review of mine-rescue and first-aid training in the United States, and field meets in 1914. By James W. Paul. Paper presented at the meeting of the Kentucky Mining Institute, Louisville, December 4. P. 15.

U. S. Bureau of Mines publications, Washington, D. C., 1914:

Notes on the Sampling and Analysis of Coal. By Arno C. Fieldner. *Technical Paper* 76. P. 61. Illustrated.

Analyses of Mine and Car Samples of Coal Collected in the Fiscal Years 1911 to 1913. By Arno C. Fieldner, Howard I. Smith, Albert H. Fay, and Samuel Sanford. *Bulletin* 85. P. 444. Ill., Index. Details are given of methods of sampling and analyzing coal, and of results in tabulated form.

Report of the fifth annual meeting of the Commission of Conservation of Canada, held at Ottawa, January 20-21, 1914. P. 287. Ill., index. This is an interesting and well arranged book. The subjects discussed cover forestry, minerals, birds, fur-farming, water-power, housing plans, farm work, and all matters which need economic investigation. The 36 plates are excellent.

U. S. Geological Survey publications, Washington, D. C., 1914:

The Source, Manufacture, and Use of Lime. By Ernest F. Burchard and Warren E. Emley. Advance chapter of 'Mineral Resources of the United States, 1913.' P. 85. Ill., map. A valuable discussion on an important mineral.

Geology and Oil Prospects in Waltham, Priest, Bitter-water, and Peachtree Valleys, California. With notes on coal. By Robert W. Pack and Walter A. English. *Bulletin* 581-D. 'Contributions to Economic Geology,' 1913. P. 42. Ill., map.

University of Illinois publications, Urbana, 1914:

Coal Mining Practice in District VI. By S. O. Andros. *Bulletin* 8. P. 49. Illustrated.

Analysis of Coal with Phenol as a Solvent. By S. W. Parr and H. F. Hadley. *Bulletin* 76. P. 41. Illustrated. This bulletin shows that by means of phenol, bituminous coal may be divided into two main portions. A study of each division can therefore be carried on to much better advantage than when in the combined state. In general it has been found that the resinic or pitch-like material is soluble in phenol, that it possesses substantially all of the coke producing ingredients, that oxidation destroys the coking property, that this oxidation occurs slowly at ordinary temperatures and proceeds much more rapidly at 212°F. The insoluble material or cellulose residuum is a more active absorber of oxygen; it has no coking property but resembles the lignitic coals in this respect as also in its avidity for oxygen. It is, therefore, to be considered as the constituent most actively involved in spontaneous combustion, deterioration, and other difficulties attending the storage of coal.

New Machines and Devices

Double-Deck Deister Tables

The Deister Machine Co.'s double-deck sand table consists of two rhomboidal shaped decks, one mounted above the other as shown in the halftone. The two decks are bound rigidly together and inclined at right angles to and slightly in the line of motion. The decks are covered with linoleum and riffled practically over the entire surface, the riffles running the full length of the decks in line with the motion. It is claimed that the patented duplex plateau type of riffle along the mineral discharge edge not only makes possible the final separation and cleaning of the concentrates, but also doubles the capacity of the machine. The average height of the riffles is one-quarter inch and they are in most cases spaced only one-inch centres. The decks are constructed of cypress timber all fastenings being either screws or bolts and rigidly tied wherever the peculiar strains to which a table deck is subjected require it. The decks may be made sectionalized for muleback transportation. The shipping weight of the table is about 2000 lb. The capacity of the table is said to be from 60 to 150 tons per 24 hours when making a finished product, depending upon the character of the ore, the mesh, and the treatment to which the ore has been previously subjected. The amount of wash water varies with the character of the ore to be treated, and is said to be from 4 to 6 gal. per minute per deck, and ¾ hp. is ample for each machine. Under average conditions a uniform speed of 215 r.p.m. and a stroke of 1¼ in. is recommended. The machine is especially adapted to the treatment of classified feeds ranging from 8 to 100 mesh and unclassified feeds.

DOUBLE-DECK TABLE.

The double-deck slime table manufactured by this Company has a capacity of from 10 to 25 tons per 24 hours, depending upon the character of the feed.

The Deister company has recently been awarded the contract for 112 tables to be used in the new mill of the Inspiration Copper Co. These tables are of the double-deck type and will be manufactured and delivered at the Company's property with the greatest possible haste. The present order is for one-half of the milling equipment, and the other half of the mill, it is expected, will be specified for shortly.

Commercial Paragraphs

WILLIAMS BROS., Ithaca, N. Y., has issued a circular entitled 'Well Drilling Machinery and Tools.' Williams drills are manufactured in a large variety to meet the requirements of practice and may be driven by steam or horse-power.

C. L. BERGER & SONS, Boston, Mass., has for distribution illustrated reprints of extracts from the *Engineering Record* entitled 'Two Hundred Twelve Shots in One Hour.' This record for fast work in topographical surveys was made with a C. L. Berger & Sons transit.

THE *Western Electric News*, which is a house organ of the Western Electric Co., for December contains an interesting illustrated article on telephone construction work on the Isthmus of Panama. The present position of the Company's European branches is also summarized.

WOOD DRILL WORKS, Paterson, N. J. Wear and tear upon drills has possibly been greater than upon any other tool, and therefore anything that increases its durability is most desirable. To increase the life of the Wood drill, the Company decided to change the construction of the cylinder chest and air head of the drill from ordinary cast iron to vanadium tungsten iron, which it is claimed adds very materially to the life of the drill. A recent catalogue of the Company describes in detail the construction and operation of the drills manufactured by this Company.

THE AMERICAN BOILER LIFE CO., Boston, Mass., is distributing an interesting pamphlet entitled 'Steam Boilers and Boiler Feed Water.' It is known that if certain of the natural elements found in waters exist to the extent of only 15 grains to the gallon, they will form over 600 lb. of solid rock scale in a 100-hp. boiler continually working at capacity for 30 days time. Experiments have proved that it takes heat as long to be transmitted through 0.1-in. layer of grease, oil, or 1-in. coating of scale, as through a 10-in. plate of steel. The influence that this will have upon the coal consumption and efficiency of the boiler is at once apparent. The booklet is devoted to a scientific discussion of boiler feed water and contains considerable data on the subject.

MESTA MACHINE CO., Pittsburgh, Pa., in Bulletin N discusses the air-compressors and vacuum-pumps manufactured by this Company. Piston speeds in excess of 500 ft. per minute have usually resulted in excessive wear and other troubles. By the use of the plate valves (Iversen patent), it is claimed that it is possible to make use of a much higher speed; in fact, the piston speed is limited only by the driving engine. The bulletin is devoted to a general discussion of compressors and vacuum-pumps and contains a discussion on the subject of efficiency. Bulletin K of the same Company is devoted to the subject of gears. The Company manufactures a large variety of gears, including the herringbone and other types, which are here illustrated and described.